Part 1 Grow Study, Plant Evolution

Name

Part 1 Lesson 1 Plant Kingdom Introduction

Your definition of a plant

Any of various _____, _____, multi-cellular organisms of the Kingdom Plantae characteristically producing _____, containing _____, having cell wall made of _____, and lacking the power of _____.

- Photosynthetic – Makes _____ from _____.
- Eukaryotic – Cells with a _____.
- Multi-cellular – Made of _____ cells.
- Embryo – Young organism that grows inside.
- Chloroplast – An organelle that does _____.
- Cellulose – A complicated and strong _____.
- Locomotion – To _____.

Name at least 20 products that are made from plants below.

The energy flow of _____ occurs because of plants. Plants _____ the energy from the sun and pass it on to all other life forms.

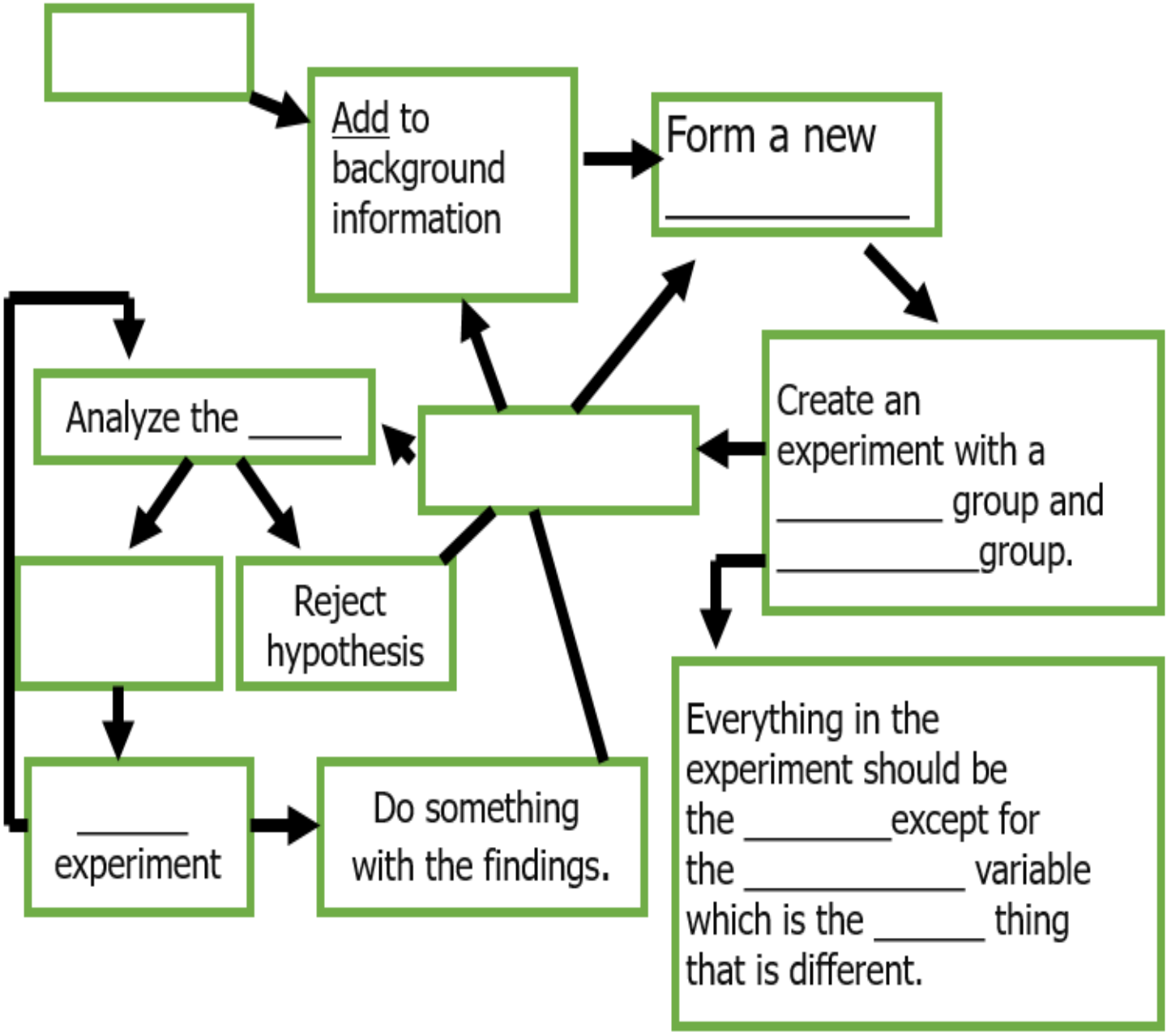
- Except for extreme bacteria on the ocean floor and their predators that use chemosynthesis.

Part 1 Lesson 2 Grow Study Set-Up

-Note: Part 2 Grow Study data collection and planning portion is at the back of this packet so that section can be removed to continue collecting data over the next month as your plants germinate and grow.

Scientific method: A process that is the basis for scientific _____ (Questioning and experimenting).

THE SCIENTIFIC METHOD



Variable: _____ quantity of something.

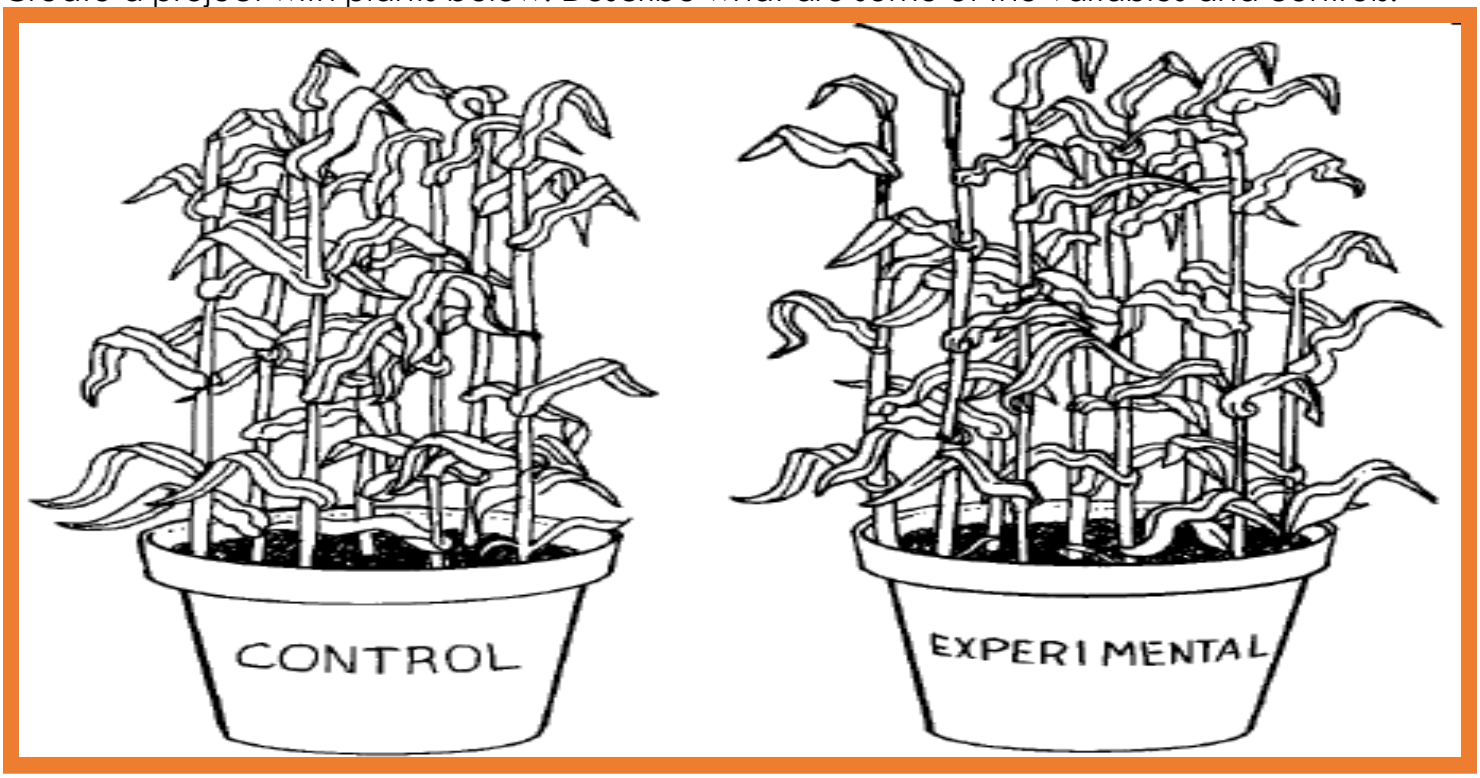
Independent: (Change) The variable you have control over, what you can choose and _____.

Dependent: (Observe) What you _____ in the experiment and what is affected during the experiment.) (Ex, color change, change in mass)

Control: (Same) Quantities that a scientist wants to remain _____ so it a fair test.

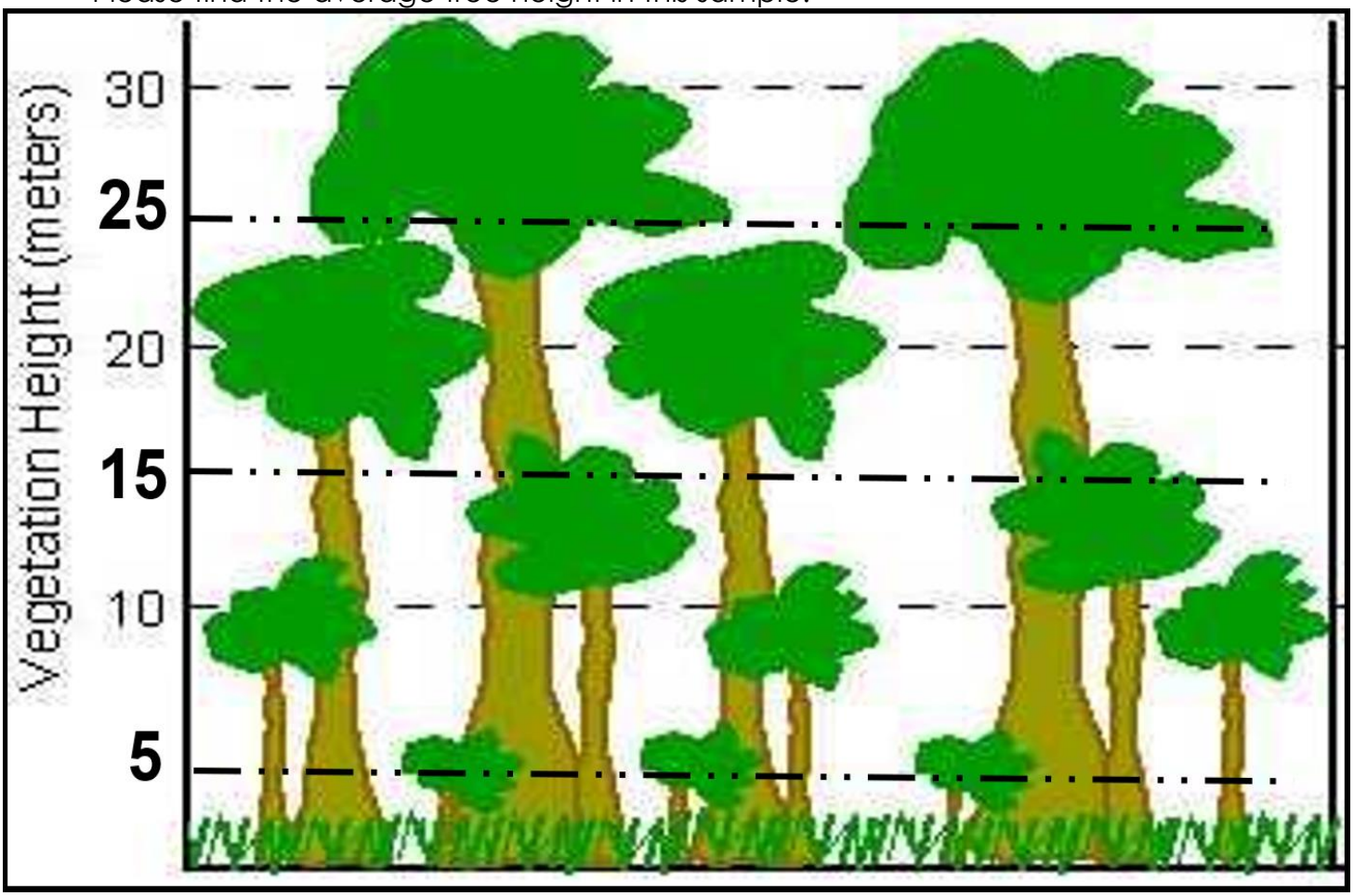
A student wants to find out what minerals melt ice the fastest. So the student places halite, calcite, hematite, and pyrite on equal sized cubes of ice on her counter in the kitchen. The student times how long it takes each mineral to melt completely through the ice cube. She records the minutes it takes for each one to melt in her science journal. Problem? =_____ _____ Independent Variable = _____ Dependent Variable = _____ _____ Control =_____ _____	A student wants to find out how cigarette smoke blown into a small greenhouse of plants damages the plant. The student grows two small plants in separate clear plastic soda bottles. The student injects one with cigarette smoke periodically. Both are watered and given the same light conditions. The student records the height, number of leaves, and flowers of both plants every day for one month. Problem? =_____ _____ Independent Variable = _____ Dependent Variable = _____ _____ Control =_____ _____
A student wants to find out if an egg will crush more easily standing straight-up or on its side. The student creates a chamber that allows weights to be placed on a board that lies on top of the egg. The student places weights in grams on the board with an egg standing straight, and then on its side. The student records the total weight that was on the board when the egg crushed. Problem? =_____ _____ Independent Variable = _____ Dependent Variable = _____ _____ Control =_____ _____	A student wants to determine if varying levels of fertilizer will increase the fitness of a plant. She sprays each plant every day with low, medium, and high levels of fertilizer. The plants are given the same soil, water, and light for one month. At the end she measures the number of leaves, plant height, and number of flowers. Problem? =_____ _____ Independent Variable = _____ Dependent Variable = _____ _____ Control =_____ _____

Create a project with plants below. Describe what are some of the variables and controls.



The average / mean is the sum of all values divided by the total number of values

- Please find the average tree height in this sample.



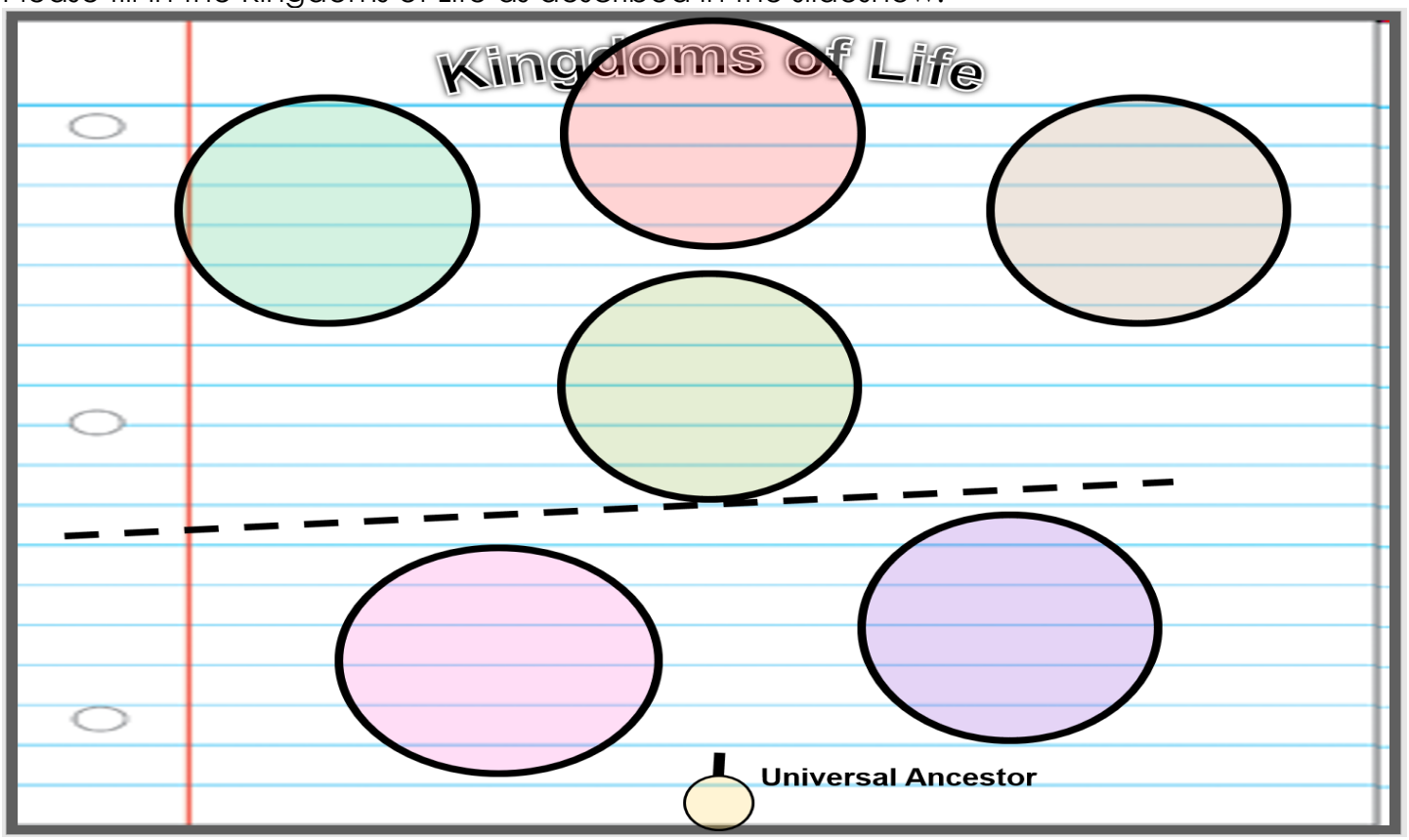
Please show your work in the space below

The Average height of the trees is =_____

The data collection section of your grow study can be found on the last few pages of this packet.

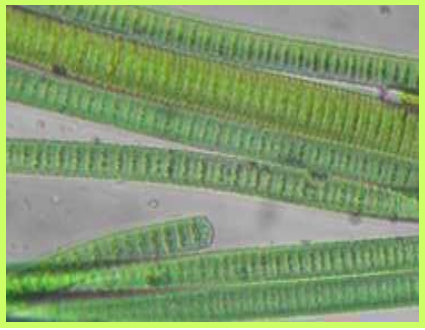
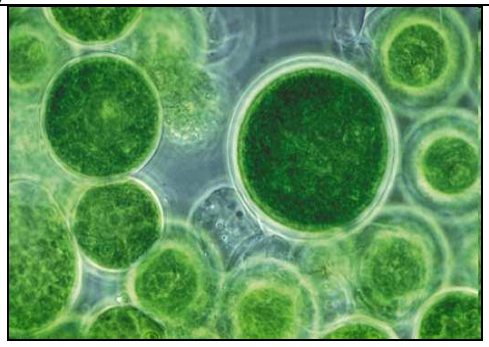
Part 1 Lesson 3 Plant Evolution

Please fill-in the Kingdoms of Life as described in the slideshow.



Algae: A simple, _____, and typically _____ plant of a large group that includes the seaweeds and many _____-celled forms. Algae contain chlorophyll but _____ true stems, roots, leaves, and vascular tissue. (Protist, not a plant)

Which is a plant, algae, and cyanobacteria? What is the difference between them?

Algae produce more than ____% of the Earth's oxygen.

Algae remove huge amounts of _____ _____from the air.

-Carbon Dioxide causes global warming, so algae is one of our most important allies in the fight against _____.

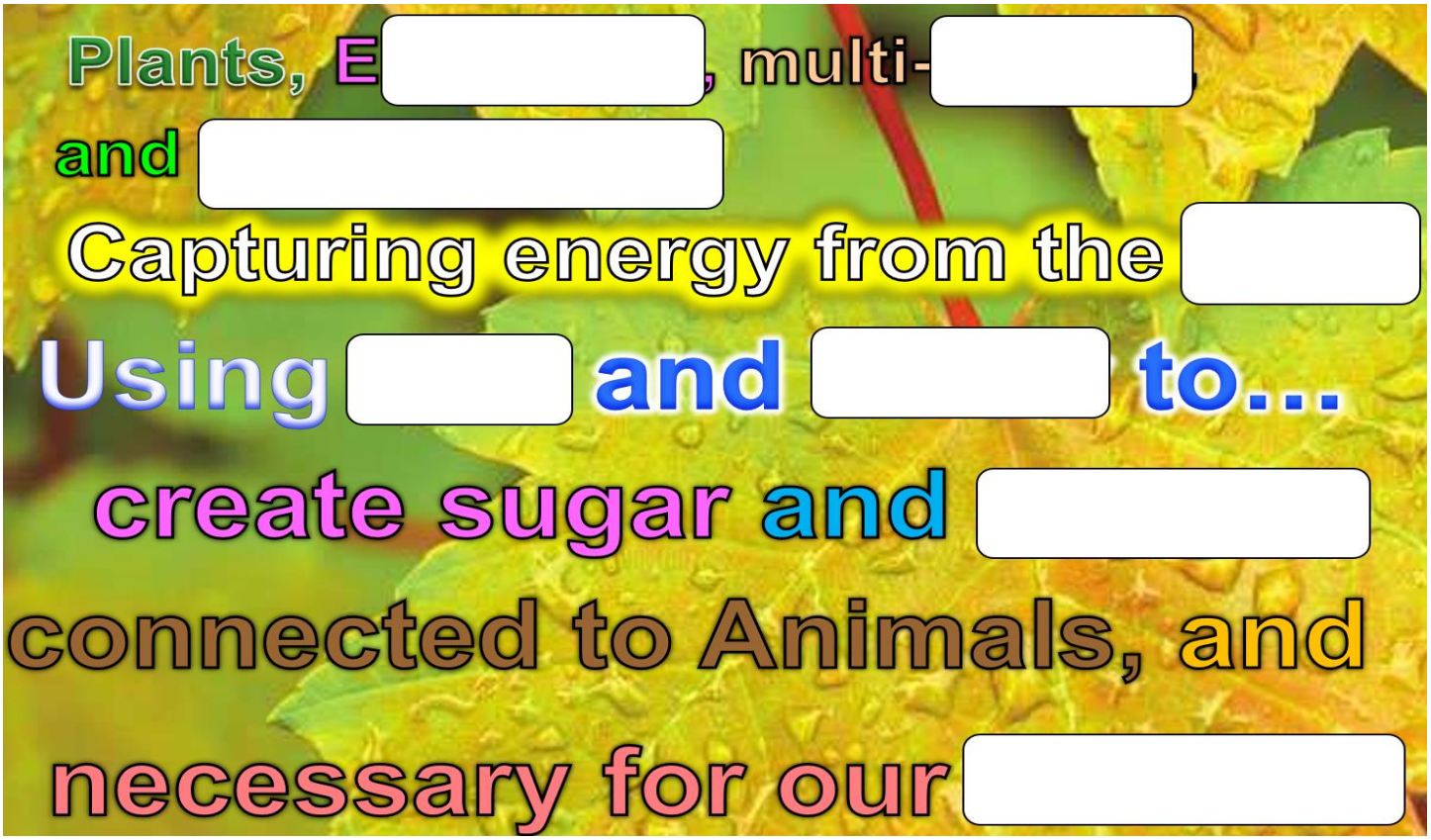
-Algae may become the next fuel of the future.

A form of bio-diesel gasoline.

Optional – Make a wet-mount slide of algae and make a sketch in the space below.

Low Power

High Power



Between _____ and _____ million years ago, some algae made the transition to land, becoming land plants required a series of adaptations to help them survive out of the water.

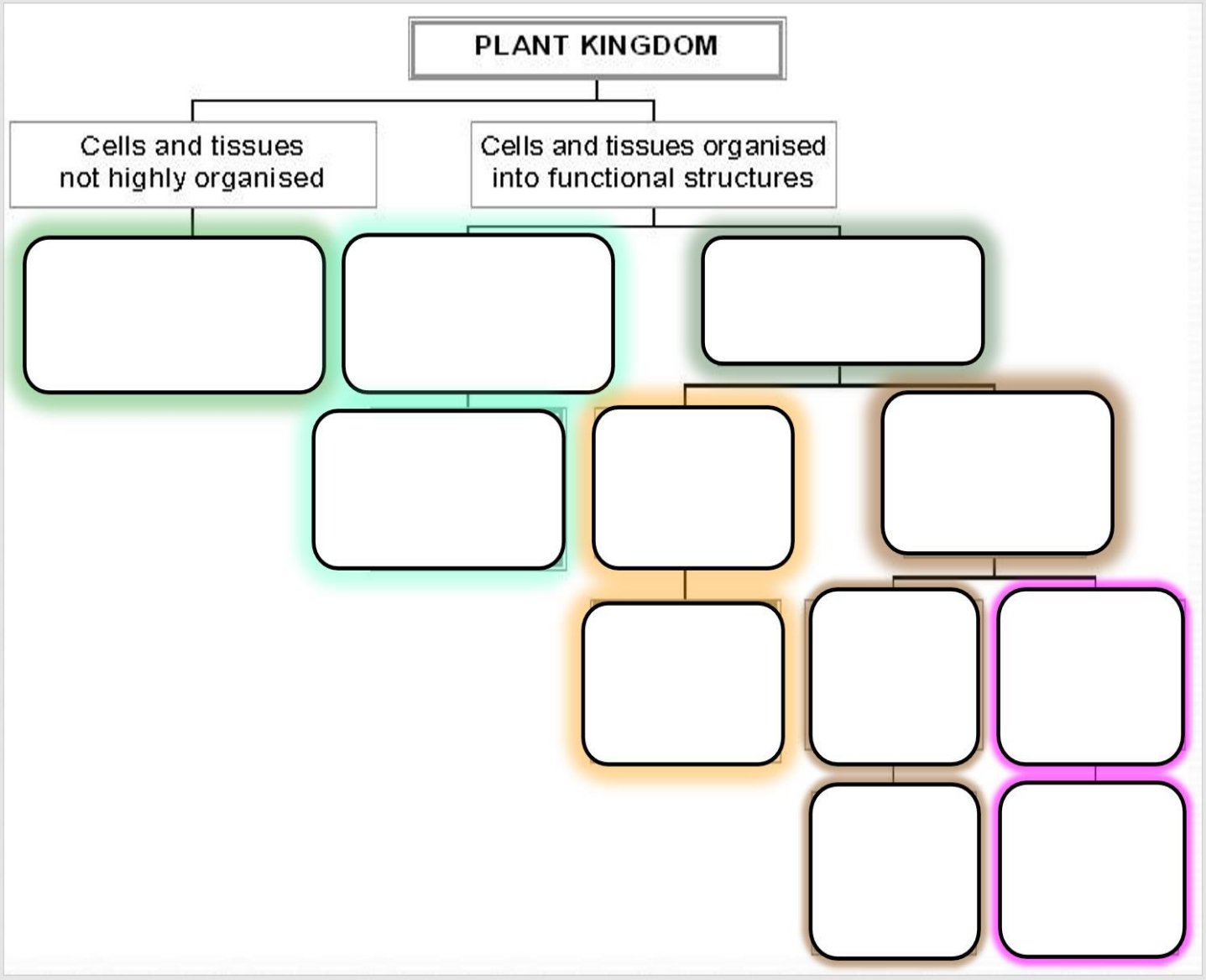
The first land plants

Had to struggle with maintaining _____ in cells.
But still need gas exchange.
How to _____ yourself out of water.
How to _____ on land.
How to _____ into ground.

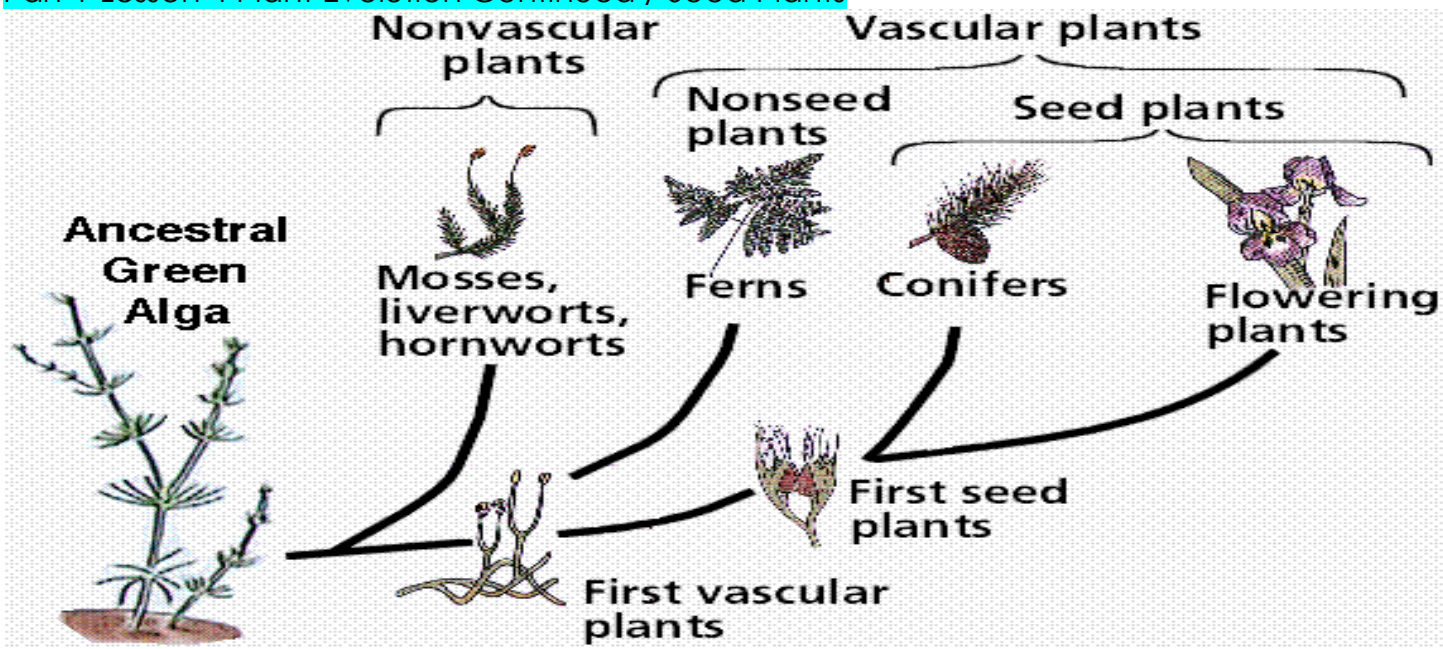
Some solutions

_____coverings to prevent water loss.
Stomata cells that _____and close.
_____.
Spores.
Vascular tissues, _____ cores.

Vascular plants appeared by _____million years ago, with forests soon following by 300 million years ago.

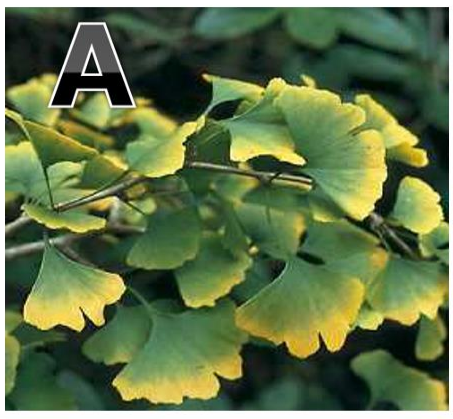


Part 1 Lesson 4 Plant Evolution Continued / Seed Plants



- Ginkgophyta (_____)
  - Seeded plant.
  - Living Fossil that dates back 270 million years.
- Cycadophyta (_____)
  - Seeded plants (Jurassic)
  - Large crown and stout trunk
- Gnetophyta (Gnetum & Welwitschia)
  - Contain vessel elements (which _____ within the plant) as found in flowering plants.
  - Relative to _____ plant.

Which one is a Ginkgo, Cycad, and which is a Gnetum of Gnetophyta?

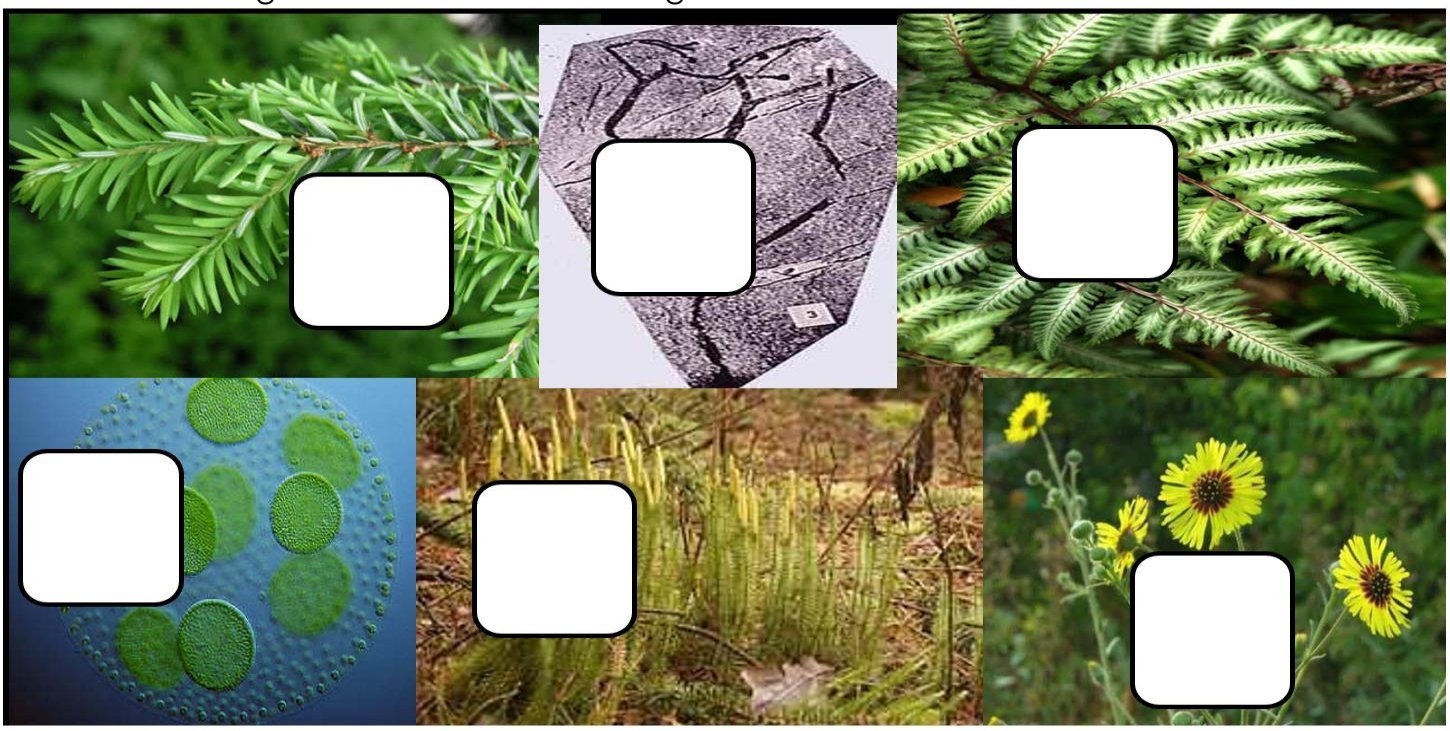
		

Gymnosperms / Seed plants evolved before flowering seed plants.

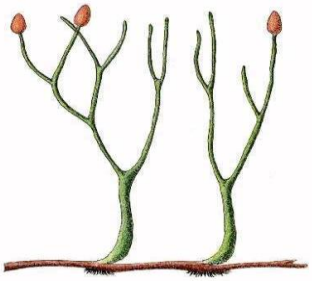
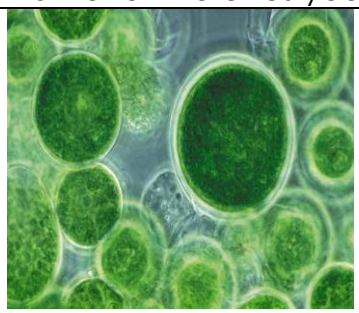
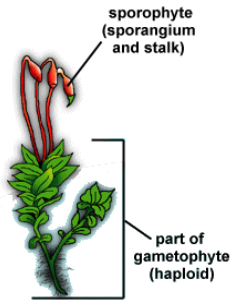
Flowering plants appeared around 140 million years ago.

Angiosperm: Flowering, covered seed, produce seeds enclosed in a fruit /ovary.

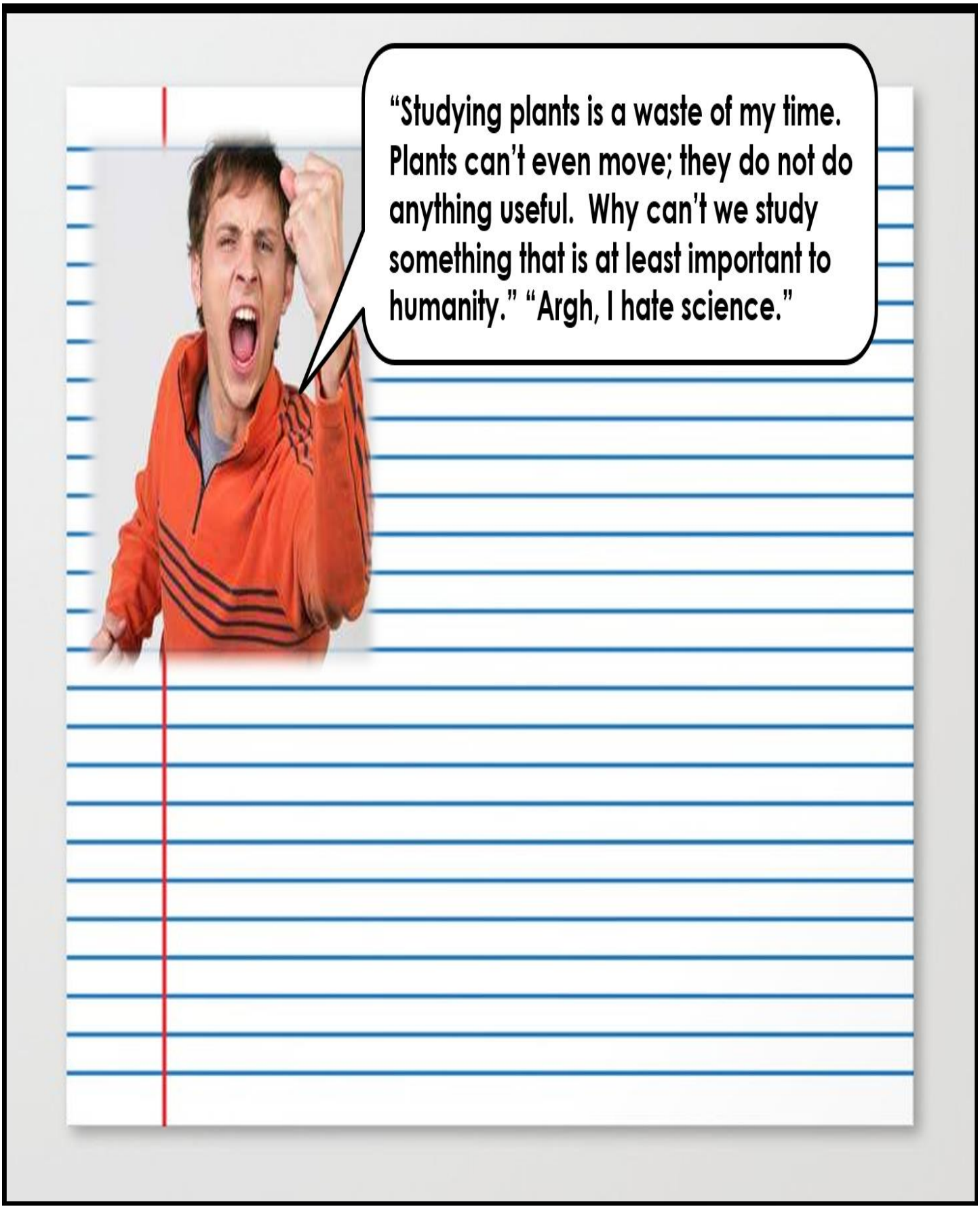
Please record a 1-6 (1 evolved first, and 6 evolved last) for the plants below. If you can name them in the margins that would be amazing as well.



Please place the following pictures in the correct order 1-7 according to their evolutionary history. 1 is the earliest, 7 is the latest. Provide a name for the ones you know underneath.

	 (First Vascular Plants)		
 Moss is a ____-vascular plant.		 (First Seed Plants)	Draw a hornwort in the space below.

Please respond intelligently to the comment from the angry student below.



Part 1 Lesson 5 Lichens (Not Plants but let's study them cause they're awesome 😊)

Lichen: a composite organism that arises from _____ or cyanobacteria living among filaments of multiple _____ species in a mutualistic relationship.
Lichens have properties different from those of their component organisms.

Lichen: Algae and fungus growing together in a _____ relationship.

The fungi extract food from the environment, while the algae are _____. This is mutualistic symbiosis.

The three types of lichens (Not Plant Kingdom –Fungi and Protist)
Crustose: Forms a _____, difficult to remove without crumbling.
Foliose: _____, can be peeled off rock with knife.
Fruticose: Forms shrubby _____. Easily removed by hand.



What is a lichen? Is it a plant? How does a lichen represent a mutualism between two species? Can you name the types of lichen above?

Activity! Going on a short walk to observe, sketch, and identify lichens.

Quiz Wiz 1-10 Name that type of lichen: Word Bank - Crustose, - Foliose, - Fruticose.
Crusty Leafy Branchy

1.)	6.)
2.)	7.)
3.)	8.)
4.)	9.)
5.)	10.)
*11.)	Score:

Part 1 Lesson 6 Review Game

Part 1 Review Game Name:
10 pts each, bonus +1 pt, 5 pt wager

GREEN MACHINE	LIKE IT OR NOT	-Bonus- TREERIFIC
1)	6)	*11)
2)	7)	*12)
3)	8)	*13)
4)	9)	*14)
5)	10)	*15)

Final Question =5 point wager Wager=_____ Score=_____

Comments/Notes

Across

1. _____ method: A process that is the basis for scientific inquiry (Questioning and experimenting).
6. Type of Lichen. Forms a crust, difficult to remove without crumbling.
7. Plants makes sugar from light using carbon dioxide and water
9. _____ Algae was one of the first algae to colonize land between 400-500 million years ago
10. The _____ flow of life occurs because of plants
11. Not a plant: A composite organism that arises from algae or cyanobacteria living among filaments of multiple fungi species in a mutualistic relationship.
12. Not a plant! A simple, nonflowering, and typically aquatic plant of a large group that includes the seaweeds and many single-celled forms. Algae contain chlorophyll but lack true stems, roots, leaves, and vascular tissue.
15. _____ plants appeared by 350 million years ago, with forests soon following by 300 million years ago.
17. A scientific _____ is an experiment or observation designed to minimize the effects of variables other than the independent variable. This increases the reliability of the results, often through a comparison between control measurements and the other measurements.
18. It is any factor that can be manipulated, controlled for, or measured in an experiment.
19. G_____: Seed plants evolved before flowering seed plants.

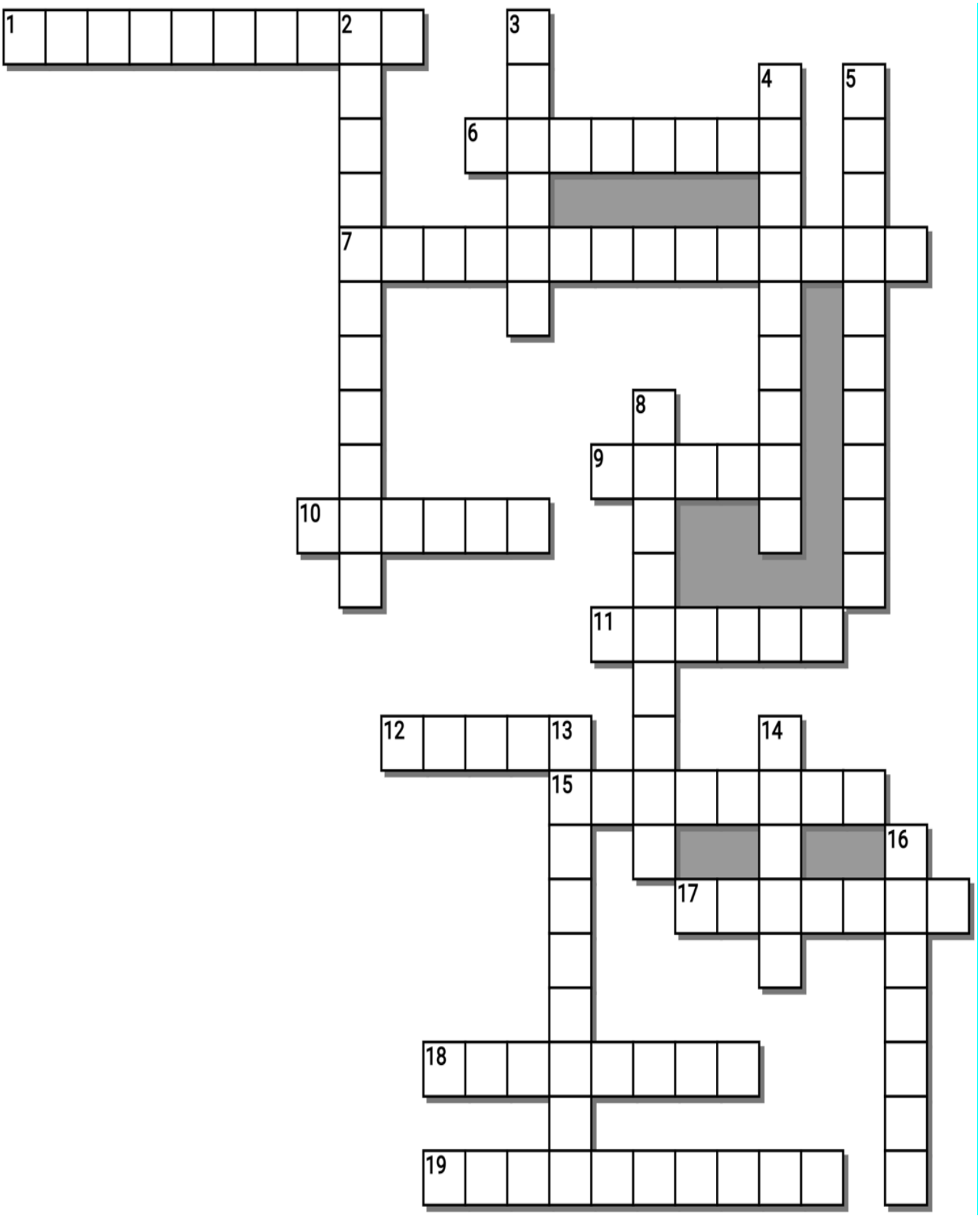
Down

2. _____ Variable: The variable you have control over, what you can choose and manipulate.
3. Algae remove huge amounts of _____-Dioxide from the air.
4. _____ Variable: (Observe) What you measure in the experiment and what is affected during the experiment. The Numbers
5. A_____: Flowering plants, covered seed, produce seeds enclosed in a fruit /ovary
8. Type of Lichen. Forms shrubby branches. Easily removed by hand.
13. Plant _____ is usually characterized as descriptive biology with the aim to explain how the present species diversity arose over a geological time frame.
14. Any of various photosynthetic, eukaryotic, multi-cellular organisms of the Kingdom Plantae characteristically producing embryos, containing chloroplasts, having a cell wall made of cellulose, and lacking the power of locomotion.
16. Type of Lichen. Leafy, can be peeled off rock with knife.

----------teacher can remove word bank to make more challenging----------

Possible Answers

EVOLUTION, ALGAE, ANGIOSPERM, BROWN, CARBON, CRUSTOSE, DEPENDENT, ENERGY, FOLIOSE, FRUTICOSE, GYMNOSPERM, INDEPENDENT , LICHEN, PHOTOSYNTHESIS, PLANT, SCIENTIFIC , VARIABLE, VASCULAR, CONTROL


1
2
3
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10
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17
18
19

Part 1 Lesson 2 Grow Study Set-Up

Plant Study Set-Up Name:_____ Partners:_____

Please complete the four terms below as they relate to the project you have selected.

Problem:_____

_____

Independent Variable:_____

_____

Dependent Variable:_____

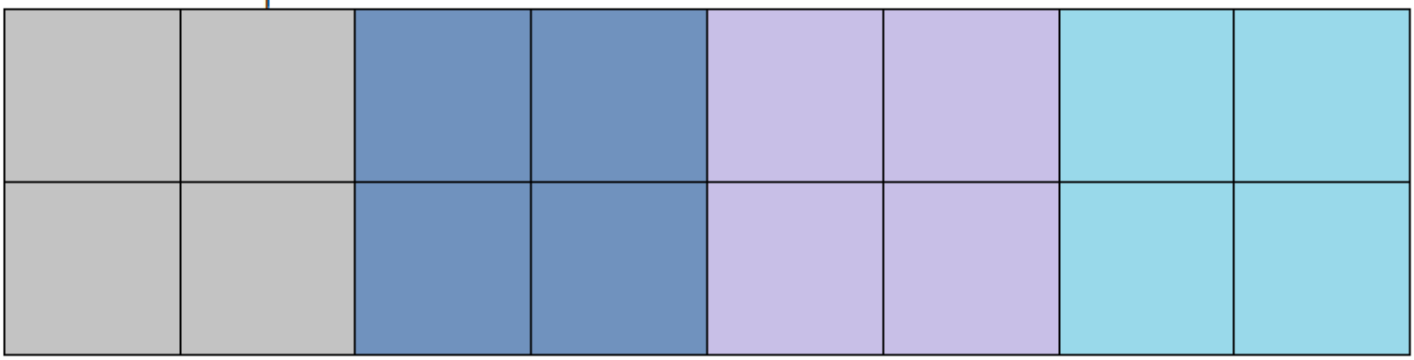
_____

Control:_____

_____

Please describe your set-up with visuals.

Additional Set-Up

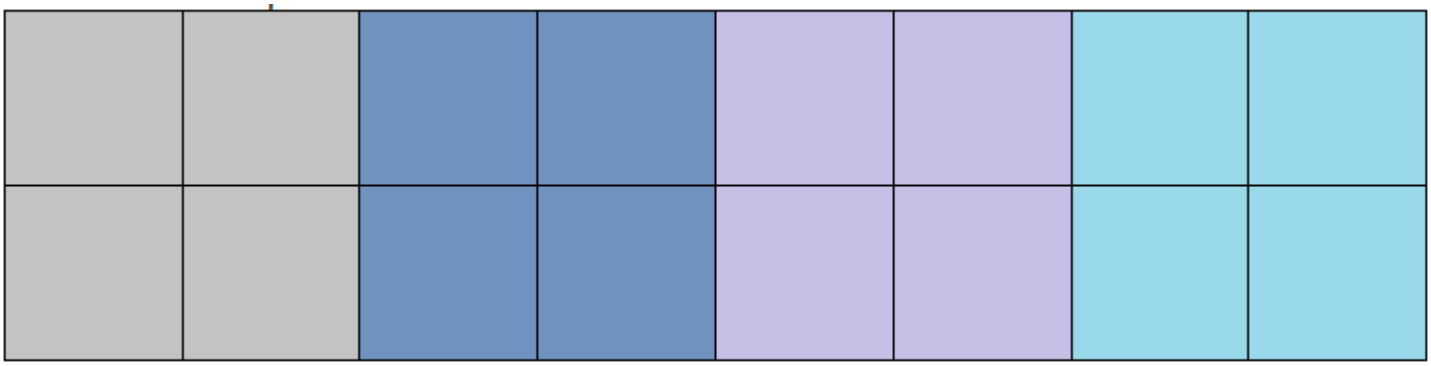


C = Control Group _____

Day / Date	Height of Plant Averages	# of True leaves Average	# of flowers Averages	Observations
C				
C				
C				
C				
C				
C				
C				
C				
C				
C				
C				
C				
C				
Final	Final Average	Final Average	Final Average	

X = Experimental Group _____

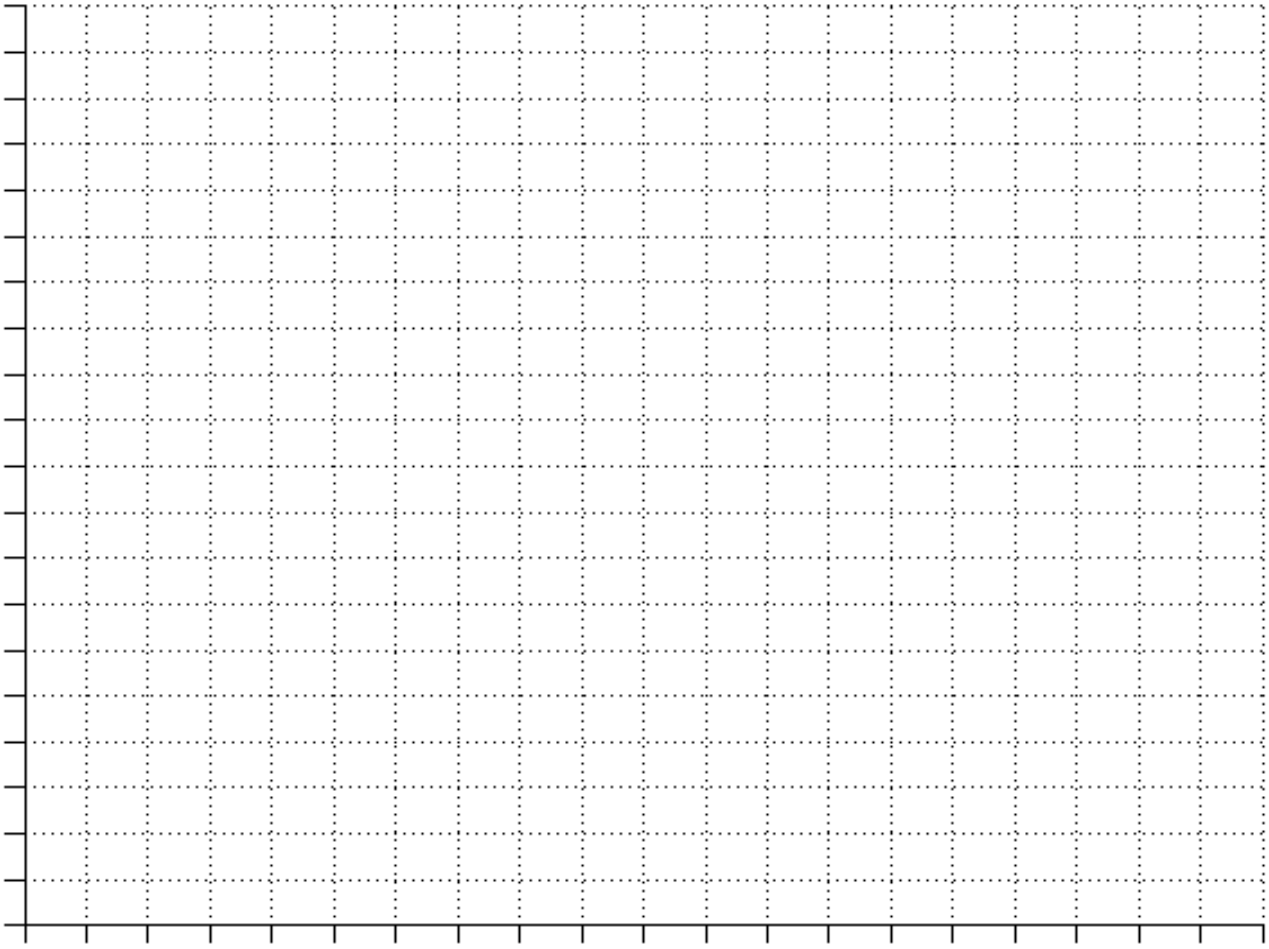
Day / Date	Height of Plant Averages	# of True leaves Averages	# of flowers Averages	Observations
X				
X				
X				
X				
X				
X				
X				
X				
X				
X				
X				
X				
X				
Final	Final Averages	Final Averages	Final Averages	

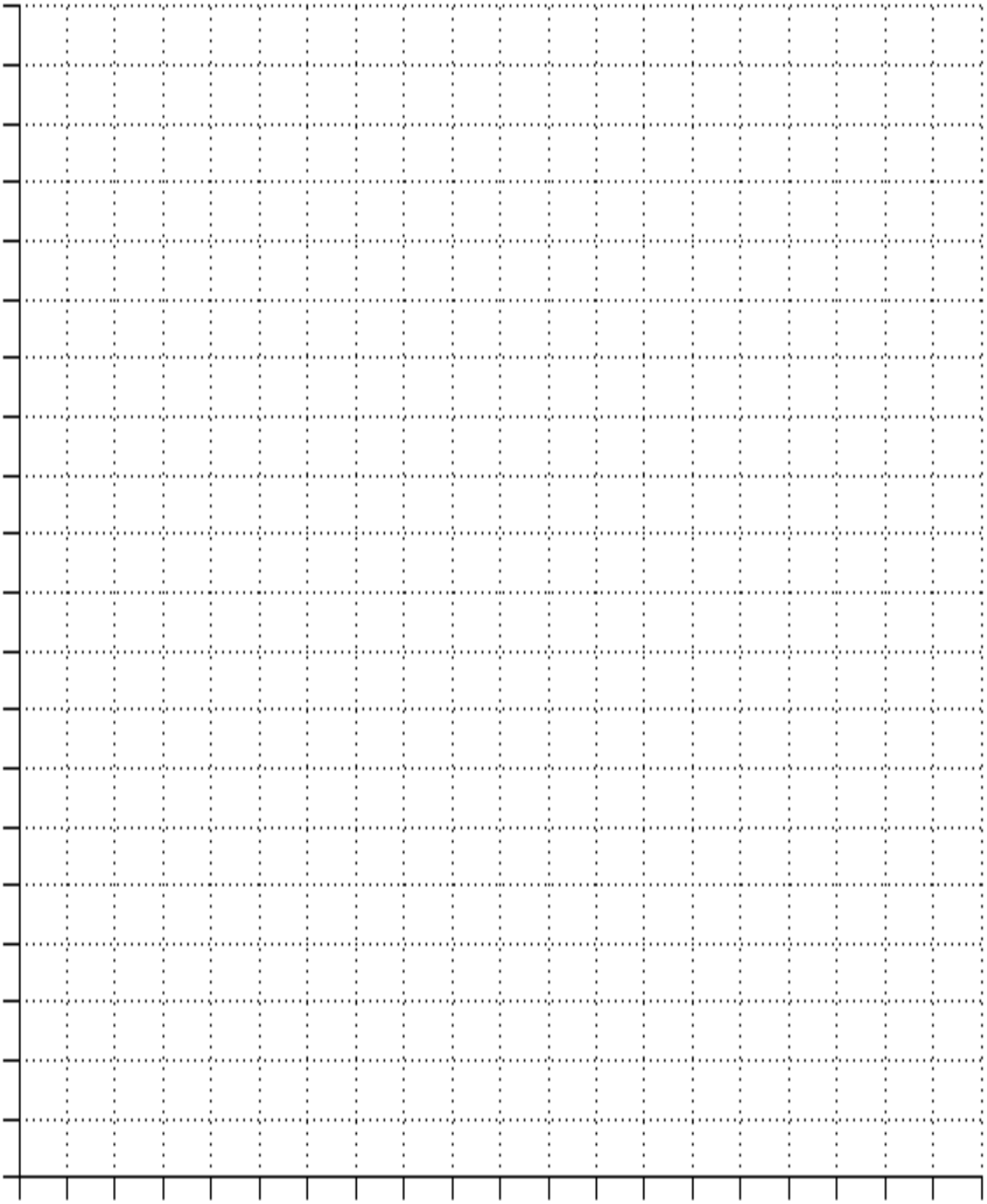


Control Group

Experimental Groups

.





Part 1 Grow Study, Plant Evolution

Name

Part 1 Lesson 1 Plant Kingdom Introduction

Your definition of a plant

Answers will vary

Any of various photosynthetic, eukaryotic, multi-cellular organisms of the Kingdom Plantae characteristically producing embryos, containing chloroplasts, having cell wall made of cellulose, and lacking the power of locomotion.

- Photosynthetic – Makes sugar from light.
- Eukaryotic – Cells with a nucleus.
- Multi-cellular – Made of many cells.
- Embryo – Young organism that grows inside.
- Chloroplast – An organelle that does photosynthesis.
- Cellulose – A complicated and strong sugar.
- Locomotion – To move.

Name at least 20 products that are made from plants below.

- Jeans
- Shirts
- Boots
- Coffee
- Baseball bat
- Flags
- Tools
- Food
- Etc…

The energy flow of life occurs because of plants. Plants harness the energy from the sun and pass it on to all other life forms.

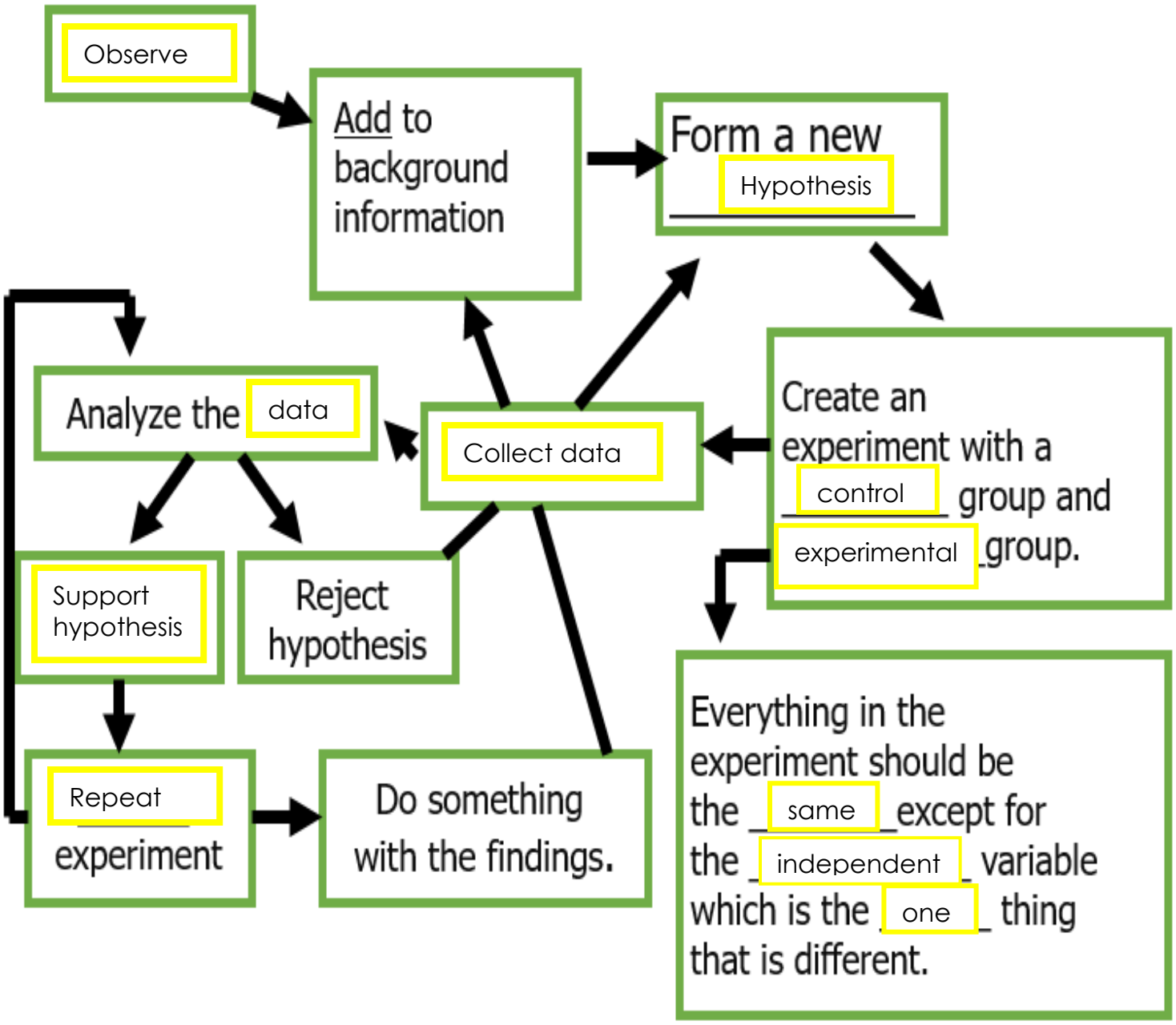
- Except for extreme bacteria on the ocean floor and their predators that use chemosynthesis.

Part 1 Lesson 2 Grow Study Set-Up

-Note: Part 2 Grow Study data collection and planning portion is at the back of this packet so that section can be removed to continue collecting data over the next month as your plants germinate and grow.

Scientific method: A process that is the basis for scientific inquiry.
(Questioning and experimenting).

THE SCIENTIFIC METHOD

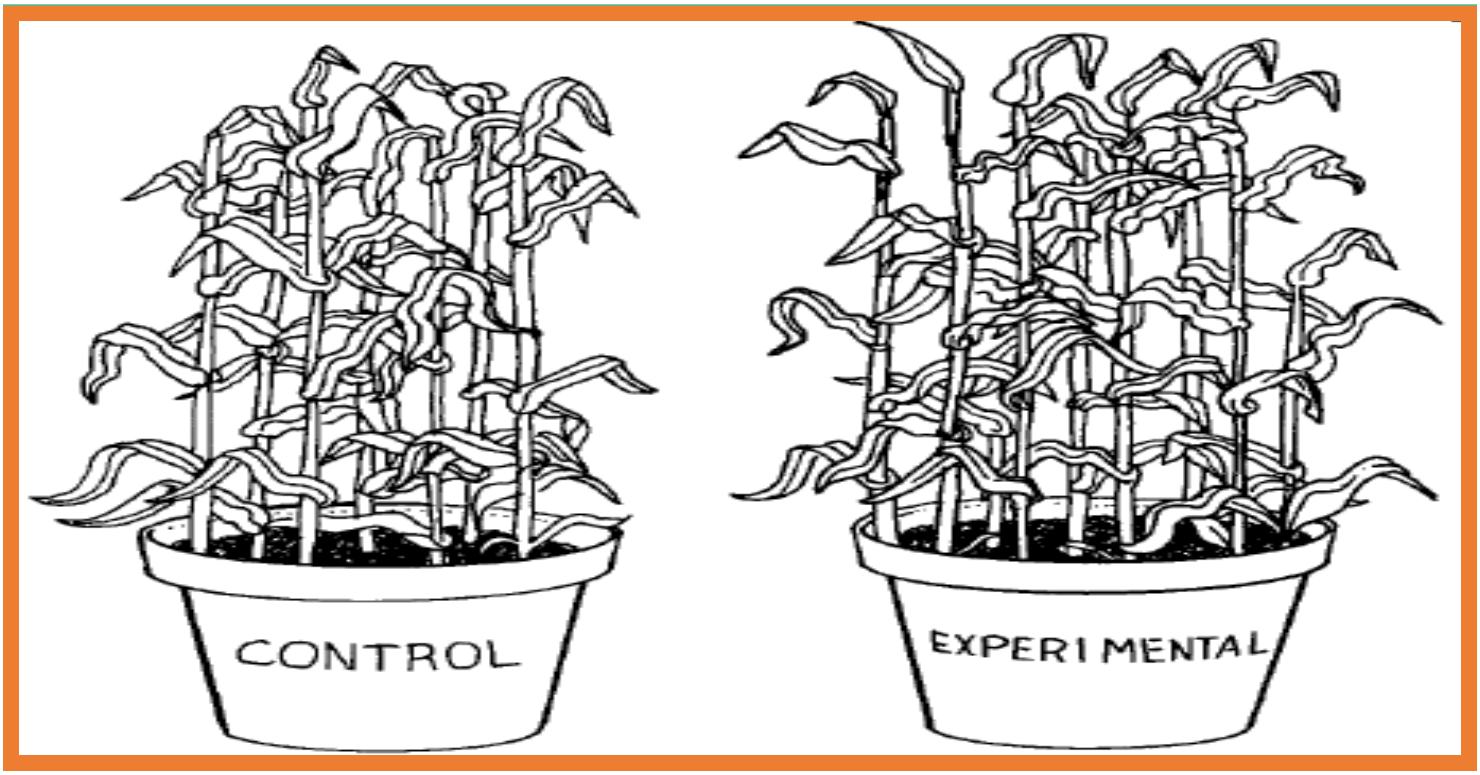


Variable: Changing quantity of something.
Independent: (Change) The variable you have control over, what you can choose and manipulate.

Dependent: (Observe) What you measure in the experiment and what is affected during the experiment.) (Ex, color change, change in mass)
Control: (Same) Quantities that a scientist wants to remain constant so it's a fair test.

A student wants to find out what minerals melt ice the fastest. So the student places halite, calcite, hematite, and pyrite on equal sized cubes of ice on her counter in the kitchen. The student times how long it takes each mineral to melt completely through the ice cube. She records the minutes it takes for each one to melt in her science journal. Problem? = What minerals melt ice the fastest? Independent Variable = Type of mineral (halite, calcite, hematite, pyrite). Dependent Variable = Amount of time it takes for the ice to melt. Control = Each ice cube is the same size.	A student wants to find out how cigarette smoke blown into a small greenhouse of plants damages the plant. The student grows two small plants in separate clear plastic soda bottles. The student injects one with cigarette smoke periodically. Both are watered and given the same light conditions. The student records the height, number of leaves, and flowers of both plants every day for one month. Problem? = Does cigarette smoke damage plants? Independent Variable = Cigarette smoke Dependent Variable = Height of plants, leaves, flowers Control = Both containers were identical except one was given cigarette smoke (independent variable).
A student wants to find out if an egg will crush more easily standing straight-up or on its side. The student creates a chamber that allows weights to be placed on a board that lies on top of the egg. The student places weights in grams on the board with an egg standing straight, and then on its side. The student records the total weight that was on the board when the egg crushed. Problem? = Which resting position will crush an egg the easiest—on its side or straight up? Independent Variable = The position of the egg—either on its side or standing straight up. Dependent Variable = How much weight it takes to crush the egg. Control = The eggs used will be as identical as possible.	A student wants to determine if varying levels of fertilizer will increase the fitness of a plant. She sprays each plant every day with low, medium, and high levels of fertilizer. The plants are given the same soil, water, and light for one month. At the end she measures the number of leaves, plant height, and number of flowers. Problem? = Does amount of fertilizer affect plant fitness? Independent Variable = Amount of fertilizer sprayed. Dependent Variable = The number of leaves, plant height, and number of flowers at the end of one month. Control = Plants are given same soil, water, and light.

Create a project with plants below. Describe what are some of the variables and controls.



EXAMPLE (STUDENTS WILL CREATE THEIR OWN EXPERIMENTS)

Problem: Does fertilizer help a plant grow?

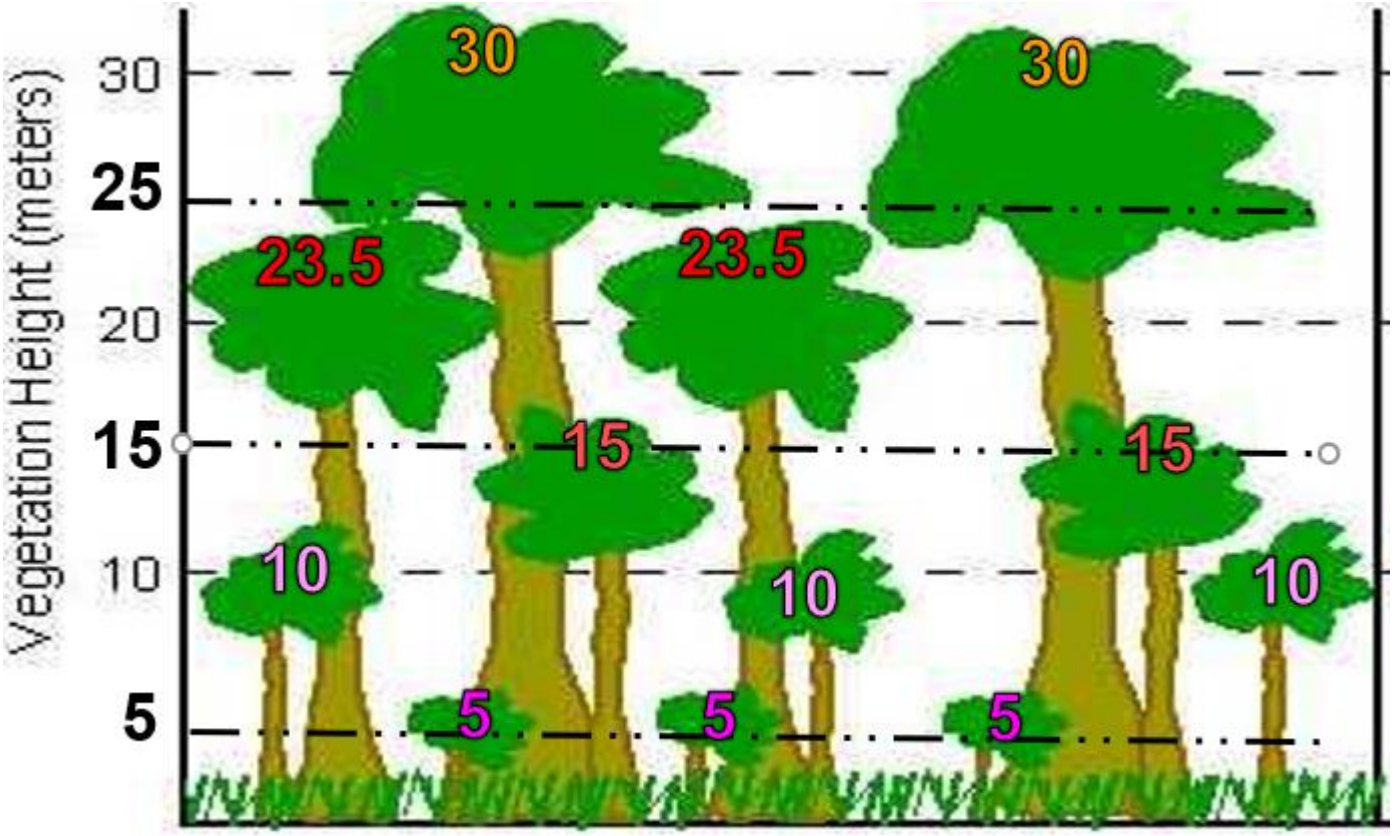
Independent variable (change): Amount of fertilizer (grams)

Dependent variable (observe): Growth of the plant, height, number of leaves, flowers, etc.

Control variable (same): Same amount of soil, light, water, space, all the same.

The average / mean is the sum of all values divided by the total number of values

- Please find the average tree height in this sample.



Please show your work in the space below

There are 12 trees total, so divide by 12 after adding all heights.

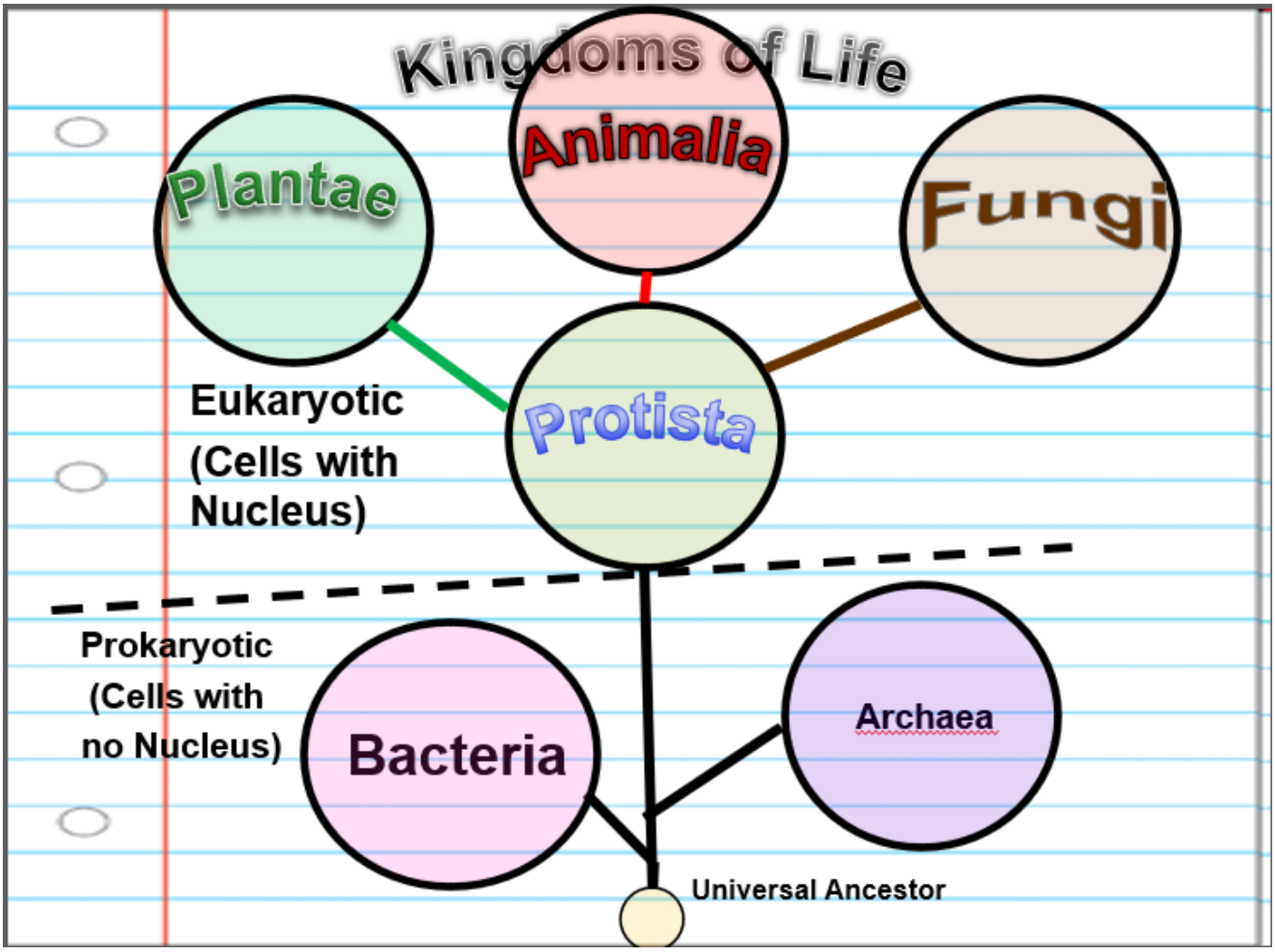
5+5+5+10+10+10+15+15+23.5+23.5+30+30 = 182

182 / 12= about 15.1 meters

The Average height of the trees is = 15.1 meters
The data collection section of your grow study can be found on the last few pages of this packet.

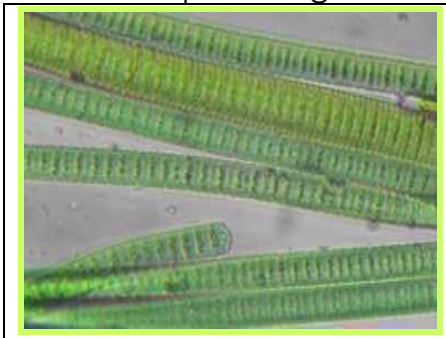
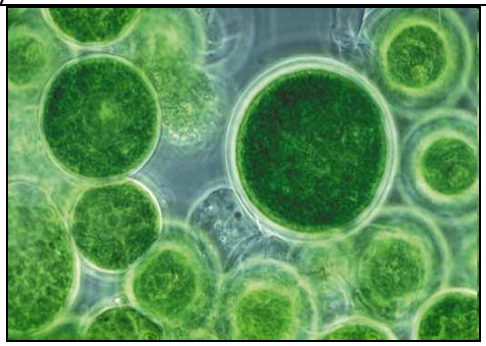
Part 1 Lesson 3 Plant Evolution

Please fill-in the Kingdoms of Life as described in the slideshow.



Algae: A simple, nonflowering, and typically aquatic plant of a large group that includes the seaweeds and many single-celled forms. Algae contain chlorophyll but lack true stems, roots, leaves, and vascular tissue. (Protist, not a plant)

Which is a plant, algae, and cyanobacteria? What is the difference between them?

 Cyanobacteria are bacteria that photosynthesize (unicellular).	 Algae are photsynthetic protists (unicellular with not roots, leaves, or stems).	 Plants are photsynthetic (multi-cellular and have leaves, roots, stems).

Algae produce more than 70% of the Earth's oxygen.

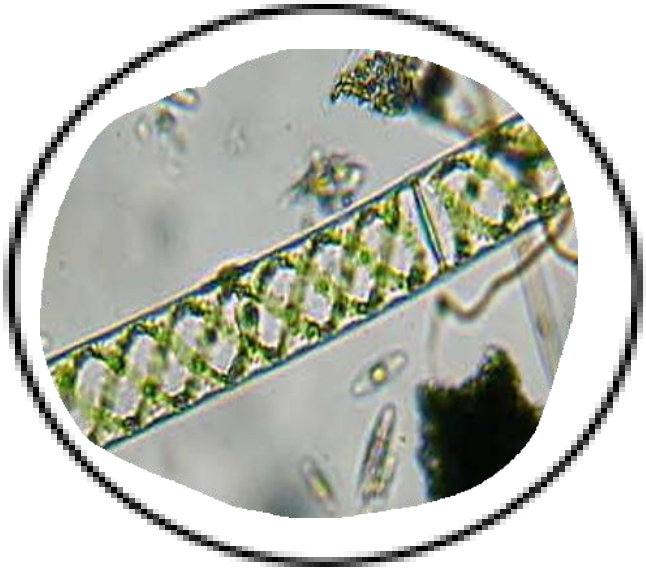
Algae remove huge amounts of carbon dioxide from the air.

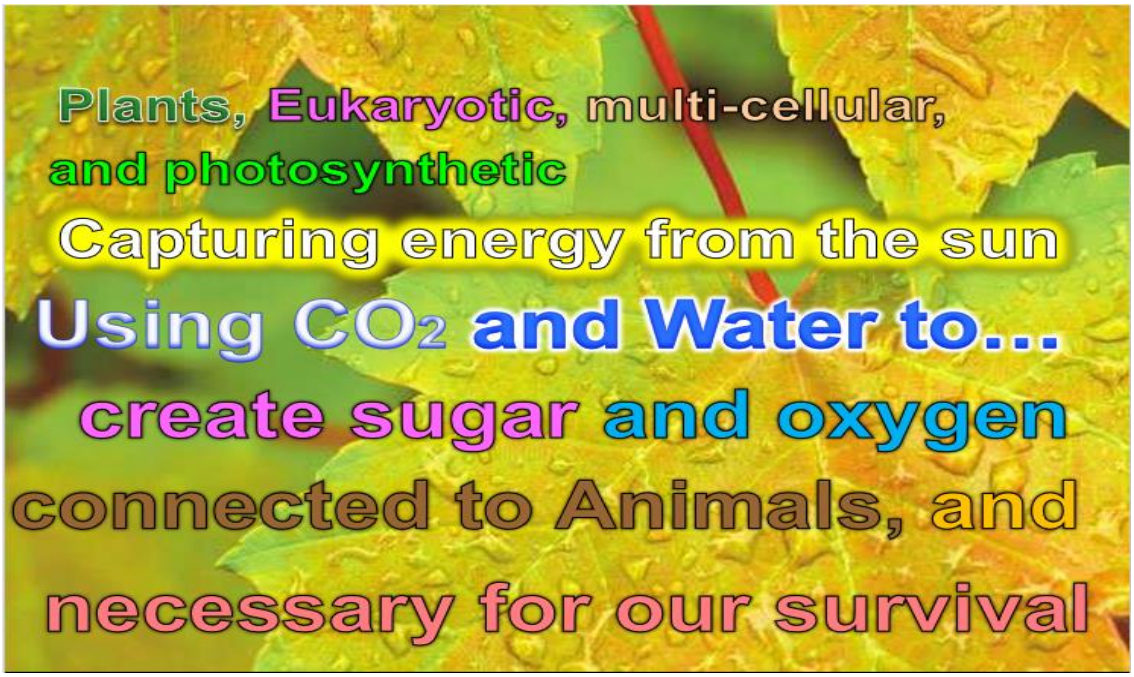
-Carbon Dioxide causes global warming, so algae is one of our most important allies in the fight against climate change.
-Algae may become the next fuel of the future.
A form of bio-diesel gasoline.

Optional – Make a wet-mount slide of algae and make a sketch in the space below.

Low Power

High Power





Between 500 and 400 million years ago, some algae made the transition to land, becoming land plants required a series of adaptations to help them survive out of the water.

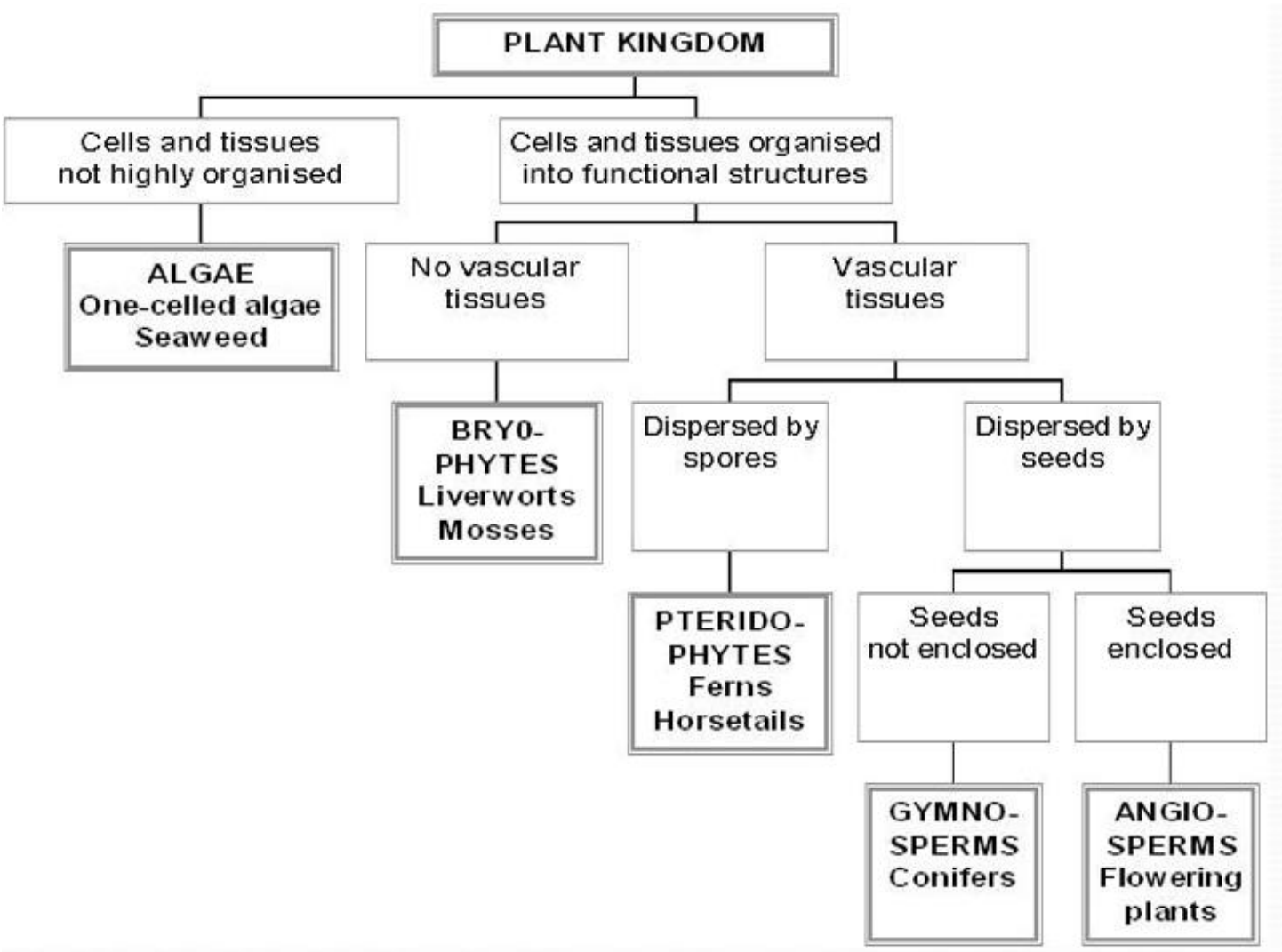
The first land plants
Had to struggle with maintaining water in cells.
But still need gas exchange.
How to support yourself out of water.

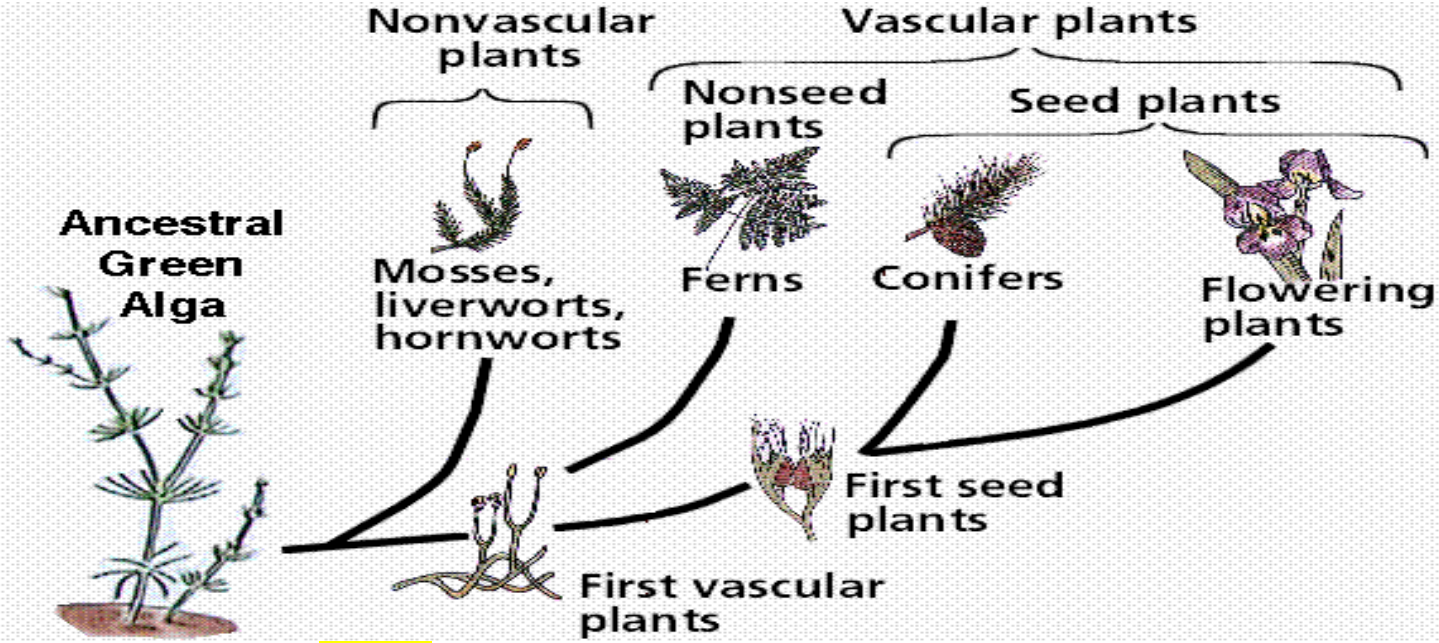
How to reproduce on land.
How to anchor into ground.

Some solutions
Waxy coverings to prevent water loss.
Stomata cells that open and close.
Roots.
Spores.
Vascular tissues, woody cores.

Vascular plants appeared by 350 million years ago, with forests soon following by 300 million years ago.

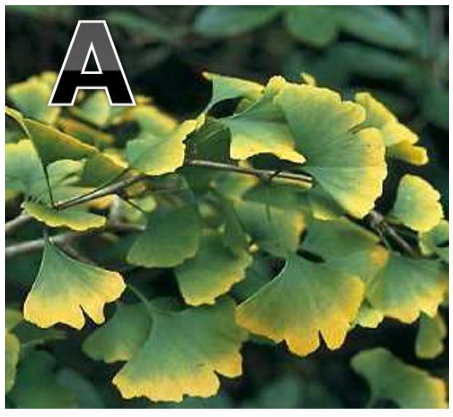
Part 1 Lesson 4 Plant Evolution Continued / Seed Plants





- Ginkgophyta (Ginkgo)
  - Seeded plant.
  - Living Fossil that dates back 270 million years.
- Cycadophyta (Cycads)
  - Seeded plants (Jurassic)
  - Large crown and stout trunk
- Gnetophyta (Gnetum & Welwitschia)
  - Contain vessel elements (which transport water within the plant) as found in flowering plants.
  - Relative to flowering plant.

Which one is a Ginkgo, Cycad, and which is a Gnetum or Gnetophyta?

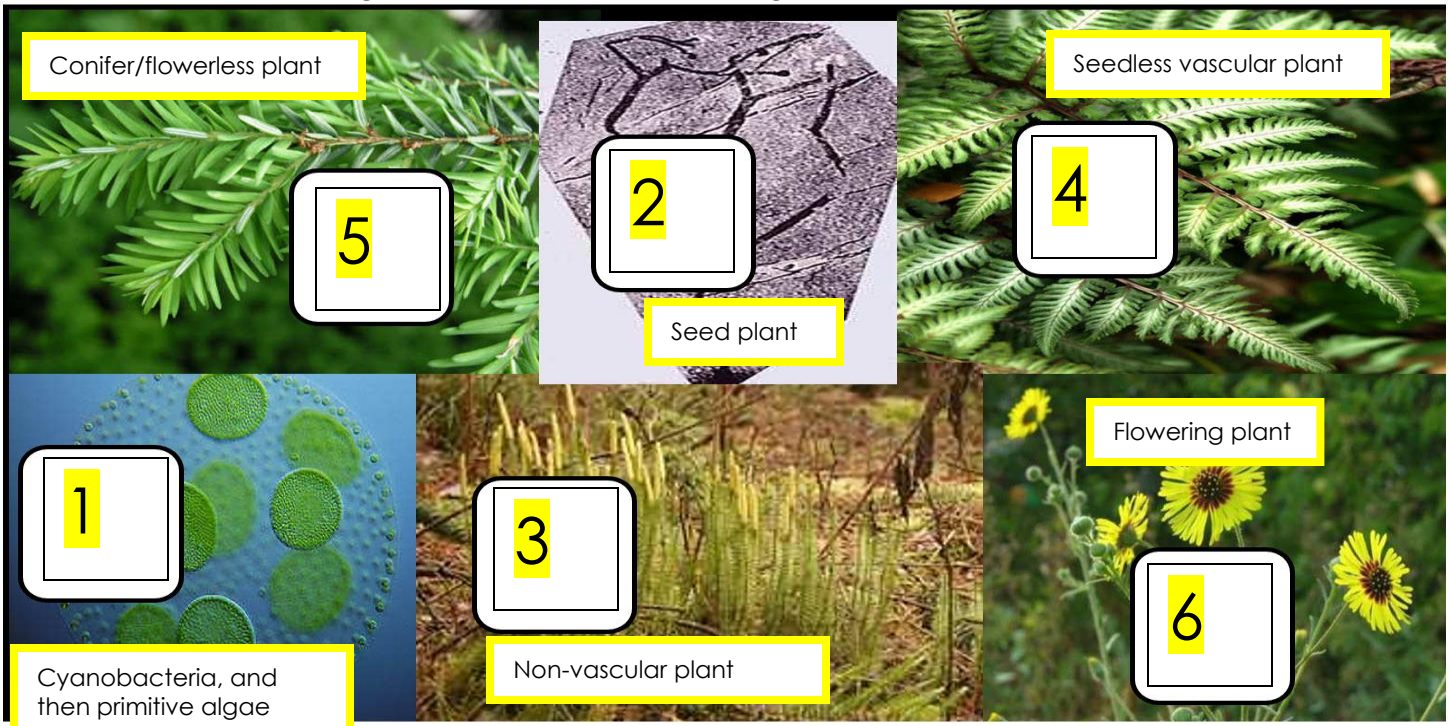
		
Ginkgo	Gnetum	Cycad

Gymnosperms / Seed plants evolved before flowering seed plants.

Flowering plants appeared around 140 million years ago.

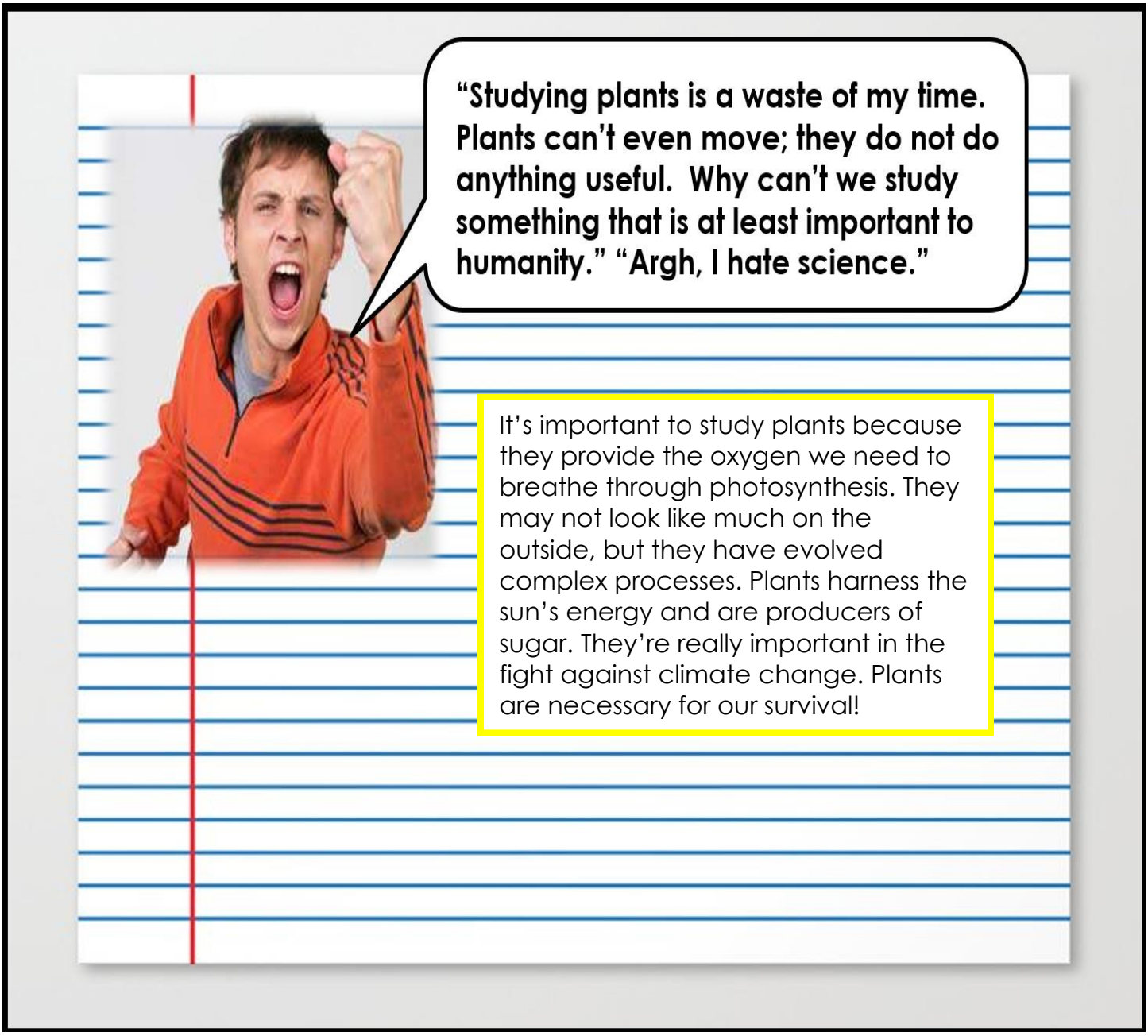
Angiosperm: Flowering, covered seed, produce seeds enclosed in a fruit /ovary.

Please record a 1-6 (1 evolved first, and 6 evolved last) for the plants below. If you can name them in the margins that would be amazing as well.



Please place the following pictures in the correct order 1-7 according to their evolutionary history. 1 is the earliest, 7 is the latest. Provide a name for the ones you know underneath.

Please respond intelligently to the comment from the angry student below.



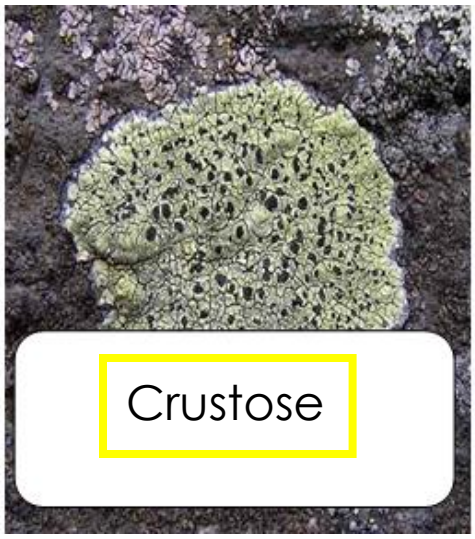
Part 1 Lesson 5 Lichens (Not Plants but let's study them cause they're awesome 😊)

Lichen: a composite organism that arises from algae or cyanobacteria living among filaments of multiple fungi species in a mutualistic relationship.
Lichens have properties different from those of their component organisms.

Lichen: Algae and fungus growing together in a symbiotic relationship.

The fungi extract food from the environment, while the algae are photosynthetic. This is mutualistic symbiosis.

The three types of lichens (Not Plant Kingdom –Fungi and Protist)
Crustose: Forms a crust, difficult to remove without crumbling.
Foliose: Leafy, can be peeled off rock with knife.
Fruticose: Forms shrubby branches. Easily removed by hand.



What is a lichen? Is it a plant? How does a lichen represent a mutualism between two species? Can you name the types of lichen above?

Lichen is not a plant. It is a fungi with some algae in it, which have a symbiotic relationship. Lichen has a mutualistic relationship (fungi and algae). The fungi get food from the environment, while the algae are photosynthetic. There are 3 types of lichen.

Activity! Going on a short walk to observe, sketch, and identify lichens.

Quiz Wiz 1-10 Name that type of lichen: Word Bank - Crustose, - Foliose, - Fruticose.
Crusty Leafy Branchy

1.) Crustose	6.) Foliose
2.) Fruticose	7.) Fruticose
3.) Foliose	8.) Crustose
4.) Fruticose	9.) Foliose
5.) Crustose	10.) Foliose
*11.) Sideshow Bob from The Simpsons	Score:

Part 1 Lesson 6 Review Game

Part 1 Review Game Name:
10 pts each, bonus +1 pt, 5 pt wager

GREEN MACHINE	LIKE IT OR NOT	-Bonus- TREERIFIC
1) Photosynthetic, eukaryotic, multi-cellular, chloroplasts, cell wall	6) A= Algae (protist) B= Plants C= Cyanobacteria	*11) The Giving Tree
2) A= Animal cell B=Plant cell	7) False. It's lichen.	*12) The Berenstain Bears
3) Energy	8) A= Foliose (leafy) B= Fruticose (branchy)	*13) Sherwood Forest
4) A= Problem B= Independent variable (change) C= Dependent variable (observe) D= Control variable (same)	9) C and E are switched.	*14) Yogi Bear
5) Eubacteria, Archaea, Protista, Plantae, Animalia, Fungi	10) Algae/algae bloom	*15) Harry and the Hendersons

Final Question =5 point wager Wager=_____ Score=_____
A= Cycad
B= Ginkgo

Comments/Notes

Across

1. _____ method: A process that is the basis for scientific inquiry (Questioning and experimenting).
6. Type of Lichen. Forms a crust, difficult to remove without crumbling.
7. Plants makes sugar from light using carbon dioxide and water
9. _____ Algae was one of the first algae to colonize land between 400-500 million years ago
10. The _____ flow of life occurs because of plants
11. Not a plant: A composite organism that arises from algae or cyanobacteria living among filaments of multiple fungi species in a mutualistic relationship.
12. Not a plant! A simple, nonflowering, and typically aquatic plant of a large group that includes the seaweeds and many single-celled forms. Algae contain chlorophyll but lack true stems, roots, leaves, and vascular tissue.
15. _____ plants appeared by 350 million years ago, with forests soon following by 300 million years ago.
17. A scientific _____ is an experiment or observation designed to minimize the effects of variables other than the independent variable. This increases the reliability of the results, often through a comparison between control measurements and the other measurements.
18. It is any factor that can be manipulated, controlled for, or measured in an experiment.
19. G_____: Seed plants evolved before flowering seed plants.

Down

2. _____ Variable: The variable you have control over, what you can choose and manipulate.
3. Algae remove huge amounts of _____-Dioxide from the air.
4. _____ Variable: (Observe) What you measure in the experiment and what is affected during the experiment. The Numbers
5. A_____: Flowering plants, covered seed, produce seeds enclosed in a fruit /ovary
8. Type of Lichen. Forms shrubby branches. Easily removed by hand.
13. Plant _____ is usually characterized as descriptive biology with the aim to explain how the present species diversity arose over a geological time frame.
14. Any of various photosynthetic, eukaryotic, multi-cellular organisms of the Kingdom Plantae characteristically producing embryos, containing chloroplasts, having a cell wall made of cellulose, and lacking the power of locomotion.
16. Type of Lichen. Leafy, can be peeled off rock with knife.

----------teacher can remove word bank to make more challenging----------

Possible Answers

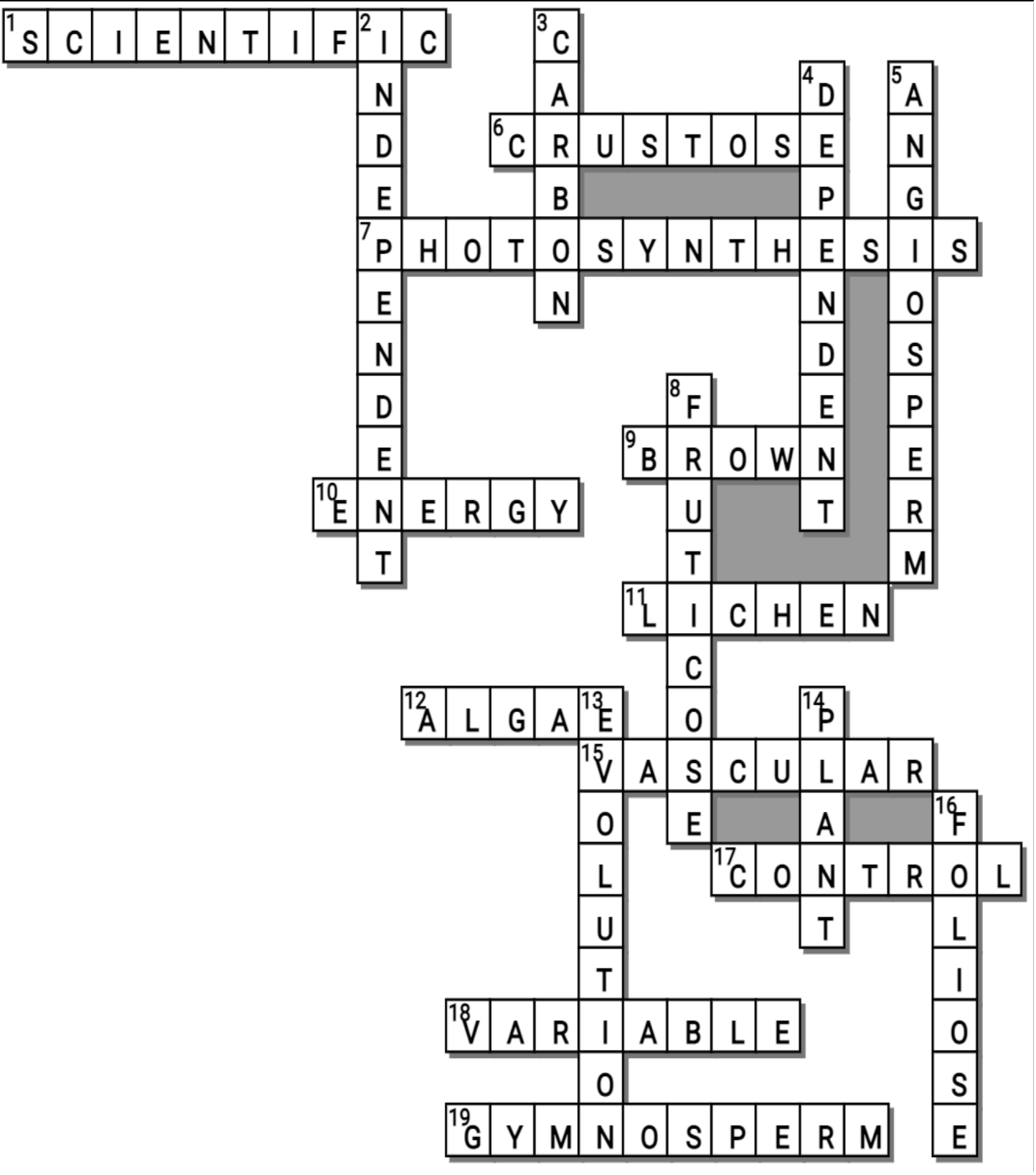
EVOLUTION, ALGAE, ANGIOSPERM, BROWN, CARBON, CRUSTOSE, DEPENDENT, ENERGY, FOLIOSE, FRUTICOSE, GYMNOSPERM, INDEPENDENT , LICHEN, PHOTOSYNTHESIS, PLANT, SCIENTIFIC , VARIABLE, VASCULAR, CONTROL

Part 1 Lesson 2 Grow Study Set-Up

Plant Study Set-Up Name:_____ Partners:_____

Please complete the four terms below as they relate to the project you have selected.

Problem:_____



Independent Variable:_____

_____

Dependent Variable:_____

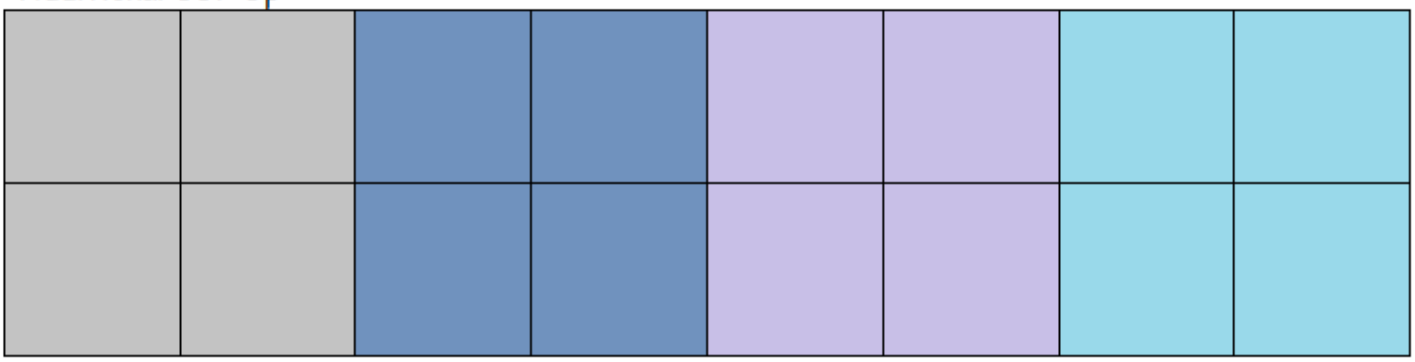
_____

Control:_____

_____

Please describe your set-up with visuals.

Additional Set-Up



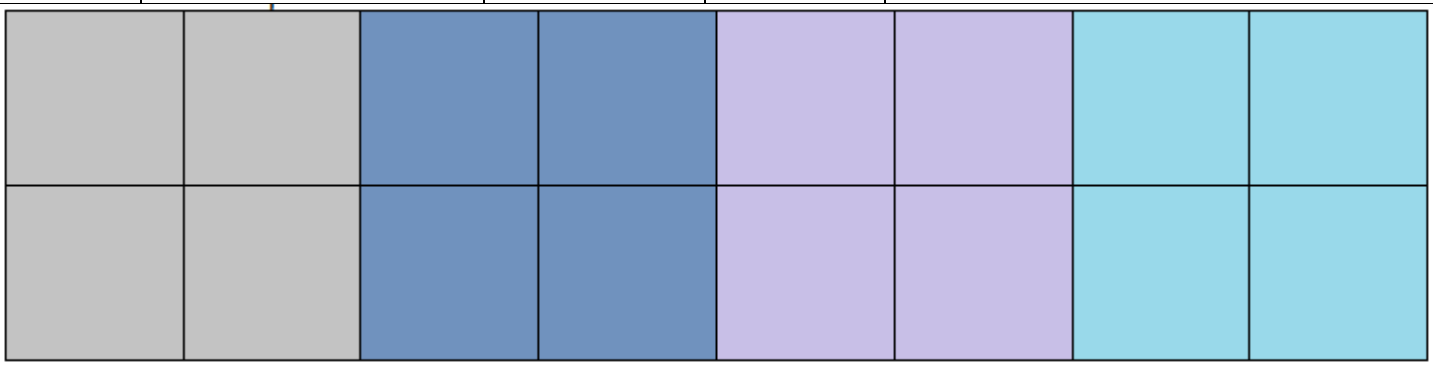
C = Control Group _____

Day / Date	Height of Plant Averages	# of True leaves Average	# of flowers Averages	Observations
C				
C				
C				
C				
C				
C				
C				
C				
C				
C				
C				
C				
C				
Final	Final Average	Final Average	Final Average	

X = Experimental Group _____

Day / Date	Height of Plant Averages	# of True leaves Averages	# of flowers Averages	Observations
X				
X				
X				
X				
X				
X				
X				
X				
X				
X				
X				
X				
X				

Final	Final Averages	Final Averages	Final Averages	



Control Group

Experimental Groups