Notes on the Practice Exam

This practice exam has three major sections to it: test, answer key with hints, and scoring guide. You'll get the most out of this practice if you make the experience as authentic as possible so carefully follow the directions below. Good luck.

Directions

Find a quiet place to spend the next hour or two. Clear away all distractions and set a timer for 35 minutes. Once you start the timer resist the urge to pause for any reason or to peek ahead at the answers and hints. Once the timer goes off stop all work on test. Use the answer key to correct your test and the scoring guide to estimate your score on this practice exam. Lastly, go back through the exam using the hints to brush up on the ones you missed.

Practice Exam 2

Passage I

Photovoltaic solar panels, also known as PV panels, are used to convert sunlight energy into electrical energy. These panels are made up of solar cells which convert the light into electricity, which then can be stored in batteries. The amount of electricity produced by the PV panels depends on a number of factors. The location of the panels, the angle that they are facing, and the amount of shade or cloud cover can all affect the amount of electricity produced. The amount of visible light produced by the sunlight (measured in lumens) can also have an effect.

Table 1 displays the amount of visible sunlight produced at a particular location throughout the day and the power generated from one PV panel from that sunlight. The graph in Figure 1 shows the average amount of power generated per day in each month for two separate locations. Table 2 lists the ideal PV panel angle for capturing the maximum amount of energy in 6 different latitudinal positions. 0 degrees would indicate a completely horizontal angle while 90 degrees would be a completely vertical position.

Table 1

	8:00 AM	10:00 AM	12:00 PM	2:00 PM	4:00 PM	6:00 PM	8:00 PM
Brightness (lumens)	2,189	8,094	18,720	17,520	16,850	10,224	1,878
Power (wattage)	26	95	220	206	198	120	20

Figure 1

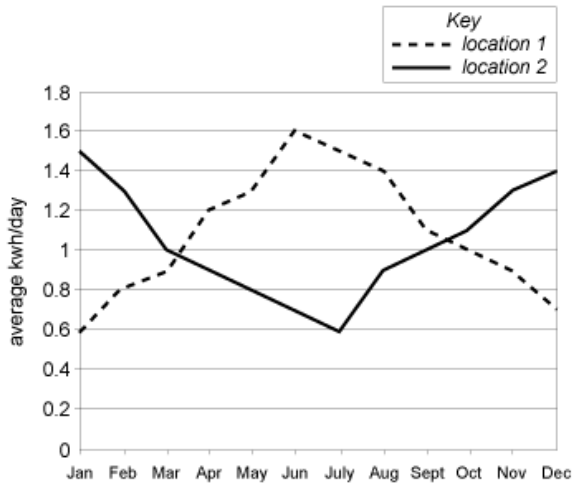


Table 2

latitude	ideal summer angle	ideal winter angle
25°	2.4	41.2
30°	6.8	45.6
35°	11.7	49.7
40°	16.1	54.1
45°	20.8	58.5
50°	25.6	62.9

1. Based on Table 1, what approximate wattage would be produced at 5:00 PM?
- **A.** 17,000 watts
- **B.** 13,000 watts
- **C.** 160 watts
- **D.** 200 watts

2. According to Figure 1, where is location 2 most likely located?
- **F.** In the northern hemisphere
- **G.** In the southern hemisphere
- **H.** In the western hemisphere
- **J.** In the eastern hemisphere

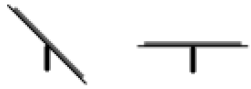
3. Based on Table 2, what would the ideal summer angle be for a solar panel located at the equator?
- **A.** 0 degrees
- **B.** 35 degrees
- **C.** 45 degrees
- **D.** 90 degrees

4. The Smith household consumes approximately 7,000 kwh per year. Assuming that the average amount of energy produced by a single PV panel throughout the year is approximately 1 kwh per day, how many panels would be required to produce enough electricity for the home If the Smith family were installing a solar energy system?
- **F.** 7,000 panels
- **G.** 1,000 panels
- **H.** 365 panels
- **J.** 20 panels

5. How would the summer and winter solar panels appear if they were set up with the ideal angles at a location at 25° latitude?

A. Summer Winter

B. Summer Winter



C. Summer Winter

D. Summer Winter

Passage II

To better understand the water quality of a particular region, scientists studied the pollution levels in several rivers and lakes in the region. The scientists performed tests in several locations in order to determine the sources of pollution and understand what areas were most affected.

During their tests, the scientists measured the phosphate levels in the water supply. Phosphates are present in many fertilizers used by farmers, and elevated levels of phosphates in the water supply are an indicator of fertilizer runoff. Scientists also tested the water supply for enterococcus, a bacteria that is often present as a result of sewage runoff.

Table 1 displays the phosphate and enterococcus levels at 4 points along a local river. Table 2 compares the water temperature, PH level, and phosphate levels of five local lakes.

Table 1

	Downstream →			
	Emmytown	Kenzton	Ashton City	Alyville
Phosphate Levels	5 mg/L	4 mg/L	35 mg/L	11 mg/L
Enterococcus Levels	25 mg/L	22 mg/L	576 mg/L	572 mg/L

Table 2

	Mauer Lake	Lake Morneau	Lake Willingham	Perkins Lake	Lake Worley
Average water temp	69 degrees	72 degrees	70 degrees	69 degrees	70 degrees
pH level	8.5	7.5	7	7.5	10
phosphate levels	23 mg/L	4 mg/L	5 mg/L	12 mg/L	45 mg/L

6. Based on Table 1, what is the most likely location of the source of pollution in the river?
- **A.** Before Emmytown
- **B.** Between Emmytown and Kenzton
- **C.** Between Kenzton and Ashton City
- **D.** Between Ashton City and Alyville

7. What would be a valid reason to explain why phosphate levels drop from Ashton City and Alyville where enterococcus levels remain almost equal?
- **F.** Phosphates dissipate faster into the water where enterococcus remains concentrated
- **G.** Phosphates would not travel downstream like enterococcus would
- **H.** Enterococcus travels faster downstream compared to phosphates
- **J.** The phosphate readings are probably not accurate

8. Local authorities have stated that lakes and rivers have to contain less than 10 mg/L of phosphates to be considered safe to swim in. According to Tables 1 and 2, which river locations or lakes would NOT be suitable for swimming?
- **A.** Emmytown, Kenzton, Lake Morneau, and Lake Willingham
- **B.** Ashton City, Alyville, Mauer Lake, Perkins Lake, and Lake Worley
- **C.** Ashton City, Alyville, Lake Morneau, and Lake Willingham
- **D.** Ashton City and Lake Worley

9. According to Table 2, what affect do phosphates have on the pH level of lakes?
- **F.** Lower concentrations of phosphates raise the pH level
- **G.** Higher concentrations of phosphates lower the pH level
- **H.** Higher concentrations of phosphates raise the pH level
- **J.** There is no correlation between phosphate level and pH level

10. If the direction of flow was reversed for the river in Table 1, what would the expected phosphate level be for Kenzton?

A. Approximately 35 mg/L
B. Approximately 4 mg/L
C. Approximately 22 mg/L
D. Approximately 570 mg/L

Passage III

Scientists recently studied worldwide earthquake statistics in order to document any patterns or trends in earthquake activity. Scientists studied the magnitude of each earthquake in order to determine the severity and damage potential. The magnitude scale increases exponentially as outlined in table 1 below; for every increase by 1.0 in magnitude, the amount of motion created increases by 10 times the original amount and the amount of energy is 32 times larger. For example, an earthquake with a magnitude of 2.0 creates 32 times the energy of an earthquake with a 1.0 magnitude.

Table 1

Magnitude Increase	Ground Motion Change (Displacement)	Energy Change
1.0	10.0 times more	about 32 times more
0.5	3.2 times more	about 5.5 times more
0.3	2.0 times more	about 3 times more
0.1	1.3 times more	about 1.4 times more

Table 2

Magnitude	2006	2007	2008	2009	2010	2011	2012
8.0 to 9.9	2	5	2	0	2	1	2
7.0 to 7.9	9	13	12	15	22	19	13
6.0 to 6.9	132	178	168	144	150	185	108
5.0 to 5.9	1712	2072	1762	1896	2209	2242	1301
4.0 to 4.9	13838	12072	12291	6805	10164	12312	9534
3.0 to 3.9	9990	9272	11735	2905	4341	2791	2453
2.0 to 2.9	3020	3597	2855	3014	4567	3643	3111
1.0 to 1.9	18	32	21	26	39	42	43
0.1 to 0.9	2	3	0	1	0	1	0
Less than 0.1	827	1607	1922	17	24	11	3
Total	29550	28851	30768	14823	21518	21247	16568

Percentage of all earthquakes that occur on each continent

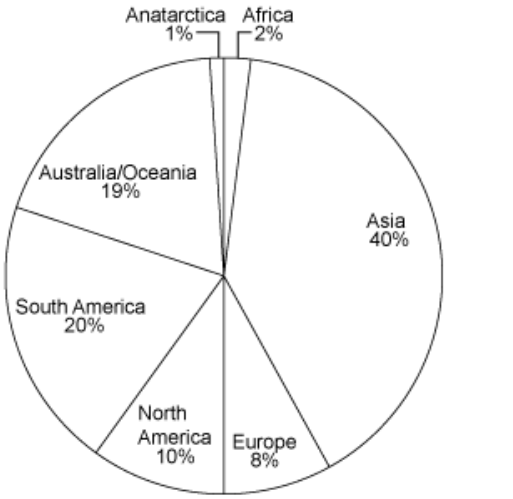


Figure 1

11. According to Figure 1, what percentage of earthquakes occur in the western hemisphere?
- **A.** 19%
- **B.** 30%
- **C.** 40%
- **D.** 50%

12. According to Table 1, what magnitude of earthquake is most common?
- **F.** No Magnitude
- **G.** 3.0 to 3.9
- **H.** 4.0 to 4.9
- **J.** 5.0 to 5.9

13. According to Figure 1, in terms of ground motion, how much stronger is a magnitude 3.0 earthquake compared to a magnitude 1.0 earthquake?
- **A.** 3 times stronger
- **B.** 10 times stronger
- **C.** 32 times stronger
- **D.** 100 times stronger

14. Approximately what percentage of all earthquakes in 2006 were between a magnitude 4.0 and 5.9?
- **F.** Approximately 25%
- **G.** Approximately 50%
- **H.** Approximately 75%
- **J.** Approximately 90%

15. If the energy output of a magnitude 2.0 earthquake is 2,000,000 joules, what would the estimated energy output be for a magnitude 2.3 earthquake?

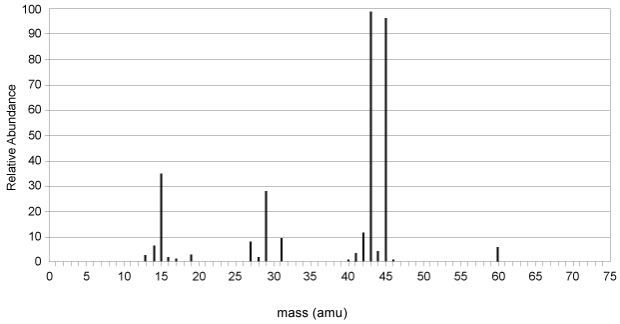
A. 4,000,000 joules
B. 6,000,000 joules
C. 20,000,000 joules
D. 64,000,000 joules

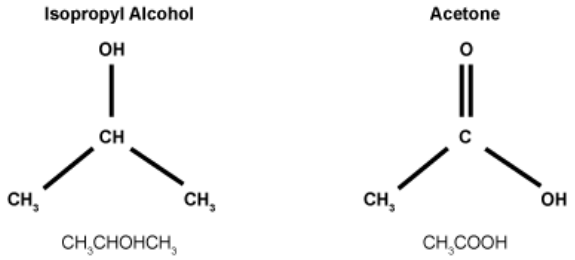
Passage IV

Mass spectrometry is an analytical technique that can be used to determine the identity of an unknown compound. In a mass spectrometer, a molecule is bombarded with high energy electrons, which causes the molecule to become charged and to break into smaller, charged fragments. These ions are accelerated through a magnetic field, where they are sorted based on a ratio of their mass and charge. The mass-to-charge ratio is very closely related to the mass of the fragments. The abundance of fragments of different masses is called a mass spectrum.

Two students analyzed an unknown compound using a mass spectrometer. Figure 1 below shows the abundance of fragments of different masses that were detected from the analysis. Masses are reported in atomic mass units (amu). Each line represents a fragment with a particular mass and is referred to as a peak.

Figure 1





The two students explain their view of the identity of the molecule, based on the mass spectrum, list of masses of molecular fragments, and molecular structure diagrams.

Student 1

The identity of the molecule is isopropyl alcohol. The peak with the highest mass always represents the mass of the entire unfragmented molecule. The molecular mass of isopropyl alcohol is 60 amu, which corresponds to the final peak on the graph. This molecule is likely to split along the bond between CH and CH3, which would leave two fragments: CH3CHOH and CH3. The CH3CHOH fragment has a mass of 45 amu, which has a very high abundance based on the mass spectrum, only surpassed by a fragment with a mass of 43 amu. This new fragment results from the additional loss of two hydrogen (H) atoms from the CH3CHOH fragment. After these two peaks, the third largest peak corresponds to the mass of CH3.

Student 2

The identity of the molecule is acetone. The acetone molecule is not likely to fragment along the double bond between OH and C, because double bonds are stronger than single bonds. Instead, the acetone molecule is likely to fragment in two ways. First, the bond between OH and C break, leaving OH with a mass of 17 amu and CH3CO with a mass of 43 amu. Another second possible fragmentation could occur at the bond between C and CH3, creating COOH with a mass of 43 amu and CH3, with a mass of 15 amu. The mass spectrum shows large peaks at masses of 43 amu and 45 amu, which is consistent with the two possible ways the acetone molecule could fragment. There are also peaks at 17 amu and 15 amu. There is no peak at a mass higher than 60 amu, which is the molecular mass of the acetone molecule.

16. Both students agree that
- **A.** The mass spectrum cannot have a peak showing a mass higher than the molecular mass of the molecule.
- **B.** The molecule can only fragment in one way.
- **C.** The number and types of bonds in a molecule do not matter in the analysis.
- **D.** The number of peaks equals the number of atoms in the molecule.

17. The explanation provided by Student 2 is different from that of Student 1 because student 2
- **F.** Suggested two possible fragmentations of the molecule.
- **G.** Suggested the molecule could not have a mass larger than the mass displayed on the spectrum.
- **H.** Additional peaks represent fragments that have lost additional hydrogen atoms.
- **J.** Believes the analysis represents two molecules with different identities.

18. According to student 2, of the types of bonds in the two suggested molecules, what type of bond is the strongest?

A. Single bonds
B. Double bonds
C. Bonds between carbon and hydrogen
D. All bonds have the same strength, but they differ in their lengths.

19. Another molecule was tested using mass spectrometry. The last peak on the spectrum was at mass 32. Based on Table 1, what is a possible identity of this molecule?

F. CH_2
G. COOH
H. CH_3OH
J. CH_3COOH

20. Which of the following fragments do both students agree are created in the mass spectrometer?

A. CH_2
B. CH_3
C. COOH
D. CH_3O

21. An analysis of another compound containing the fragment COOH showed a peak at a mass of 44 amu. How would student 1 explain this result?

F. The difference of 1 amu is due to a lack of precision of the measurements from the mass spectrometer.
G. There is another fragment within the molecule that has a mass of 44 amu.
H. The fragment CH_3CO must also be present, and the fragment gained an additional hydrogen (H) atom.
J. The COOH group lost a hydrogen atom due to a second fragmentation, causing a decrease in mass of 1 amu.

22. The term ions refers to

A. Charged particles
B. Neutral molecules
C. High energy electrons
D. Individual atoms

Passage V

A student conducted two related experiments to study the reactivity of metals. In both experiments, the student studied the behavior of iron and the behavior of zinc in relation to other metals.

Experiment 1

The student set up an electrochemical cell and used different metals as the anode and cathode. The anode and cathode are the electrodes or terminals that are connected by a wire in an electrochemical cell. Electrons travel through the wire from the metal at the anode to the metal at the cathode, which creates an electric current. For each electrochemical cell, the student measured the potential difference using a voltmeter. A positive potential indicates that a current will be produced; a negative potential difference indicates the current will not be produced.

Anode	Cathode	Potential Difference (V)
Iron	Cadmium	0.036
Iron	Copper	0.778
Iron	Lead	0.298
Iron	Silver	1.226
Iron	Zinc	-0.322

Anode	Cathode	Potential Difference (V)
Zinc	Cadmium	0.358
Zinc	Copper	1.100
Zinc	Iron	0.322
Zinc	Lead	0.620
Zinc	Silver	1.548

Experiment 2

The student tested the reactivity of several metals by submerging solid metals into solutions containing metal ions. Observations that can indicate that a reaction has taken place include color changes, the formation of a new solid, change in energy, or the production of a gas. Any reaction that took place could be described by saying the solid metal replaced the metal ion in solution, according to the following equation, where A is the solid metal, B is the metal ion in solution, and C is an unchanged ion.

$A + BC \rightarrow B + AC$

Solid Metal, A	Metal ion in Solution, B	Observation
Iron	Cadmium	Silver-colored solid changes to dark grey solid
Iron	Copper	Blue solution changes to clear, solid forms
Iron	Lead	New solid forms
Iron	Silver	Shiny powdery solid builds up around solid iron
Iron	Zinc	No Change
Zinc	Cadmium	New solid forms with powdery texture
Zinc	Copper	Blue solution changes to clear, solid forms.
Zinc	Lead	New darker colored solid forms
Zinc	Iron	New darker colored solid forms
Zinc	Silver	Powdery solid forms

23. Another student wanted to create a second electrochemical cell with iron and zinc. Which metal should be the anode and which metal should be the cathode in order for a current to be produced?

A. The iron should be the anode, and the zinc should be the cathode.
B. The zinc should be the anode, and the iron should be the cathode.
C. Both iron and zinc should be the anode.
D. Both iron and zinc should be the cathode.

24. In Experiment 2, which two metals did not react?

F. Solid iron and zinc ion in solution
G. Solid zinc and lead ion in solution
H. Solid iron and silver ion in solution
J. Solid zinc and iron ion in solution

25. Based on Experiment 1 and Experiment 2, if two metals have a negative potential difference in an electrochemical cell, will the metals react?

A. Yes, but only if the anode of the electrochemical cell is the metal ion in solution (B) and the cathode in the electrochemical cell is the solid metal (A).
B. Yes, but only if the anode of the electrochemical cell is the solid metal (A) and the cathode in the electrochemical cell is the metal ion in solution (B).
C. No reaction happens between the two metals that will have a negative potential difference in an electrochemical cell.
D. Yes, the metals will always react when the potential difference in the electrochemical cell is negative.

26. Copper can be described as being a more "active" metal than cadmium. Do the results of experiment 1 support this statement?

- **F.** No, because when serving as the cathode in an electrochemical cell, copper creates a higher potential difference than cadmium.
- **G.** No, because when serving as the cathode in an electrochemical cell, copper creates a lower potential difference than cadmium.
- **H.** Yes, because when serving as the cathode in an electrochemical cell, copper creates a higher potential difference than cadmium.
- **J.** Yes, because when serving as the cathode in an electrochemical cell, copper creates a lower potential difference than cadmium.

27. Based on Experiment 2, what color is the solution containing the copper ion?

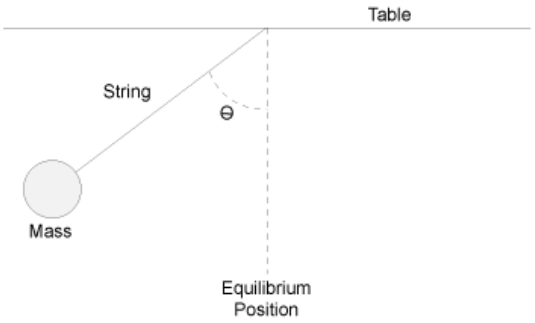
- **A.** Clear
- **B.** Green
- **C.** Blue
- **D.** Orange

28. In Experiment 2, what indicators of a chemical reaction were observed?

- **F.** Color changes and the formation of a new solid
- **G.** Color changes and the production of a gas
- **H.** The formation of a new solid and a change in energy
- **J.** The formation of a new solid

Passage VI

Simple harmonic motion is a periodic back-and-forth motion through an equilibrium position; the motion is periodic because it repeats in equal intervals of time. Three experiments were conducted to study simple harmonic motion using a pendulum. A pendulum was made by attaching a mass onto a string, which was freely suspended from a table. In each experiment, the time required for ten complete cycles of motion was measured using a stop watch. A cycle is the full forward and reverse swing that returns the mass to its original position.



Experiment 1

A mass was hung from the string of the pendulum. The mass was pulled back and released at an angle measured from the equilibrium position using a protractor. The same mass and the same length of string were used for each trial at each angle.

Angle, θ	Time for Ten Cycles (s)			
	Trial 1	Trial 2	Trial 3	Average
10°	28.4	28.2	28.2	28.3
20°	28.6	28.4	28.5	28.5
30°	28.9	28.6	28.8	28.8
40°	29.3	28.9	29.2	29.1
50°	29.9	29.5	29.9	29.8
60°	30.4	30.2	30.3	30.3
70°	31.3	31.3	31.4	31.3
80°	32.3	32.1	32.2	32.2
90°	33.5	33.2	33.3	33.3

Experiment 2

In Experiment 2, varying masses were hung from the same length of string. Each mass was released at a 40° angle from the equilibrium position.

Mass (kg)	Time for Ten Cycles (s)			
	Trial 1	Trial 2	Trial 3	Average
0.10	29.3	29.2	29.0	29.2
0.20	29.3	29.2	29.2	29.2
0.30	29.2	29.1	29.1	29.1
0.40	29.1	29.3	29.3	29.2
0.50	29.2	29.3	29.1	29.2

Experiment 3

In Experiment 3, the length of the pendulum string was varied while the same mass was used for each string and each trial. The pendulum was released from an angle of 40° from the equilibrium position.

Length (m)	Time for Ten Cycles (s)			
	Trial 1	Trial 2	Trial 3	Average
0.50	14.6	14.4	14.4	14.5
0.75	17.9	17.9	17.8	17.9
1.00	20.6	20.5	20.6	20.6
1.25	22.9	22.8	22.7	22.8
1.50	25.1	25.2	25.1	25.1
1.75	27.3	27.3	27.4	27.3
2.00	29.1	29.0	28.9	29.0

29. The experimental design of Experiment 2 differs from Experiment 1 in that in Experiment 1:
- **A.** The mass of the pendulum was held constant
- **B.** The length of the string was held constant.
- **C.** The length of the string was varied
- **D.** The angle from the equilibrium position was held constant

30. A period is defined as the time required for one complete cycle in periodic motion. What is the period for the motion of the pendulum in Experiment 1 released at an angle of 70° from the equilibrium position?
- **F.** 31.3
- **G.** 2.92
- **H.** 3.13
- **J.** 1.45

31. Based on the results of all three experiments, which of the following variables has no effect on the period of the pendulum?

A. Mass of pendulum
B. Length of string
C. Angle
D. Both the angle and length of string

32. Based on the results of Experiment 3, what length of string was used in experiment 1?

F. 0.50 m
G. 1.00 m
H. 1.50 m
J. 2.00 m

33. Based on Experiment 3, approximately how much time would be required for ten cycles of the pendulum if a 2.25 meter string were used?

A. 27.0
B. 29.0
C. 31.0
D. 39.0

34. Why was the time for ten cycles of motion measured instead of the time for one cycle?

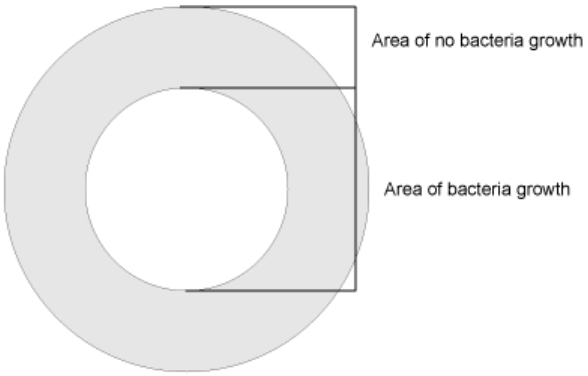
F. The mass does not swing smoothly for several cycles.
G. One cycle may occur in a time too short to measure accurately.
H. Ten cycles is the total length of time that the pendulum is in motion.
J. Ten cycles provides more data to analyze.

Passage VII

Disinfectants are substances used to kill microorganisms present on nonliving surfaces. Three experiments were conducted to study the effectiveness of common household disinfectants on bacteria. In each experiment, tests were conducted using petri dish plates with a ten centimeter diameter containing a sterile nutrient, agar.

Experiment 1

A cotton swab was dipped into an E.coli culture broth and then streaked across the entire surface of an agar plate. One drop of a disinfectant was released onto the center of the plate; this was repeated on a separate plate for each disinfectant. The plates were left undisturbed overnight. After twenty-four hours, the space around the disinfectant without bacteria growth was determined by measuring the length between the edge of the plate and the edge of the area without bacteria growth.

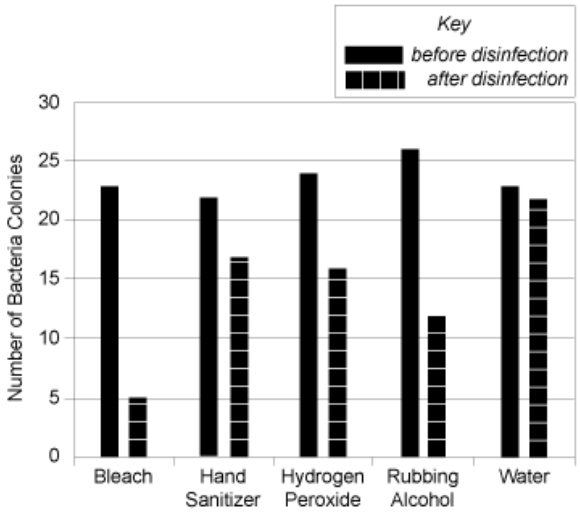


Disinfectant	Length between Edge of Plate and End of Bacteria Growth (cm)
Bleach	1.9
Rubbing Alcohol	2.6
Hydrogen Peroxide	3.9
Hand Sanitizer	3.2
Water	4.8

Experiment 2

In a second experiment, a damp cotton swab was rubbed against the surface of a table in order to collect a sample of bacteria present on the surface. This cotton swab was streaked across agar in one plate, labeled "Before Disinfection". The same surface was then cleaned with a disinfectant, and the procedure was repeated, with the second swab being streaked across agar in a second plate, labeled "After Disinfection". This was repeated in different places on the same table for each of the five disinfectants. The plates were left undisturbed for twenty-four hours, at which point the number of bacteria colonies in each plate was counted and recorded. Graph 1 shows the number of bacteria colonies present before and after disinfection.

Graph 1



Experiment 3

A third experiment was conducted to determine the effective concentration of bleach. A 1% bleach solution was diluted five times to create six different solutions of bleach, each with a different concentration, as listed in the table below. Ten milliliters of each bleach solution was placed into a test tube, and a syringe was used to add 0.1 mL of an E.coli culture broth to each test tube. The test tubes were sealed, mixed, and left undisturbed for thirty minutes. After thirty minutes, a cotton swab was dipped into the test tube and was then rubbed over the surface of the agar. After twenty-four hours, the number of bacteria colonies was counted and recorded.

Concentration of Bleach	Number of Bacteria Colonies		
	Trial 1	Trial 2	Trial 3
1 %	0	0	0
0.1 %	5	3	13
0.01 %	15	17	36
0.001 %	30	29	Too many to count
0.0001 %	Too many to count	Too many to count	Too many to count
0 % - water	Too many to count	Too many to count	Too many to count

35. What served as the control in all three experiments?
- **A.** Alcohol
- **B.** Hand Sanitizer
- **C.** Water
- **D.** None of the substances, because a control wasn't necessary.

36. If a 5% bleach solution were used in experiment 3, how many bacterial colonies would grow?
- **F.** 0
- **G.** 10
- **H.** 30
- **J.** Too many to count

37. The active ingredient in most hand sanitizers is alcohol. Based on Experiment 1, is the concentration of alcohol in the hand sanitizer higher or lower than in the rubbing alcohol?
- **A.** The concentration of alcohol is higher in the hand sanitizer, because length of bacteria growth on the hand sanitizer plate is greater than that of rubbing alcohol.
- **B.** The concentration of alcohol is higher in the hand sanitizer, because the distance of bacteria growth on the hand sanitizer plate is smaller than that of rubbing alcohol.
- **C.** The concentration of alcohol is lower in the hand sanitizer, because the distance of bacteria growth on the hand sanitizer plate is greater than that of rubbing alcohol.
- **D.** The concentration of alcohol is lower in the hand sanitizer, because the distance of bacteria growth on the hand sanitizer plate is greater than that of rubbing alcohol.

38. Based on the results in Experiment 1, which of the following correctly lists the five types of disinfectants in order of increasing effectiveness?
- **F.** Water, hydrogen peroxide, hand sanitizer, rubbing alcohol, bleach
- **G.** Bleach, rubbing alcohol, water, hydrogen peroxide, hand sanitizer
- **H.** Water, hand sanitizer, rubbing alcohol, hydrogen peroxide, bleach
- **J.** Bleach, hand sanitizer, hydrogen peroxide, rubbing alcohol, water

39. In Experiment 2, how many fewer bacterial colonies grew after the surface was disinfected with hydrogen peroxide?
- **A.** 2
- **B.** 8
- **C.** 15
- **D.** 30

40. Experiments involving microorganisms require sterile conditions in order to avoid introducing bacteria from the environment into the bacteria being studied. In Experiment 3, which trial is most likely to have had contamination?
- **F.** Trial 1
- **G.** Trial 2
- **H.** Trial 3
- **J.** All three trials likely had contamination

ANSWER KEY IS ON THE NEXT PAGE

ANSWER KEY		
Question #:	**Correct Answer**	**Hint**
1	C	You'll need table 1 to answer this question. 5:00 is not listed on the table, but you can estimate based on the other times listed.
2	B	Notice the trends of each line in Figure 1. Keep in mind that the amount of power generated will be highest in the summer and lowest in the winter. Also keep factor in when the seasons occur in each of the hemispheres.
3	A	Look for the trend of ideal angles in Table 2. Also, there's some helpful information in the introduction that describes what the panel angles look like.
4	D	If you know that 1 panel generates 1 kwh per day, first determine how much power that would generate within a full year (365 days). Next, divide the Smith's power need by the amount of power generated by 1 panel to determine your answer.
5	A	The figures are pictures of the panels as shown from the side. The introduction also has some helpful information that will help you illustrate positions of the solar panels.
6	C	To answer this, take a look at Table 1 and the map and make note of where the pollution levels spike. Also, pay attention to the direction of flow in the river.
7	A	Here, you are looking for the most logical explanation of why phosphate levels would drop and not enterococcus. Look through each answer and determine which one is the most plausible
8	B	To answer this question, you are looking for any rivers/lakes in Table 1 and 2 with phosphate levels below 10 mg/L.
9	C	Look through Tables 1 and 2 and compare the Phosphate and PH levels. What is the connection?
10	A	This question is similar to question 1, but the flow of the river is reversed. If the source of pollution is the same but flows in the opposite direction, what city would be affected?
11	B	A little previous science knowledge is needed here. Both North America and South America are in the Western Hemisphere.
12	C	In Table 2, look for the line with the highest number of occurrences
13	D	You can refer to the middle column of Table 1 for the answer to this one. Keep in mind that you are comparing a 3.0 earthquake to a 1.0 earthquake, so the difference is a change of 2.0. The easiest way to solve this is to think in terms of the increase from 1.0 to 2.0 and then the increase from 2.0 to 3.0.
14	B	Start by looking for the total number of quakes in 2006. Then, compare the total number to the number of quakes in the 4-4.9 and 5-5.9 range. You should be able to come up with a rough percentage estimate.
15	B	In this problem, the first thing to note is that the increase in magnitude is 0.3. Next, look at Table 1 under the "energy change" column. This will tell you how many times larger the energy output will be when the magnitude increases by 0.3.
16	A	Try reading each choice, then look in the text to see which student made that statement. Eliminate any choice that was not stated by either student, and any choice that was only stated by one student.

17	A	As you read each answer choice, determine whether the statement in the answer choice is the view of student 1, student 2, neither student, or both students. Write this as a note beside the answer choice. The correct answer is the choice that only applies to student 2, but not student 1. There is one choice that applies only to student 2 (the correct answer). There is one choice that both students agree with. There is one choice that only applies to student 1, and there is one choice that is not the view of either student.
18	B	Because the question says "According to student 2," you can focus on the text explaining the view of student 2. Read the passage carefully until you see information about the strengths of different types of bonds.
19	C	Both students stated that the last peak on the spectrum could not be larger than the mass of the entire compound. In this question, the mass of the molecule must be 32 amu, because that is the value of the last peak on the spectrum. Using the masses listed in Table 1, eliminate any answer choice that will have a mass over 32 amu. Look for an answer choice with a molecule whose mass will be very close or equal to 32 amu.
20	B	As you read the view for each student, list the fragments that the student believes were created. Student 1 stated the fragments CH_3CHOH and CH_3 were created. Student 2 stated the fragments OH, CH_3CO, COOH, and CH_3 were created. Which fragment was listed by both students?
21	D	Table 1 shows the mass of COOH to be 45 amu. Read the text for student 1, looking for an explanation for why a peak would exist at 1 amu less than the mass.
22	A	Since this question doesn't refer to either student, it's a good idea to read the introduction again to find the information needed to answer the question.
23	B	Read the introduction carefully - "a positive potential indicates a current will be produced." What arrangement of zinc and iron have a positive potential shown in the data table?
24	A	Find the reaction with no observable change. Notice the metal in the first column is solid, and the metal in the second column is the ion in solution.
25	A	There is only one cell in Experiment 1 with a negative potential. Find these two metals in the table for Experiment 2 – do they react? Look for every possible reaction – there should be two. After seeing that the iron anode and zinc cathode have a negative potential, try finding these in the experiment 2 table. In the reaction that does take place, write anode beside iron and cathode beside zinc. Now you will be able to better see how the anode and cathode correspond to the solid metal (A) or the metal ion in solution (B).
26	C	In the first table of potentials for electrochemical cells, there are two cells that have iron as the anode, and copper or cadmium as the cathode. The higher the potential, the more likely a current will be produced. You can check your conclusion with the second table where zinc is the anode.
27	C	Read the observation for the experiments that include copper as the ion in solution (there are two). The copper ion in solution is present before the reaction takes place, so what is the initial observation?

28	A	There are four types changes mentioned within the answer choices. Read each observation and decide how you would categorize that description into the different types of changes.
29	A	Identify what variable is being purposefully changed in both Experiment 1 and Experiment 2. Use this information to select the best answer choice. Be careful not to select an answer choice that is true for both Experiment 1 *and* Experiment 2. Since the question asks about what differs, choose the answer that is true for Experiment 1, but not true for Experiment 2.
30	C	The measurements recorded are for ten cycles of the pendulum motion. Find the time on the table for ten cycles for a pendulum released at a 70° angle. If this value is for ten cycles, how would you determine the time for just one cycle?
31	A	One variable was changed in each of the three experiments. Which of these variables had no effect? (Look for data that is nearly the same within one experiment.)
32	D	Notice that each trial in Experiment 3 was released at a 40° angle. Can you find a length in Experiment 3 that has the same time as the 40° release angle in Experiment 1?
33	C	Using the average time values will be easier and more efficient than looking at the individual trials. Look at the values for the time as the string length increases. What would be expected for a 2.25 meter string?
34	B	Read each answer choice carefully. Eliminate an answer choice that is impossible, incorrect, or irrelevant to these experiments and the passage. Is there an answer choice that stands out as the best?
35	C	A control is a variable included in an experiment to serve as a reference. What substance would not typically be considered a disinfectant, but would be included in the experiment as a standard for comparing results?
36	A	Imagine inserting another row for a bleach concentration of 5% in the table for Experiment 3. Where would the row be placed? What values for number of bacteria colonies would be consistent with the rest of the data in the table?
37	D	The plate with the smallest amount of bacterial growth will have the highest amount of alcohol. The data table shows how much bacteria grew on the plate. There are two parts to each of the answer choices. You may want to start with the reason – the hand sanitizer had more bacteria growth than the rubbing alcohol. Then answer the question – which has a higher concentration?
38	A	The data table shows a length of bacteria growth from the edge of the plate towards the center, which means smaller numbers correspond to less bacteria and a more effective disinfectant. This means listing in order of increasing effectiveness will be listing from the highest lengths of growth to the smallest.
39	B	Use the bar graph in Experiment 2 to estimate the number of bacteria colonies before disinfection with hydrogen peroxide. Then estimate from the bar graph the number of colonies after disinfection. Even with estimates, the difference of these values should be close to only one of the answer choices.
40	C	Contamination would cause more bacteria to grow on the plate. Which trial had more bacteria? You can also consider which trial had data that was inconsistent with the other trials.

Scoring Guide	
Estimated Score	**Number Correct**
36	40
35	39
34	-
33	38
32	37
31	-
30	36
29	35
28	34
27	33
26	31-32
25	29-30
24	28
23	26-27
22	24-25
21	22-23
20	20-21
19	18-19
18	16-17
17	14-15
16	13
15	12
14	10-11
13	8-9
12	7
11	-
10	6
9	5

8	4
7	3
6	-
5	2
4	-
3	1
2	-
1	0