Student Name: _____ Date: _____

Activity Sheet 2

BACTERIA TAKE-DOWN

Problem:

What metals are the most effective in inhibiting bacterial growth?

Background:

Germs are EVERYWHERE!!! We have hear this all before. Quite often illnesses and diseases can be caused by the transmittance of some sort of microorganism. These different ***microorganisms*** could vary from some sort of virus, fungi, or bacteria. These little invaders use the ***nutrient*** rich and warm human body to prosper and to replicate themselves (Alberts, Johnson, & Lewis). The surplus of these invaders is often what will cause a person to become ill. Therefore it is the medicines that we take that will play a role in affecting the life and growth of these microorganisms, and in some cases these organisms can even be killed off by the medicines that we take..

Medications can be made of of many things. One ingredient present in many medicines, as weird as it may sound, are different types of metals. Metals such as platinum, titanium, ruthenium, and more have been used in medical applications in the past.Some metals have antibacterial properties. In this lab experiment you will be testing to see if any metals seem to have these properties.

Hypothesis:

What metals are the most effective in inhibiting bacterial growth?

I believe that…

_____

Because,

_____

Materials:

- petri dishes (atleast 2 per group)
- agar powder
- heater or incubator
- cotton swabs
- vinegar
- hand sanitizer
- marker for labeling
- penny, nickel, quarter, aluminum foil, and other miscellaneous metals for testing.
- liquid bleach
- lab safety gloves

Safety:

- Wearing lab safety gloves, goggles, and an apron or lab coat
- Make sure that bacteria is dead before disposing of it by washing it down the sink. This can be done by using bleach.
- Make sure that all bacteria is contained and that hands are always washed after working with samples.

Student Name: _____ Date: _____

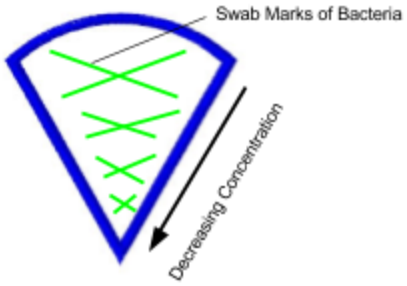
Procedure:

1. Aquire 1-2 agar plates. Plate cover should not be removed until instructed to do so.
2. Take the petri dishes out of the refrigerator and turn upside down. Using a marker split your dish up into three different sections.
3. Label each section with the metal that will be placed on the bacteria. Remember that one section should be labeled as "controlled" or "un-treated" and another should be labeled as "hand sanitizer sample.".An example is given to the right.

Example Petri Dish Bottom:

Note: The next few steps(4-9) should be done quickly in order to ensure the least amount of contamination**

4. Lif up the lid of the petri dish.
5. Introduce bacteria to the petri dishes. Use your bacteria of choice (ex: a thumb print or swab of the table) in each labeled section of the two petri dishes except for the hand sanitizer section (should be the same source introducing the bacteria into each section of the plate. When introducing bacteria into the dish press your sample down firmly into each section of the dish without breaking the agar. If using a cotton swab make has marks as seen to the right.



6. For the metal sections of the petri dishes add the metal on top of your plated bacteria. NOTE: If you are using coins you should first wash them with vinegar.
7. Quickly re-cover your petri dish.
8. Clean your hands or cotton swab thoroughly with hand sanitizer, let them dry, and then place your sample onto the final section of the perti dish (hand sanitizer sample).
9. After adding your bacteria replace the tops to the appropriate petri dishes quickly, as an extra precaution to prevent contamination, you can place each petri dish in a zipper-lock bag. This will provide an extra layer of protection against any hazardous bacteria colonies that may develop, but will still allow you to view the contents of the petri dish.
10. Record your Day 1 observations on the ***Data Sheet.***
11. Place the petri dishes in a warm, dark place (incubation system is ideal). Leave the petri dishes in a warm, dark place where the bacteria can develop, undisturbed, for several days. The ideal temperature for growing bacteria is around 98^0 F ($37\ ^0$C)... Similar to human body temperature!.
12. Leave the petri dishes in their warm dark place for 4-6 days, checking on them each day and writing down observations based of their appearance, smell, and size on the ***Data Sheet.***
13. After the 4-6 days record your final observations and compare your results with the rest of the class and examine which metals seemed to inhibit bacterial growth the most.

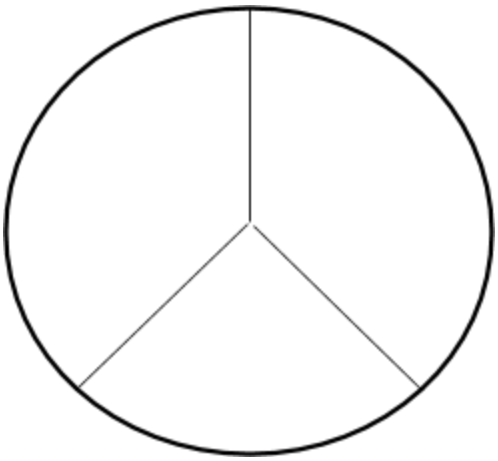
Student Name: _____ Date: _____

Data Sheet-

Day 1:

PETRI DISH #1

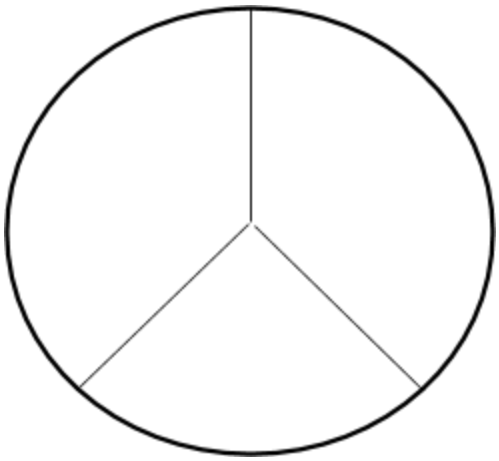
Diagram-



Observations-

PETRI DISH #2

Diagram-

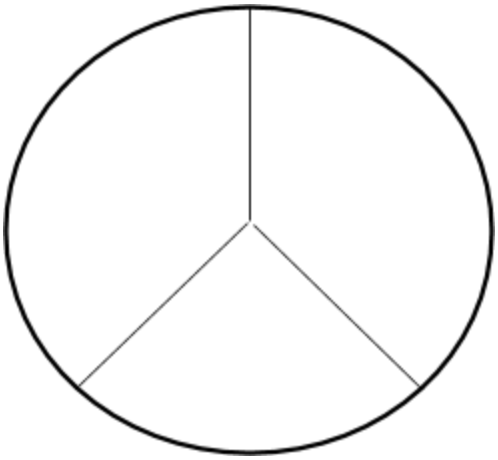


Observations-

Day 2:

PETRI DISH #1

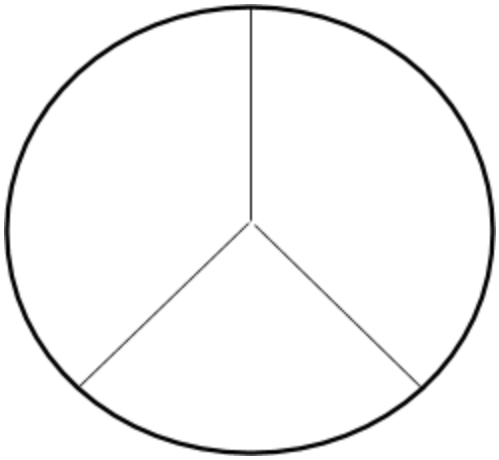
Diagram-



Observations-

PETRI DISH #2

Diagram-



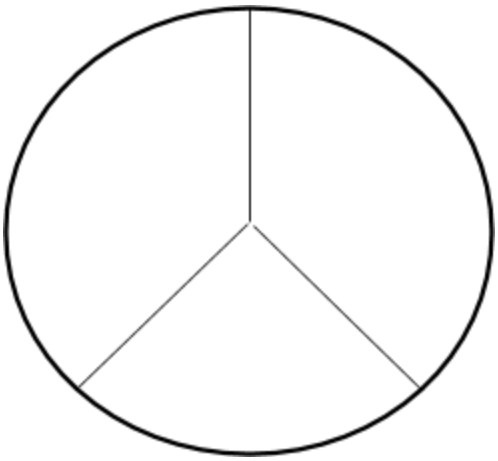
Observations-

Student Name: _____ Date: _____

Day 3:

PETRI DISH #1

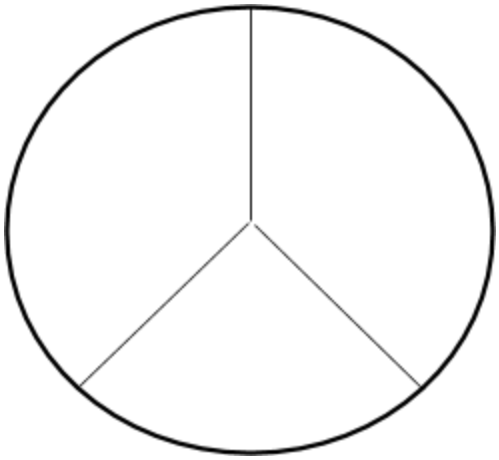
Diagram-



Observations-

PETRI DISH #2

Diagram-

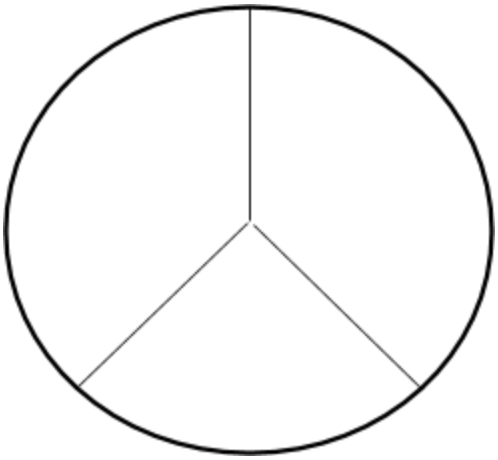


Observations-

Day 4:

PETRI DISH #1

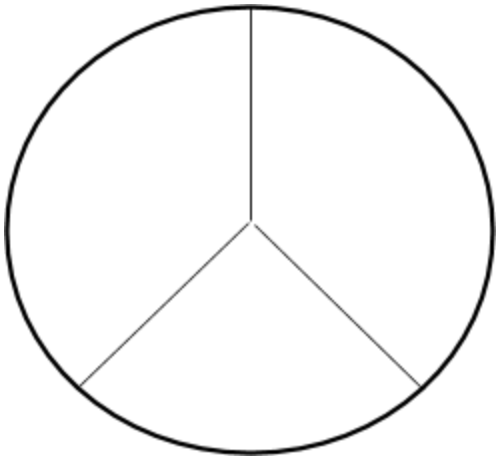
Diagram-



Observations-

PETRI DISH #2

Diagram-



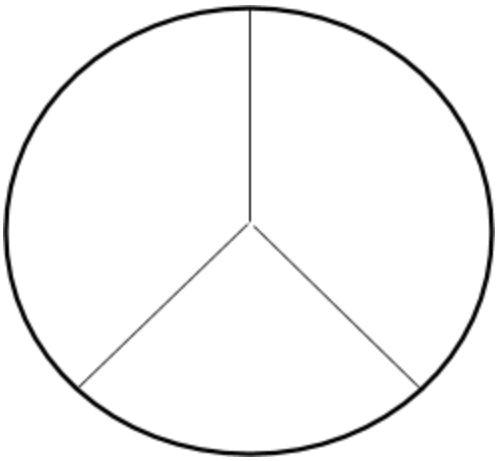
Observations-

Student Name: _____ Date: _____

Day 5:

PETRI DISH #1

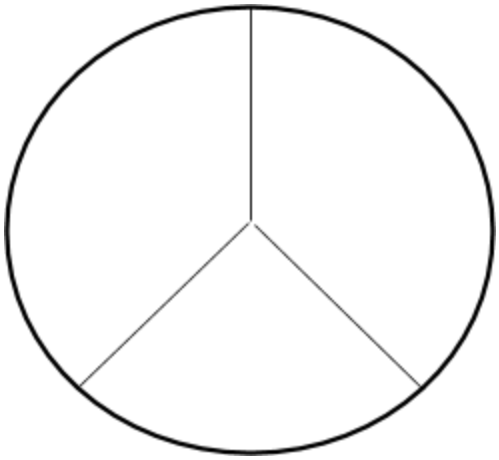
Diagram-



Observations-

PETRI DISH #2

Diagram-

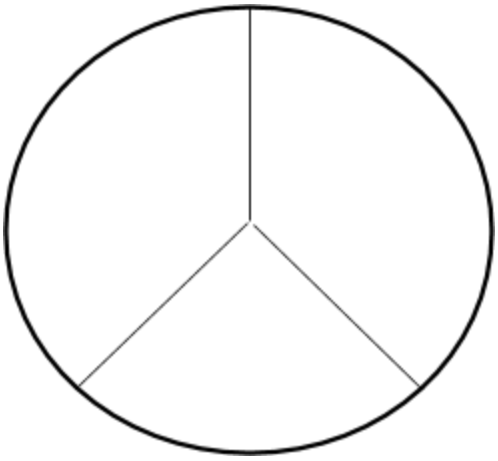


Observations-

Day 6:

PETRI DISH #1

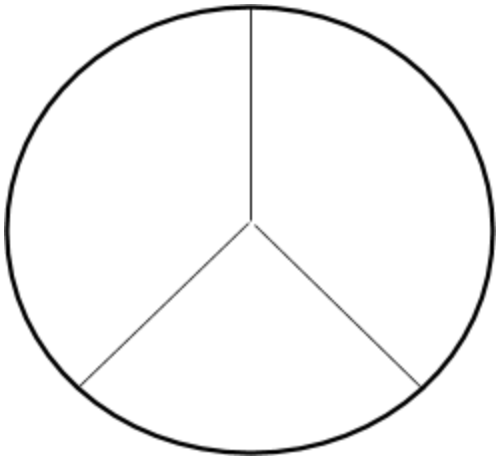
Diagram-



Observations-

PETRI DISH #2

Diagram-



Observations-

Student Name: _____ Date: _____

Discussion Questions:

1. How extensive was the growth of the "control" section of your petri dishes? Did this surprise you?

    a. Explain why you believe you normally do not see this bacteria on your hand?

2. Did your group see that any metals affected the growth of your bacteria compared to your control? Explain.

3. After comparing results with the rest of the class what were some other metals that were effective in killing bacteria in this experiment? Did these groups use a different source for their bacteria than you? Explain your findings.

4. Research the ingredients in pepto bismol and how it works. Write down some of your findings and record if you see any correlations to the lab we have completed today.

5. Explain why do you believe it may be important to use hand sanitizers and antibacterial soaps?

6. Hand sanitizers often claim to kill 99.99% of germs. What do you believe happens to that remaining 0.01% of germs that are not killed? Explain.

7. Explain how do you believe garguling salt water could help a sore throat?

8. Explain why you believe that metals may be used in sportswear.

9. It takes on average 12 years and over US$350 million to get a new drug from the laboratory onto the pharmacy shelf. Explain why you believe this process is so lengthy, considering many drugs have metals in them.

Student Name: _____ Date: _____

Conclusion Questions:

1. What metal was most effective as an antibacterial?

2. What were your findings with the hand sanitized section of the petri dish?

3. How do antibiotics work?
4. Research metals that have shown to hinder bacteria in medicine.

5. Research the drug "cisplatin" and explain its interaction with cancer cells to hinder their existence.

6. How would increasing the concentration of these metals in the bacteria's environment affect their growth and development?

7. What metal was the most affective in destroying bacteria in your experiment? What elements of the periodic table are present in that metal. Research that metal and hypothesize what some characteristics of it are that may lead to its antibacterial properties.

Extensions:

- You know that certain metals can hinder the growth of bacteria, but can they kill bacteria. Try this experiment again, but this time introduce the metal after the bacteria has shown significant growth to see if the metal is able to kill of the already grown bacteria.
- Coins have been made out of different combinations of different metals over the years. Test how coins of different ages would affect bacteria growth.