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GREATER ATLANTA CHRISTIAN SCHOOL

# College Prep. Biology

## Summer Assignment 2024

**Your summer assignment consists of 3 parts:**

1. Read the 2 passages and answer the questions following each passage. Activities like this will help in reading and comprehension in CP Biology.
2. Attached is a list of root words that you will encounter throughout CP Biology. Please learn these root words and be prepared for a quiz on them after the spiritual retreat.
3. Complete the graphing packet – make the graphs as instructed and answer the associated questions.

**Be prepared to turn in the entire packet on the first day of school.**
**Each student should complete the work independently. Do not collaborate.**

**Passage I**

Eutrophication is a phenomenon where excessive amounts of nutrients are added to a marine ecosystem. These nutrients cause plant life like algae to multiply rapidly, leading to very high population densities. In freshwater ecosystems, the algae can become so dense that it can turn ponds, lakes or even smaller rivers green. The algae grows to an unreasonable level at a very fast rate. The algae are known as phytoplankton and are microscopic, single-celled organisms.

A body of water that is experiencing eutrophication and a resulting bloom can be quickly devastated. Eutrophication affects all living organisms in the area including fish, birds and mammals. The top layer of phytoplankton causes such a build-up on the surface that they accumulate sediment. When this occurs, the sunlight is blocked and it will choke off the plant life below the surface. The phytoplankton will also cause less surface area for the water to interface with air. As a result, there will be less oxygen available in the water. As oxygen continues to deplete, the depletion can have a negative effect on life as there will be less oxygen to support the organisms below the surface that depend on the oxygen from plants that diffuses into the water.

*Scientist 1 explains:*

The root cause of eutrophication is not known. However, the frequency and increasing incidents of eutrophication point to human farming activity as the potential cause. The growth of the phytoplankton is caused by runoff that contains multiple sources of nitrates that are also found in fertilizer. The nitrates allow for the phytoplankton to grow rapidly. The solution to the problem is to either move the drainage so the runoff from the human farming activity cannot reach the water source or move the farms.

*Scientist 2 explains:*

Sometimes eutrophication can happen naturally without any real cause. Sometimes when there are periods of heavy rain, the increase in rain water leads to an imbalance in the pH of the water. This in turn

creates favorable conditions for the phytoplankton to grow and proliferate. This is a natural cycle that also ensures that too many fish and other animals do not build up in a freshwater source. This type of bloom is nature's way of eliminating overpopulation with an abiotic factor. Although many organisms will die as a result, it will help to thin the numbers of organisms and ensure a healthier freshwater source.

**Answer each of the following questions based on Passage I.**

**Question 1**

According to Scientist 1, which of the following is the cause of the eutrophication?

_____ A change in the pH of the water.
_____ The increasing changes in phytoplankton.
_____ Agricultural run-off from human activity.
_____ The build-up of phosphates in the body of water.

**Question 2**

What is the main point of disagreement between Scientist 1 and Scientist 2?

_____ The source of the nitrogen.
_____ The root cause of the eutrophication.
_____ The effects of the lack of oxygen.
_____ The effect of the plant life in the aquatic ecosystem.

**Question 3**

Both scientists would likely agree that eutrophication is

_____ algae that will occasionally grow in aquatic ecosystems due to human activities.
_____ a bloom of phytoplankton that grows in response to high levels of phosphates.
_____ a large build-up of algae that grows at a rapid rate in a body of water.
_____ an explosion of algae due to natural factors and the need to reduce overpopulation.

**Question 4**

According to Scientist 2, eutrophication is necessary for

_____ the control of overpopulation in an aquatic ecosystem.
_____ the natural control of the pH of water in an aquatic ecosystem.
_____ the normal process that takes place in a pond in response to farmland runoff.
_____ the rejuvenation of aquatic life, which thrives during such an event.

**Question 5**

Scientist 1 probably mentions farming and agriculture in order to:

_____ point to a human activity that would cause eutrophication.
_____ show that humans changing natural land is bad for the environment.
_____ bolster his case for humans causing a change in the pH of the water that leads to eutrophication.
_____ bolster his case that human activity such as farming increases nitrates, leading to eutrophication.

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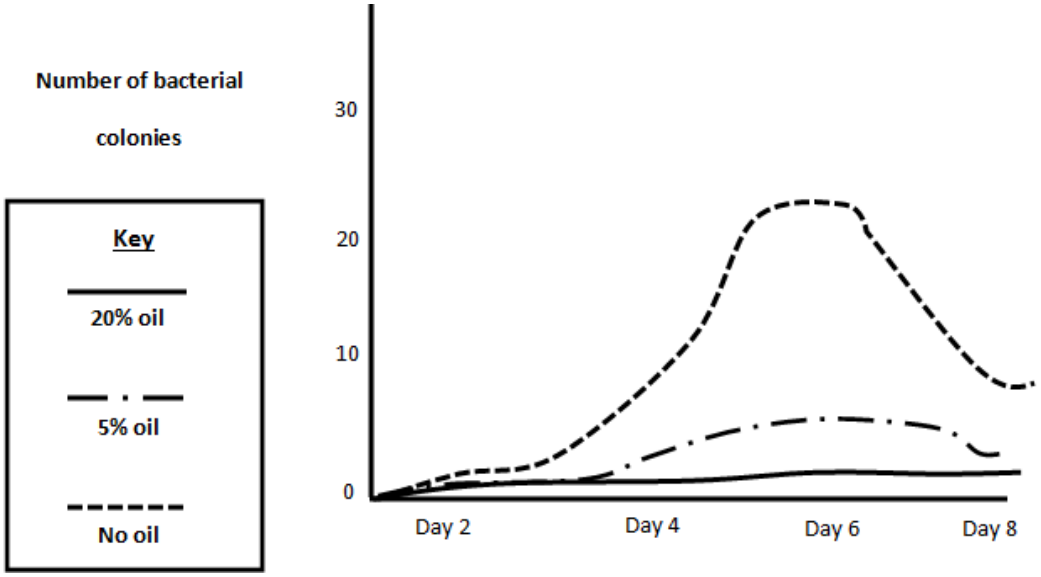
**Question 6**

The end result of a severe eutrophication event will always be:

_____ A regrowth of new life because of the nitrates in the water.
_____ The death of the phytoplankton when it over-accumulates.
_____ A massive die off of both plant and animal life in the aquatic environment.
_____ The growth of more plant life in the water as they grow well with plankton.

**Passage II**

A group of scientists were studying the growth of bacteria. It is their hope that they will be able to induce the bacteria to grow and metabolize oil as a food source. They have taken three samples of Escherichia coli and are growing them on nutrient agar plates. The scientists used three conditions to test the E. coli bacteria. The first group was grown at 37°C on plain nutrient agar plates. The second group was grown at 37°C on plain nutrient agar plates with a 5% oil solution. The third group was grown at 37°C on plain nutrient agar plates with a 20% oil solution. The results of the experiment are listed in the graph below.




**Answer each of the following questions based on Passage II.**

**Question 1**

What is the independent variable in the experiment above?

_____ The type of bacteria used.
_____ The nutrient agar.
_____ The percentage of oil on the nutrient agar.
_____ The number of days the bacteria grew.

**Question 2**

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What is the dependent variable in the experiment above?
_____ The number of days the bacteria grew.
_____ The nutrient agar.
_____ The nutrient agar with oil.
_____ The amount of growth (number of colonies) of the bacteria.

**Question 3**
Which bacterial culture had the greatest rate of growth throughout the 8 day period?
_____ Only the culture grown on nutrient agar had significant growth.
_____ The nutrient agar plate and the 5% oil plate had growth.
_____ The nutrient agar plate and the 20% oil plate had growth.
_____ The 5% oil and 20% oil plates had growth.

**Question 4**
What is the best explanation for why the *E.coli* grew on the 5% oil plate but not the 20% oil plate?
_____ The bacteria are used to an environment with 5% oil and not 20% oil.
_____ The bacteria were able to mutate to tolerate a slightly oily environment of 5% oil.
_____ The 5% plate had conditions that are similar to the natural environment they are accustomed to.
_____ The 5% plate allowed more oxygen to interface with the bacteria because less oil was present.

**Question 5**
Why did the nutrient agar bacteria plateau and then drop in numbers as they approached Day 8?
_____ The bacteria died because they had reached their mature age.
_____ The bacteria ran out of nutrients and had reached the carrying capacity of the plate.
_____ The bacteria always die after Day 6 in culture.
_____ There is no definitive reason why the bacteria died off after Day 6.

**Question 6**
An excellent way to demonstrate that the scientists have induced E.coli to survive and metabolize oil would be to:
_____ Repeat the experiment several times with 5% oil on a nutrient agar plate.
_____ Induce the bacteria on the 5% oil plate to grow on nutrient agar.
_____ Take the bacteria from the 5% oil plate and test them on a new 20% oil plate.
_____ Try new bacteria with the same experiment to see if that is the only bacteria that can accomplish this.

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## Part 2

## Root Words that you will encounter throughout CP Biology

Please learn these root words and be prepared for a quiz on them after the spiritual retreat.

| | | |
|---|---|---|
| ***ad***- *next to as in adaxial* | ***aeros***- *air as in aerobic* | ***an*** *- without -as in anaerobic* |
| ***ana*** *- away -as in anaphase* | | |
| | ***anti*** *- against - antibody* | ***aqua*** *- water - aquatic* |
| ***archae -*** *ancient - archaebacteria* | ***arthron*** *- jointed - arthopod* | ***autos -*** *self - autoimmune* |
| | ***aster*** *- star - asteroid* | |
| ***bi -*** *two - bipedal* | ***bio*** *- life - biology* | ***carn*** *- flesh - carnivore* |
| ***ceph***- *head - cephalopod* | ***chloros*** *- pale green - chloroplast* | ***chroma*** *- colored - chromatography* |
| ***cide*** *- kill - pesticide* | ***cyte*** *- cell - ecytoplasm* | ***con*** *- together - convergent* |
| ***derma*** *- skin - epidermis* | ***de*** *- remove - decompose* | ***dendron*** *- tree - dendrite* |
| ***di*** *- two - disaccharide* | | |
| ***eco*** *- house - ecosystem* | ***ella*** *- small - organelle* | ***endo*** *- within - endosperm* |
| ***epi*** *- upon - epidermis* | ***eu*** *- true/good - eukaryote* | ***exo*** *- outside - exoskeleton* |
| ***genos*** *- make - genotype* | ***gravis*** *- heavy - gravitropism* | ***genesis*** *- orgin - parthenogenesis* |
| ***jugare - join -conjugate*** | | ***halo -*** *salt - halophile* |
| ***haplo*** *- single - haploid* | | ***hemo*** *- blood -hemoglobin* |
| ***herba*** *- plant -herbivore* | ***heteros*** *- mixed - heterotrophic* | ***homeo*** *-same - homeostasis* |
| ***homo-*** *human - hominid - Latin word meaning man* | ***homos*** *- alike - homozygous - Greek word meaning the same* | ***hydro -*** *water hydrolysis* |

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| | | |
|---|---|---|
| ***inter*** *- between - internode* | ***intra*** *- within - intracellular* | ***isos*** *- equal - isotonic* |
| ***jugare*** *- join -conjugate* | ***karyon*** *- seed - prokaryote - karyon means nut/kernal - referring to the nucleus of a cell* | ***keras*** *- horn - chelicerae are organisms that have pinchers or claws; keratin is a strong structural protein* |
| ***Leukos -*** *white - leukocyte* | ***logy*** *- study of - biology* | ***lympha*** *- water - lymphatic* |
| ***lysis*** *- loosen/dissolve- hydrolysis* | ***makros*** *- large-macromolecule* | ***megas*** *- large-megacolon* |
| ***mesos*** *- middle- mesoderm* | ***meta*** *- after - meta analysis* | ***micro*** *- small-microscopic* |
| ***monos*** *- single - monarchy* | ***morphe*** *- form-amorphous* | ***nomia*** *- law- taxonomy* |
| ***neuro****-nerve-neurotoxin* | ***nodus*** *- knot- nodule* | ***oligos*** *- few - oliguria* |
| ***para*** *- beside - parallel* | ***omnis*** *- all - omnipotents* | ***paleo*** *- ancient-paleontology* |
| ***Pathos*** *- disease-pathogen* | ***pedis*** *- foot-pedal* | |
| ***per*** *- through-permeable* | ***peri*** *- around-perimeter* | ***phago-****eat-phagocyte* |
| ***photos*** *- light-photon* | ***phulon*** *- related group-phylogeny* | *phyllon - leaf-chlorophyll* |
| ***phyton*** *- plant- bryophyte* | ***pilus*** *- hair - depillatory* | ***pinna*** *- feather - pinnate* |
| ***plasma*** *- mold - plasmodium* | ***pod*** *- foot - gastropod* | ***polys*** *- many- polycystic* |
| ***post*** *- after - posterior* | ***pro*** *- before - prokaryote* | ***protos*** *- first - prototype* |
| ***pseudes*** *- false - pseudoscience* | ***re*** *- again - repeat* | |
| ***scop*** *- look - microscope* | ***soma*** *- body - somatic* | ***sperma*** *- seed - gymnosperm* |
| ***stasis*** *- staying - homeostasis* | ***stoma*** *- mouth- stomata* | ***syn-*** *together - synapse* |
| ***telos*** *- end - telophase* | ***terra*** *- earth - terrestrial* | ***therme*** *- heat - endotherm* |
| ***thulakos*** *- pouch - thylakoid* | ***trans*** *- across - transport* | ***trich*** *- hair - trichome* |
| ***trope*** *- turn-tropism* | ***trophe*** *- nourish - autotroph* | ***uni*** *- one - unicellular* |
| ***vacca -*** *cow - vaccine* | ***vorare*** *- devour - voracious* | ***xeros*** *- dry - xerosis* |
| ***zoon*** *- animal - zoology* | ***zygous*** *- joined - zygote* | ***tax*** *- arrangement - taxonomy* |

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**Part 3**

# Graphing Packet

## Introduction

Graphing is used by scientists to display the data that is collected during an experiment. A line graph must be constructed to accurately depict the data collected. An incorrect graph could lead to acceptance of an incorrect hypothesis or prevent the acceptance of a correct hypothesis.

The graph should contain 5 major parts: the title, the independent variable, the dependent variable, the scales for each variable, and a legend.

1) **The Title:** This tells what the graph is about. Reading the title should give the reader an idea about the graph. Your title should be concise.

2) **The Independent Variable:** This is the variable that is manipulated in an experiment (part of the experiment that changes. This variable should be placed on the horizontal or x-axis.

3) **The Dependent Variable:** This is the variable that is directly affected by the independent variable. It is the result or outcome of what happens because of the independent variable. This variable is placed on the y or vertical axis.

4) **The Scales for each Variable:** When constructing a graph, you will need to know where to place each point of data. A scale is used that will include all the data points from your collected data. Each block on your graph should have a consistent amount or increment on a particular axis. It is important not to make the scale too big or too small. It is also important to use multiples (ex: 5, 10, etc.) that are easy to handle. Try to use as much of the graph space that is provided when labeling your scale.

5) **The Legend**: This is a short explanation of your graph. It should be concise and to the point.

Graph paper has been supplied at the end of this packet.

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**Graphing Activity #1**

The rate of photosynthesis can be measured in plants based on the number of bubbles produced per minute. In this experiment, the number of bubbles produced by two different aquatic plants was measured at different depths of water.
Use the data in the table below to complete the graph provided. Remember to include the title of your graph, label the x and y axes properly, create an appropriate scale and write a legend for your graph. After completing your graph, answer the questions below.

| **Depth in meters** | **Number of bubbles/min Plant A** | **Number of bubbles/min Plant B** |
|---|---|---|
| 2 | 30 | 20 |
| 5 | 36 | 30 |
| 10 | 45 | 40 |
| 15 | 35 | 50 |
| 25 | 20 | 35 |
| 30 | 10 | 20 |

Legend:_____

_____

_____

**Answer the following questions based on the graph you created using the data above.**

1. What is the independent variable? _____
2. Why is this the dependent variable? _____

_____

3. What is the dependent variable? _____
4. Why is this the dependent variable? _____

_____

5. Briefly state your conclusion about the data in graph #1 (1-2 sentences).

_____

_____

**Graphing Activity #2**

Diabetes is a disease that affects the insulin producing cells of the pancreas. If there is not enough insulin or if cells are not responding normally to insulin, the amount of glucose in the bloodstream will remain high. Two hours after eating, blood glucose levels between 140 – 200 mg/dL indicate prediabetes and above 200 mg/dL indicate diabetes. The following data shows blood glucose in 2 individuals at different intervals of time after eating.
Use the data in the table below to complete the graph provided. Remember to include the title of your graph, label the x and y axes properly, create an appropriate scale and write a legend for your graph. After completing your graph, answer the questions below.

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| **Time After Eating (hrs.)** | **Glucose Level in mg/dL Person A** | **Glucose Level in mg/dL Person B** |
|---|---|---|
| 0.5 | 170 | 180 |
| 1 | 155 | 195 |
| 1.5 | 140 | 230 |
| 2 | 135 | 245 |
| 2.5 | 140 | 235 |
| 3 | 135 | 225 |
| 4 | 130 | 200 |

Legend:_____

_____

_____

**Answer the following questions based on the graph above you just completed.**

1. What is the independent variable? _____
2. Why is this the independent variable? _____
   _____
3. What is the dependent variable? _____
4. Why is this the dependent variable? _____
   _____

5. Which, if any of the above individuals has diabetes? Be sure to justify your answer!

_____

_____

_____

_____

6. If the time period were extended to 6 hours, what would be the expected blood sugar level for Person B? _____
7. What would be a probable blood sugar level for person B at 3.5 hours? _____
8. Briefly state your conclusion about the data in graph #2 (1-2 sentences).

_____

_____

_____

_____

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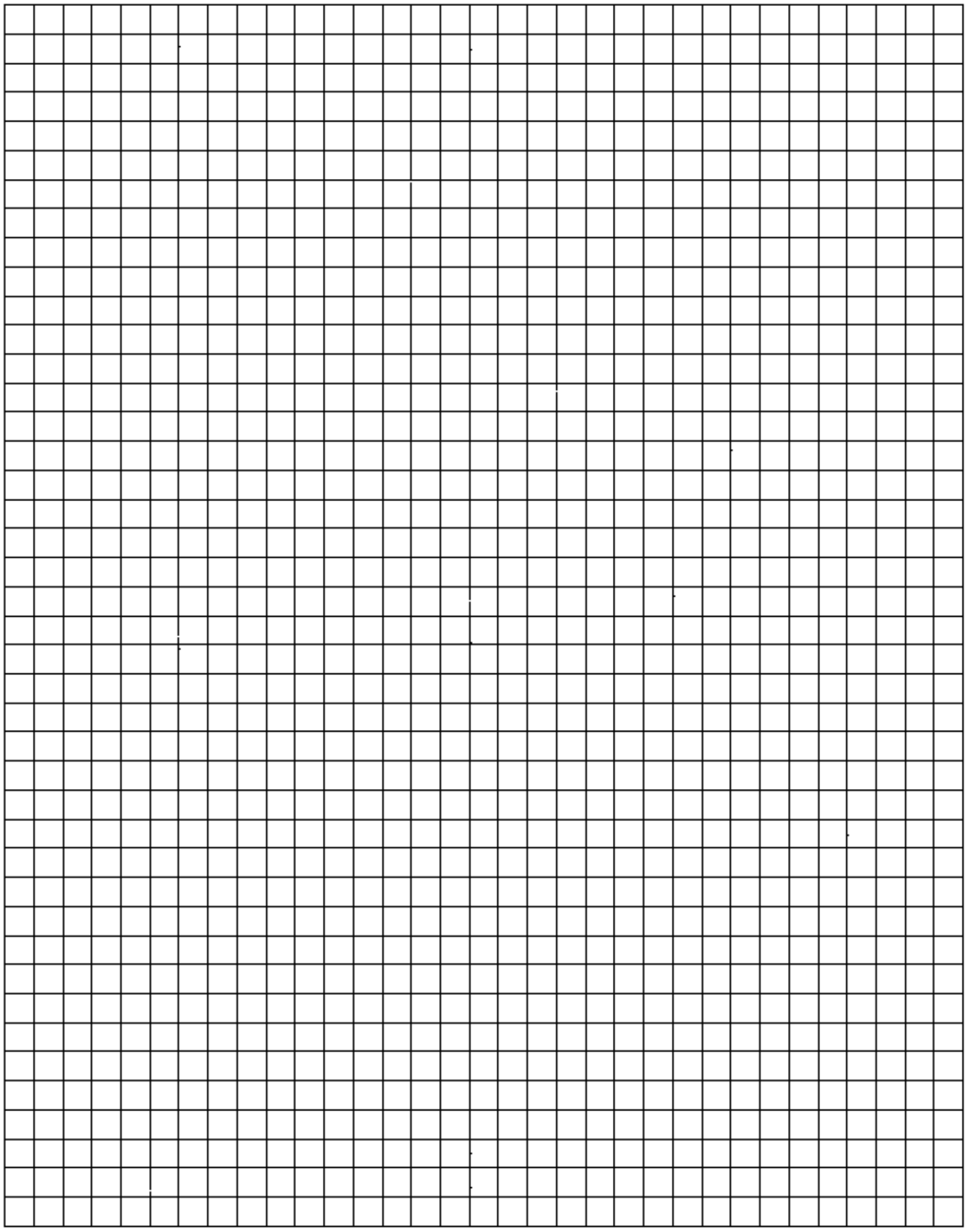

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