Bio Lab Test Review

**Lab 1: Safety Rules**

* Important: security rules, being able to find it in classroom, and using information found in safety manual
* Important rules:
  + Important to use a lab coat (batas) and goggles (gafas) – especially when dealing with chemicals or live or preserved specimen

\*Sometimes other security is needed like gloves

* + No eating, drinking, smoking, or putting on makeup during the laboratory
  + Know where things are in the classroom: fire extinguisher and blanket, first aid kit, safety and eye showers
  + Be aware of the Material Safety Data Sheet (MSDS) and be aware of what parts are needed for specific labs
  + Reading the labels of everything being used (chemicals) in order to be aware of the dangers and its use (reactivity, etc)
  + Dressing appropriately with long pants, closed shows, and hair back
  + Have bookbags and personal belongings to the side of the classroom so they do not get in the way
  + All lab equipment stays in the classroom
  + Label everything correctly with your name
  + Never point reactions or equipment at yourself or others
  + Make sure to stay in the classroom and at your designated table during the lab time (or waiting for your turn to use some lab equipment)
  + Ask instructor about any instrument, especially if broken
  + Use only the necessary amount of materials and dispose of it once done (never putting it back in the original container)
  + The type of waste should be disposed of in the correct place, solid waste in the correct container (not the sink), liquids down the drain (if they are able to), wait for instructor’s instructions on waste
  + Keep your area in order and neat and put everything back in its correct place once done. Leave the classroom how you found it.
  + Hands should always be clean, before, during, and after experiment
  + Inform instructor about any accident or problem and wait for his instructions, if needing to evacuate. Make sure to be aware of safety instruments if they ever become necessary to be used.

\*First make sure your fellow students become aware of situation, then notify instructor, who will then notify the external authorities. This may lead to needing to fill out a report on the accident.

**Lab 2: Scientific Method**

* **Scientific method**: systemic and rational way that scientists design experiments, collect data and information, and test ideas. Way to find the answer to a question
  + **Observation**: using your senses or instruments that help with perception. Observations should be without error and exact. Opinions and emotions shouldn’t influence observations. Have all observations written down and recorded.
  + **Problem**: through observation, problems and questions arise. This problem is the one the scientist tries to solve, using a well-planned experiment. Developing an experiment and thinking of an investigation requires an inquisitive mind and ability to question.
  + **Hypothesis**: A possible answer to the question (problem) that has been based on observation, writing, and scientific intuition and knowledge. The hypothesis is created using your own thinking and creativity in thinking of a possible explanation to the problem. A hypothesis needs to be tested using an experiment in order for there to be real evidence to support it.
  + **Look for information before beginning experiment**: finding all possible information on this topic before beginning experiment allows the scientist to be well-versed and avoid possibly duplication experiments already done.
  + **Experimentation**: an investigation that is performed under strict conditions in order to control all variables beside the ones being studied.
  + **Analysis of results**: Taking the information and data gained from the experiment and analyzing it in regard to the hypothesis in order to determine if it was correct or incorrect. A conclusion is then inferred from this information, and this establishes possible new questions to be experimented.
* Relationship between scientific investigation in the natural science and other sciences (Social sciences, psychology)
  + Scientific investigation and experimentation are not only used in natural sciences like biology, chemistry, and physics. It is also heavily used in other types of sciences, such as the social sciences (like psychology), because those studies also require a process in which problems are tested and theories are made. Both areas of study have similar processes of investigation, because it’s a universal process thacan be applied to any topic and branch of life, they just studythings. Scientific investigation is a process that helps ensure accurate and unbiased answers to questions.
* What are experimental conditions?
  + The variable that applies to what is being studied or tested, is being studied to see any change or affect. What is being changed for the sake of the experiment and problem being studied.
* Importance of the control group
  + This allows for the scientist to focus on only the variable being studied, the control group allows for the experiment to be accurate and have no outside factors affecting it. A control groups allows for the experimenter to determine changes or affects due to the experiment or a variable not being experimented that may ruin the experiment. Kept constant.
* What are replicas and importance of them
  + Replicas is a process in the scientific community in which experiments are redone in order to test the question once again and ensure the result that was reached in the original experiment is accurate and holds up in repeated experimentation. This is an important step in the process of establishing theories and scientific laws, because it ensures that the information being proven is accurate and can be deemed a reliable claim or theory.
* Importance of data and differentiate it from information
  + Data is what is acquired from performing the experiment, it is statistics or numbers that are initially gathered. This data needs to be organized and applied to whatever the problem or objective is in order for it to becomes information that is useful and has a meaning toward what is being studied.

DATA INFORMATION

|  |  |  |
| --- | --- | --- |
| * **Description** | Qualitative/ Quantitative variables that present themselves with the potential to be developed into ideas or analytical conclusions. | Data that is structured and collated to further its meaning and contextual usefulness. |
| **Format** | Data follows the form of either letters, numbers or characters. | Information follows the format of either ideas or references |
| **Representation** | Data is structured either in graphs, data trees, flowcharts, or tables. | Information is represented as ideas, thoughts, and languages after collating the data acquired. |
| **Meaning** | Data doesn’t serve any purpose unless given to. | Data when interpreted and assigned with some meaning derived out of it, gives information. |
| **Interrelation** | Data is information collected | Information is data processed |
| **Features** | Data is raw and doesn’t contain any meaning unless analyzed. | Information is data collated and produced to further a logical meaning. |
| **Interdependence** | Data doesn’t depend on information. | Information can’t exist without data. |
| **Unit** | Data is measured in bits and bytes. | Information if mostly measured in units like quantity, time et al. |
| **Use Case for Decision Making** | Data alone doesn’t pertain to the qualities to help derive decisions. | The information contains analytical coherence to help derive a decision. |
| **Use Case for Researchers** | Data acquired by researchers might become useless if they have no analytical inferences to make. | Information adds value and usefulness to researchers since they are readily available. |

* Define and give examples of these different types of reasoning:
  + Deductive: drawing conclusions from facts already known

Ex: John’s pet is a dog, all dogs have four legs, so johns pet has four legs

* + Inductive: using a specific scenarios to come to a generalized conclusion

Ex: The swans in the lake are all white, so all swans are white

* + Logic: a way of thinking that uses reasoning to make assumptions

Ex. If Diego is limping, then he must be hurt

* + Subjective: Reasoning based on a person’s own individual perspective or preferences

Ex. Someone thinking rollercoasters are unsafe because they fear heights

* + Objective: Making assumptions without the influence of own personal views and opinions

Ex. Creating a hypothesis based on observations instead of personal opinion

* Define and give examples of:
  + Experience: gaining knowledge and information due to observation and experimentation

Ex. Determining results and establishing a conclusion after an experiment, proving or disproving your hypothesis

* + Science: the study of nature and the environment by observing and experimenting, as well as testing theories using evidence

Ex. Scientific process (Biology, Chemistry, etc)

* + Pseudoscience: A type of study that cannot be tested with experiments to find qualitative or quantitative evidence. Cannot use scientific method, so no scientific basis.

Ex. Astrology

* + Phenomenon: An occurrence that takes places and is questioned and experimented with

Ex. A natural phenomenon (Earthquake, tornado, etc)

* + Problem: A question that needs to be answered with a scientific experiment

Ex. How does sunlight affect a plant?

* Identify, differentiate, and give examples of:
  + Hypothesis: A possible answer to the question (problem) that has been based on observation, writing, and scientific intuition and knowledge. It is what is supposed to be proven or disproven with the experiment.
  + Theories: an explanation with a high degree of reliability, a hypothesis that has been repeated and proven by several experiments and observations. The theory explains the reasons behind what is observed and allows for a base for additional experiments.
  + Laws: when a theory has been accepted and proven over and over and generated further predictions, it then becomes a law, which is something that describe an aspect of nature.
  + Arguments: An explanation proposed that explains something and needs to be tested.
  + Postulates: A statement that has been accepted to be true and is used as the bases for theories and arguments
* Importance of system of measurements in making decisions
  + Metric system vs English:
    - Metric: feet, inches, pounds – in US
    - English: meter, grams (kilo, mili, centi) – in Europe and rest of world
  + Precision and accuracy: important during an experiment in order to make sure the results and data/information gotten from the experiment is useful
    - Precision: how close measurements are to each other
    - Accuracy: how close the measurement is to the true value
  + Rounding and precision:
    - Rounding: useful when the number is too big or small, so it is rounded up where it only contains the significant values

**Lab 3: Data Analysis**

* Statistics: method of collecting, organizing, and analyzing numeric data and observation. Presents data in a simple and comprehensible form.
  + Constructing data in tables and graphs allows for observing clearly groups of data, which allows us to establish tendencies and relations, compare different groups of data, and create a relationship between one or more variables.
  + Data is represented by variables which can be stuff like weight, length, temperature, and time. The data that is based on some variable. Usually, two or more variables are compared (ex. Weight throughout time)
    - Dependent variable: variable that depends on the other variable
    - Independent variable: variable that does not depend on the other
* **Table**: allows better observation of the summary of the data obtained, a representation of the data in relation to the variables being studied
* **Graphs**: using the information from the table, different types of graphs (histogram, pie chart, line graph)
  + Histogram: used usually when the information can be grouped into distinct groups of similar magnitude, which shows the variation that is present in the entire data group.
    - Frequency: the number of times that a certain data repeats in the entire data group
      * Grouped frequencies: reorganized data into different group intervals that allows for a better, clearer, and faster interpretation of information.
    - Needs title, label both x and y axis
  + Pie chart: percent distribution, data needs to be converted to percentage. Each section of the circle represents a certain percentage pertaining to a specific interval of data. This allows for us to compare each individual percentage of an interval of data to the entire data group
  + Line graphs: there is y axis (ordered- dependent) and x axis (abscissa- independent)
    - Where it intersects represent 0, and to the right of x is positive, to the left negative
    - Divided into 4 quadrants
    - Each point is a specific (x,y)
    - Needs a title and legend, label both x and y axis
    - **Dispersion diagram**: when the graph rises then falls creating an upside-down U
* **Statistical analysis**: allows us to make decision on the validity of the results and its significance
  + **Measures of central tendency**: mead, median, and mode
    - Mead: sum of all the results divided by the number of data
    - Median: middle point of the data when it is in order of smallest to largest
    - Mode: most frequent value that is repeated in the group of data
* **Vernier calibrator**: an object used to measure things with precision, even very small things
  + Main jaws
  + Small jaws
  + Main scale
  + Vernier scale
    - Put object in between main jaw, and the number will be the number on the main scale that lines up with the zero on the vernier scale. That will be the number before the decimal point (main number). The number after the decimal point is determined by finding the first number on the vernier scale that lines up with a number on the main scale. The number that lines up from the vernier scale will then be multiplied by the measurement that a single line on the vernier scale stands for. This will give you the decimal number which you just add to your main number, giving you your final number.

**Lab 4: Acids and Bases**

* Water is the standard for pH. It is neutral, equal amounts of positive and negative iones (hidrogeno and hidróxido)

H20 🡨-> H+ + OH-

* **Acid**: créate iones of hidrogeno when disolved in water, increase the amount of hidrogeno iones, decreasing hidroxido
* **Bases**: decrease the concentration of hidrogeno iones in a solution, increase hidróxido
* **pH**: measure of hidrogeno iones in a solution and helps determine the acids or bases in the substance

pH = -log [H+]

* + Concentration of H+ is always between 0 and 1 (a decimal) and the logarithm is negative, but using the inverse the pH Will always come out positive
  + Scale goes from 1 to 14
* Escala de pH: es una escala para medir la cantidad de iones de hidrógeno en una solución.
  + 7 significa neutral, no acidez o alcalinidad
  + 1 significa acidez, una concentración alta de iones de hidrogeno (menos hidróxido)
  + 14 significa alcalinidad, una concentración baja de iones de hidrogeno (más hidróxido)
* Agua disocia en iones de hidróxido e hidrogeno, este reaccione es reversible
* Sustancias amortiguadoras: sustancia que mantenga el nivel de acidez o alcalinidad en una solución, añade o absorbe iones de hidrogeno. Es una reacción de equilibrio, cuando hay mucho de una cosa se añade el otra cosa para que mantenga los niveles necesarios
* Keeping pH in control is important, it allows for an organism to function and do its cellular functions

**Lab 5: Medidas**

* 1 ml = 1000 mg