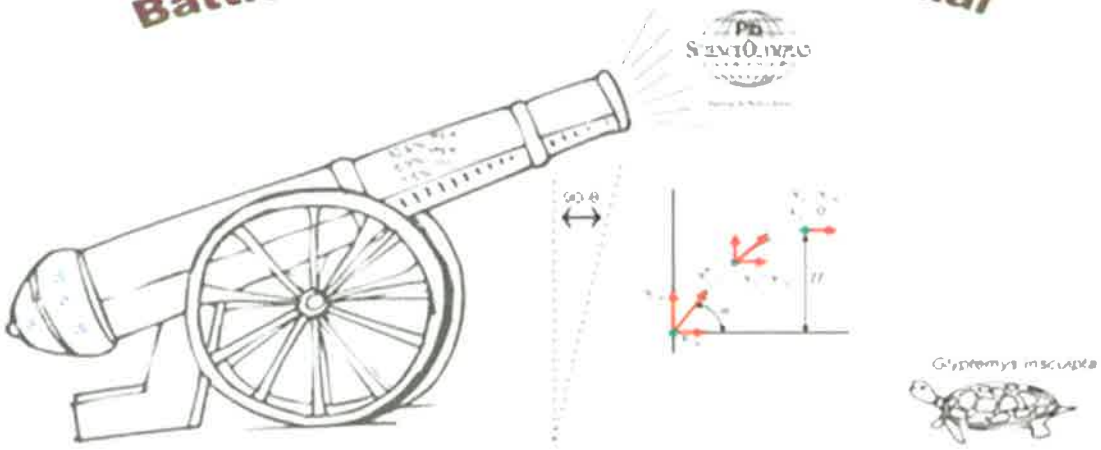
Science Olympiad Division C

Conestoga High School
Battle at Valley Forge Invitational



Microbe Mission Event- Lab Activity

Team Member Names: _____

_____

Team #: _____

School: _____

Directions: You will have 25 minutes to complete this 3 station lab activity. **Answers must be written clearly and legibly.**

Station 1
Micrometry

In this lab activity you will make measurements through a microscope of objects too small to be seen with the naked eye. You will use the Micro-Slide-Viewer and slide 91.

Slide 4 – Spirogyra- Put all metric answers in scientific notation!

Calibrating the Micrometer

1) Locate Microslide specimen 4 in your Micro-Slide-Viewer and bring it into sharp focus.
2) Insert eyepiece micrometer over the specimen slide.
3) Line up ruler A of the eyepiece micrometer with the 0.1 mm stage micrometer for specimen 4. You will notice that the 0.1 mm stage micrometer is equivalent to 11 spaces on the eyepiece micrometer. This means that 11 spaces equal 0.1 mm. You have now calibrated your meter.

The calibration made for Slide 4 is 11 eyepiece micrometer spaces = 0.1 mm

1) The length of the large cell in the center of the slide = _____ spaces = _____ mm
2) The width of that same cell= _____spaces = _____ mm
3) The volume of the spirogyra cell is _____

Surface Area And Volume	
Volume of a Sphere $V = 4/3\ \pi\ r3$ **Volume of a cube (or Square** V = l w h **Volume of a column** $V = \pi\ r2\ h$ **Surface Area of a Sphere** $A = 4\ \pi\ r2$ **Surface Area of a cube** A = 6 a **Surface Area of a rectangular Solid** A = Σ (surface area of each side)	r = radius l = length h = height w = width A = surface area V = volume Σ = Sum of all a = surface area of one side of the cube

Station 2

Taxonomy (Classifications and Keys)

Directions: There are 8 samples on the microfilm. Make sure the film is inserted with the number 217 facing in the correct direction. View each of the eight samples and use the key along with additional information provided to determine the name of each sample. Be sure to use the correct binomial nomenclature in your answers.

Key

1A General Shape is SPHERICAL (Go to 2)

1B General Shape is ROD (Go to 6)

1C General Shape is SPIRAL (Go to 10)

2A Found in pairs (3)

2B Found in chains (4)

2C Found in clumps (5)

3A With heavy cover (capsule) *Diplococcus pneumoniae* - (the cause of pneumonia)

3B Without heavy cover - *Diplococcus meningitidis*

4A Large in size - *Streptococcus pyogenes*

4B Small in size - *Streptococcus lactis*

5A Clumps of four (tetrads) - *Micrococcus tetragenus*

5B Irregular clumps - *Staphylococcus aureus* - (the cause of "staph" infections)

6A Found in chains - *Bacillus anthracis* - (the cause of Anthrax)

6B Found in pairs - *Bacillus lactis*

6C Found singly (7)

7A Containing a spore (8)

7B Not containing a spore (9)

8A Spore near the end - *Bacillus botulinum* - (the cause of Botulism poisoning)

8B Spore at one end - *Bacillus tetani* - (the cause of Tetanus infection)

9A With flagella - *Salmonella typhi* - (the cause of Typhoid infection)

9B Without flagella - *Bacillus pestis* - (the cause of Plague)

10A Filaments - *Treponema Pallidum*

10B Coma shaped- *Vibrio comma*

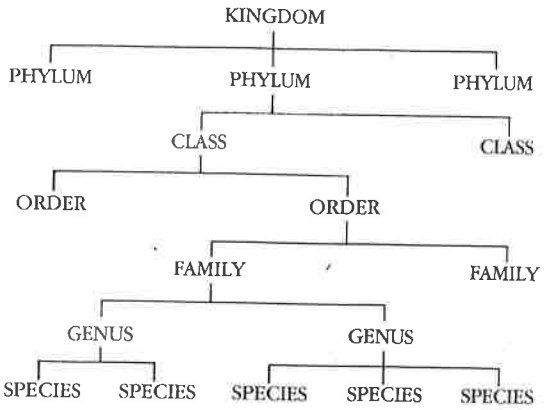
TAXONOMY

(CLASSIFICATION & KEYS)

SET 217

INTRODUCTION

The branch of Biology that deals with the naming and classifying of living organisms is known as TAXONOMY (tacs-ON-o-me). In this scheme, a worldwide name is provided for each kind of living organism based upon structural similarity. The present system is based upon the work of Carolus Linnaeus, a Swedish botanist. He separated living things first into very large groups called KINGDOMS. Each kingdom was then subdivided into smaller groups as depicted in the figure.



Linnaeus described each species by its GENUS (GEE-nus) name followed by only one descriptive word (both in Latin).Within each genus no two species could be described by the same word.

This two word system of naming living things is known as "BINOMIAL (two names) NOMENCLATURE". Each organism has a two word name, the first being the genus (Capitalized) and the second identifying the species within that genus (lower case). Man's scientific name in this system is *Homo sapiens.*

Scientists use a taxonomic tool called a "key" to identify and classify organisms. Generally keys consist of statements that occur in pairs describing characteristics (presence or absence of structures). The key with its paired statements is arranged to describe smaller and smaller groupings. To learn how a key works, a key to bacterial identification has been provided with this text folder. Examine each slide in the lesson. Begin at the top of the key for each of the slides. Choose the statement that best describes the bacterium you see on the slide. At the end of the statement you selected, you are referred to still another set of choices. Eventually, at the bottom of the key, the scientific name of the organism on the slide will be given. The magnification given means that the microscope was set at that power when the photograph was taken.

1 BACTERIA IN PAIRS–(1200x)

This particular organism can thrive in the respiratory tract of man and animals. The individual spherical cells are frequently grouped in pairs (see slide). Four of the pairs are enclosed in a delicate, well-marked capsule. In 1928, Frederick Griffith, a British bacteriologist, found that the capsule prevented white blood cells from effectively destroying cells of this bacterial strain. Similar bacteria without the protective capsule were found to be non-infectious. *Name this bacterium — use the key.*

By KATHRYN M. BAALMAN

2 A SPORE PRODUCER–stained–(1000x)

The bacterium shown on this slide is a spore producer. Notice that most of the spores are located *near* the ends of rod shaped cells (R). Some have become free of the cell (F). These spores are highly resistant to adverse conditions of heat, cold, and drying. To the bacteria, the spore is a means of survival, though it is not a means of reproduction. This ability to survive in unfavorable environmental conditions leads to medical problems. Should the spores shown here reach meats or vegetables prior to canning, and the foods are improperly sterilized and sealed, the spore may germinate and grow in the food, releasing deadly toxins. The bacterium is an ANAEROBE (an-AY-robe); it thrives only in the absence of or in limited amounts of oxygen. If the spoiled food is eaten, the toxins are absorbed and produce the symptoms of botulism (food poisoning). This can be prevented by proper sterilizing of foods. *Can you name this organism using the key?*

3 BACTERIA IN CHAINS–stained–(1000x)

Among throat infections, "strep throat" is one of the most severe. The variety of bacterium responsible for this infection belongs to a larger group with small ball-shaped cells that are arranged like beads on a string. Notice the chains on the slide highlighted by the arrows. In comparison with other round varieties, these bacteria tend to be larger than many other bacteria having the same shape. During "strep throat" infections a poison is released and absorbed into the blood stream. One result of the body's reaction to the poison is *rheumatic fever,* accompanied by aching and fever —frequently resulting in heart damage. *Nephritis,* an acute inflammation of the kidneys is another complication associated with "strep throat." *(Use the key to find the proper name of this bacterium).*

4 ROD SHAPED BACTERIA–stained–(2000x)

The bacteria on the slide are short plump rods. Most frequently they occur singly with an occasional pair. The bacterial cell is motile with about 12 FLAGELLA (flag-ELLA) arranged peripherally about the organism. The bacterium is the cause of a disease transmitted by contaminated water and food. The bacterium causes irritation of the alimentary canal, forming ulcers and producing diarrhea. This is a good example of a disease which can be transmitted by individuals who appear healthy but carry the infectious agent. The best illustration of a disease carrier was a kitchen worker whose death in 1938 ended a series of disease outbreaks resulting from her handling of food. Most cases occur from drinking polluted water. The flagella allow the bacteria to move around in the water as well as in the intestine. *Use the key to name these bacteria.*

5 ANOTHER SPORE PRODUCER–stained–(1000x)

This slide shows another anaerobic spore former. The rod shaped cells have enlarged spores at the extreme end of the cells. *Compare the location of these spores with the ones in Slide 2.* Like other species of bacteria, this bacterium produces poisonous substances (toxins) that diffuse from the cells and are absorbed by body tissues. The toxins may be carried by blood to body sites far from the wound wherein the infection is found. This bacterium may grow in a puncture wound in the foot (a particularly suitable environment for an anaerobe) and be carried to the jaw muscles producing the spasms and paralysis that account for the name "lockjaw" frequently used for this infection. *What is the disease called? Use the key.*

6 BOILS & ABSCESS BACTERIA–stained–(1000x)

The grape-like clusters you see on the slide are groups of spherical bacteria. The bacteria may enter broken skin to produce infections containing pus. The bacterium is a toxin former. This has been proven by injecting dead bacteria into animals and producing abscess and death. *Use the key to find its name.*

7 SYPHILIS BACTERIUM–Electron Micrograph–(30,000x)

The slide shows the regular spiral filaments of the syphilis bacterium. The bacteria are highly motile and are active with both backward and forward movements as well as rotations about the axis. Syphilis is a disease most commonly acquired by sexual contact. The bacteria may be carried through the lymph system to other parts of the body and in the secondary stage any tissue may be invaded. Skin rashes may be noticeable. In the final stage there may be central nervous system involvement. *Use the key to name the bacterium.*

8 SAUERKRAUT BACTERIA–stained–(2000x)

The rod-shaped cells shown here are frequently found in pairs. This group of bacteria is responsible for the fermentive process that occurs in shredded cabbage leaves. In order to carry out the formation of lactic acid, at least a partial exclusion of air is required during the fermentation process. This prevents decay from setting in. *Use the key to name this bacterium.*

SUMMARY

Frequently bacterial cells cannot be identified by the use of shape alone. Far too many characteristics are not visible, so bacteriologists have developed other methods to help in the identification process. Bacteria are classified and identified not only by their visible traits but also by traits such as the type of colony they form, the reaction to stains, metabolism and enzyme action. The key provided here was intended to introduce you to techniques of classification used in taxonomy and therefore made use of simplified traits that could be observed in microscope slides.

Station 2 Taxonomy Answers

1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

7) _____

8) _____

Station 3

Animal Parasites of Man

Directions: View specimens 1, 2, & 5 under the microviewer on film 75. Make sure the arrow is facing the correct direction when viewing. Name each of the parasites.

1) Specimen 1 _____

2) Specimen 2 _____

3) Specimen 5 _____

****Tie Breaker****
Micrometry

In this lab activity you will make measurements through a microscope of objects too small to be seen with the naked eye. You will use the Micro-Slide-Viewer and slide 91.

Calibrating the Micrometer

1) Locate Microslide specimen 3 in your Micro-Slide-Viewer and bring it into sharp focus.
2) Insert eyepiece micrometer over the specimen slide.
3) Line up ruler A of the eyepiece micrometer with the 0.1 mm stage micrometer for specimen 3. You will notice that the 0.1 mm stage micrometer is equivalent to 29 spaces on the eyepiece micrometer. This means that 29 spaces equal 0.1 mm. You have now calibrated your meter.

Slide 3 – Starfish Egg- Put all metric answers in scientific notation!

The starfish egg is an almost perfect sphere. We see it as a circle because we are looking at one level, at the equator of the sphere.

1) Locate Microslide specimen 3 in your Micro-Slide-Viewer and bring it into sharp focus.
2) Measure the diameter of the egg.
3) Measure the diameter of the nucleus.
4) Measure the diameter of the nucleolus.

The calibration of the slide is 29 eyepiece micrometer spaces = 0.1 mm

1) The diameter of the egg = _____spaces = _____ mm
2) The diameter of the nucleus = _____spaces = _____ mm
3) The diameter of the nucleolus = _____spaces = _____ mm
4) The volume of the egg = _____ mm^3
5) The volume of the nucleus = _____ mm^3
6) The volume of the nucleolus = _____ mm^3
7) What is the ratio in volume of the egg to the nucleus? _____ the egg to the nucleolus? _____

Surface Area and Volume	
Volume of a Sphere	r = radius
$V = 4/3\ \pi\ r3$	l = length
Volume of a cube (or Square	h = height
V = l w h	w = width
Volume of a column	A = surface area
$V = \pi\ r2\ h$	V = volume
Surface Area of a Sphere	Σ = Sum of all
$A = 4\ \pi\ r2$	a = surface area of one side of the
Surface Area of a cube	cube
A = 6 a	
Surface Area of a rectangular Solid	
A = Σ (surface area of each side)	

KEY

Introduction

In this lab activity you will make measurements through a microscope of objects too small to be seen with the naked eye. **You will use the Micro-Slide-Viewer.**

Slide 4 – Spirogyra- Put all metric answers in scientific notation!

Calibrating the Micrometer

4) Locate Microslide specimen 4 in your Micro-Slide-Viewer and bring it into sharp focus.
5) Insert eyepiece micrometer over the specimen slide.
6) Line up ruler A of the eyepiece micrometer with the 0.1 mm stage micrometer for specimen 4. You will notice that the 0.1 mm stage micrometer is equivalent to 11 spaces on the eyepiece micrometer. This means that 11 spaces equal 0.1 mm. You have now calibrated your meter.

The calibration made for Slide 4 is 11 eyepiece micrometer spaces = 0.1 mm

4) The length of the large cell in the center of the slide = _____28_____ spaces = ___0.25 or 2.5×10^{-1}___ mm
5) The width of that same cell= __11_____spaces = _____0.1 or 1×10^{-1}___ mm
6) The volume of the spirogyra cell is __0.002 mm^3 or 2×10^{-3}___

Station 2- Taxonomy Key

1) Diplococcus pneumoniae
2) Bacillus botulinum
3) Streptococcus lactis
4) Salmonella typhi
5) Bacillus tetani
6) Staphylococcus aureus
7) Treponema Pallidum
8) Bacillus lactis

Station 3- Animal Parasites of Man Key

1) Specimen 1 = Trichina worms
2) Specimen 2 = Adult Hookworm
3) Specimen 5 = Malarial Parasite

****Tie Breaker****

Slide 3 – Volume (Starfish Egg) Put metric all answers in scientific notation!

The calibration of the slide is 29 eyepiece micrometer spaces = 0.1 mm

1) The diameter of the egg = _____29_____spaces = _____0.1 or 1 x10^{-1}_____ mm

2) The diameter of the nucleus = _____14_____spaces = ____0.048 or 4.8 x 10^{-2}__ mm

3) The diameter of the nucleolus = _____4____spaces = _____0.013 or 1.3 x 10^{-2}____ mm

4) The volume of the egg = _____0.0005 or 5 x 10^{-4}_____ mm^3

5) The volume of the nucleus = ___0.00005 or 5 x 10^{-5}_____ mm^3

6) The volume of the nucleolus = ____0.000001 or 1 x 10^{-6}_____ mm^3

7) What is the ratio in volume of the egg to the nucleus? _____10:1_____ the egg to the nucleolus? _____500:1_____