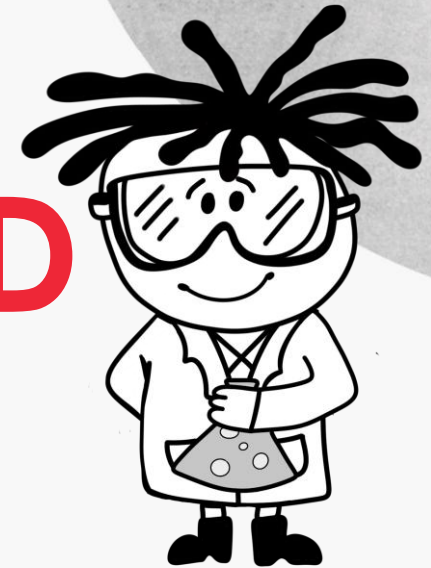


THE SCIENTIFIC METHOD



! The content in this document is shared under the [CC BY-NC-ND 4.0](https://creativecommons.org/licenses/by-nc-nd/4.0/)
Creative Commons Attribution-Non-Commercial-No-Derivatives 4.0 International

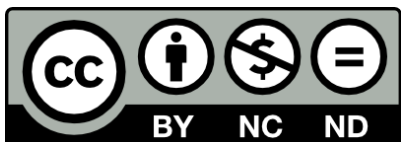


This means you are free to:

Share – copy and redistribute the material in any medium or format for any purpose. The licensor cannot revoke these freedoms as long as you follow the license terms.

Under the following terms:

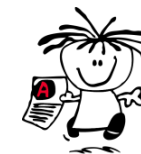
1. **Attribution** – You must give [appropriate credit](#) and provide a link to the license. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.
2. **Non-Commercial** – You may not use the material for [commercial purposes](#).
3. **No Derivatives** – If you [remix, transform, or build upon](#) the material, you may not distribute the modified material.
4. **No additional restrictions** – You may not apply legal terms or [technological measures](#) that legally restrict others from doing anything the license permits.



START WITH A QUESTION

START WITH A QUESTION

It's your best friend's birthday next week and you want to bake him/her a cake.



THE
ANSWER
SERIES *Your Key to Exam Success*

START WITH A QUESTION

It's your best friend's birthday next week and you want to bake him/her a cake.

So, you get your mom's recipe book and locate...



Granny's famous sponge cake

4 eggs

1 cup sugar

1 tbsp hot water

1 cup flour

1 tsp baking powder

2 tbsp melted butter

1 tsp vanilla extract

Whip eggs until foamy.

Add cup of sugar 1 tbsp at a time. Continue to whip.

Fold in dry ingredients.

Mix melted butter, hot water and vanilla extract. Fold into egg mixture.

Bake 35 min at 180°C.



THE
ANSWER
SERIES Your Key to Exam Success

START WITH A QUESTION

Going through the ingredients you see only 1 tsp baking powder is added to the batter.



Granny's famous sponge cake

4 eggs

1 cup sugar

1 tbsp hot water

1 cup flour

1 tsp baking powder

2 tbsp melted butter

1 tsp vanilla extract

Whip eggs until foamy.

Add cup of sugar 1 tbsp at a time.
Continue to whip.

Fold in dry ingredients.

Mix melted butter, hot water and vanilla extract. Fold into egg mixture.

Bake 35 min at 180°C.



START WITH A QUESTION

Going through the ingredients you see only 1 tsp baking powder is added to the batter.

You remember that baking powder gives a cake its height.



Granny's famous sponge cake

4 eggs

1 cup sugar

1 tbsp hot water

1 cup flour

1 tsp baking powder

2 tbsp melted butter

1 tsp vanilla extract

Whip eggs until foamy.

Add cup of sugar 1 tbsp at a time. Continue to whip.

Fold in dry ingredients.

Mix melted butter, hot water and vanilla extract. Fold into egg mixture.

Bake 35 min at 180°C.



START WITH A QUESTION

In the pantry you find TWO different types of baking powder...



Granny's famous sponge cake

4 eggs

1 cup sugar

1 tbsp hot water

1 cup flour

1 tsp baking powder

2 tbsp melted butter

1 tsp vanilla extract

Whip eggs until foamy.

Add cup of sugar 1 tbsp at a time.
Continue to whip.

Fold in dry ingredients.

Mix melted butter, hot water and vanilla
extract. Fold into egg mixture.

Bake 35 min at 180°C.



START WITH A QUESTION

In the pantry you find TWO different types of baking powder...

... 'No Name' Baking Powder & 'Best' Baking Powder ...



Granny's famous sponge cake

4 eggs

1 cup sugar

1 tbsp hot water

1 cup flour

1 tsp baking powder

2 tbsp melted butter

1 tsp vanilla extract

Whip eggs until foamy.

Add cup of sugar 1 tbsp at a time. Continue to whip.

Fold in dry ingredients.

Mix melted butter, hot water and vanilla extract. Fold into egg mixture.

Bake 35 min at 180°C.



START WITH A QUESTION

But, which one are you going to use to give you the biggest cake?



Granny's famous sponge cake

4 eggs

1 cup sugar

1 tbsp hot water

1 cup flour

1 tsp baking powder

2 tbsp melted butter

1 tsp vanilla extract

Whip eggs until foamy.

Add cup of sugar 1 tbsp at a time.
Continue to whip.

Fold in dry ingredients.

Mix melted butter, hot water and vanilla extract. Fold into egg mixture.

Bake 35 min at 180°C.



THE
ANSWER
SERIES Your Key to Exam Success

START WITH A QUESTION

Which one are you going to use to give you the biggest cake?

So, you find yourself asking this question...



Granny's famous sponge cake

4 eggs

1 cup sugar

1 tbsp hot water

1 cup flour

1 tsp baking powder

2 tbsp melted butter

1 tsp vanilla extract

Whip eggs until foamy.

Add cup of sugar 1 tbsp at a time. Continue to whip.

Fold in dry ingredients.

Mix melted butter, hot water and vanilla extract. Fold into egg mixture.

Bake 35 min at 180°C.



THE
ANSWER
SERIES Your Key to Exam Success

START WITH A QUESTION

Which type of baking powder will cause a cake to rise higher?



START WITH A QUESTION

But before baking this cake, you need to consider some things...

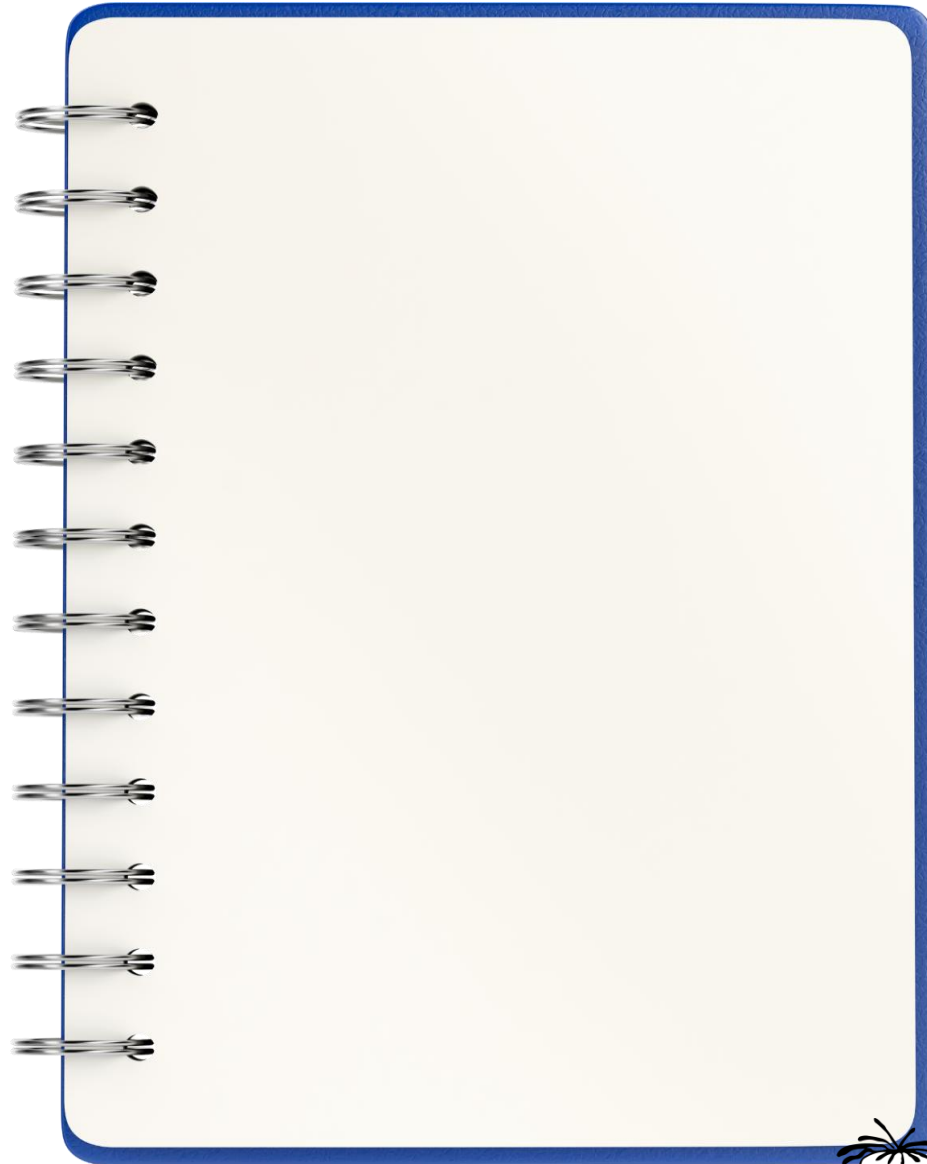
Which type of baking powder will cause a cake to rise higher?



PLAN THE INVESTIGATION

PLAN THE INVESTIGATION

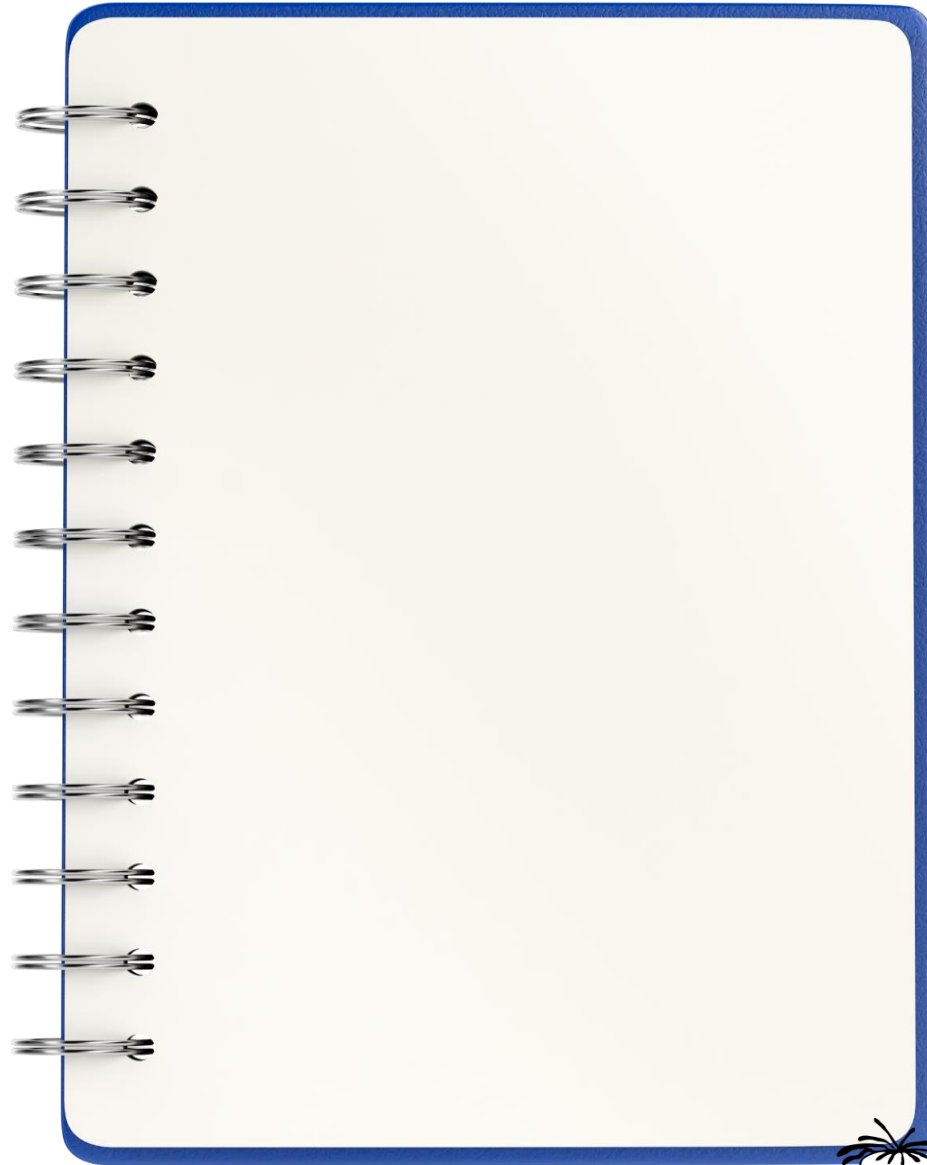
You need to plan how you are going to perform this experiment.



PLAN THE INVESTIGATION

You need to plan how you are going to perform this experiment.

This means asking some important questions.



PLAN THE INVESTIGATION

You need to plan how you are going to perform this experiment.

This means asking some important questions.



Let's brainstorm...



PLAN THE INVESTIGATION

You need to plan how you are going to perform this experiment.

This means asking some important questions.



1. How many cakes would you have to bake?



PLAN THE INVESTIGATION

You need to plan how you are going to perform this experiment.

This means asking some important questions.



1. How many cakes would you have to bake?
2. What would be different each time?



PLAN THE INVESTIGATION

You need to plan how you are going to perform this experiment.

This means asking some important questions.



1. How many cakes would you have to bake?
2. What would be different each time?
3. What would you look for?



PLAN THE INVESTIGATION

You need to plan how you are going to perform this experiment.

This means asking some important questions.



1. How many cakes would you have to bake?
2. What would be different each time?
3. What would you look for?
4. **When** will you do the experiment?



PLAN THE INVESTIGATION

You need to plan how you are going to perform this experiment.

This means asking some important questions.



1. How many cakes would you have to bake?
2. What would be different each time?
3. What would you look for?
4. **When** will you do the experiment?
5. **How** will you take the measurements?



PLAN THE INVESTIGATION

You need to plan how you are going to perform this experiment.

This means asking some important questions.



1. How many cakes would you have to bake?
2. What would be different each time?
3. What would you look for?
4. **When** will you do the experiment?
5. **How** will you take the measurements?
6. **How** will you record your results?



PLAN THE INVESTIGATION

You need to plan how you are going to perform this experiment.

This means asking some important questions.



1. How many cakes would you have to bake?
2. What would be different each time?
3. What would you look for?
4. **When** will you do the experiment?
5. **How** will you take the measurements?
6. **How** will you record your results?
7. **Where** will you do the experiment?



PLAN THE INVESTIGATION

You need to plan how you are going to perform this experiment.

This means asking some important questions.



1. How many cakes would you have to bake?
2. What would be different each time?
3. What would you look for?
4. **When** will you do the experiment?
5. **How** will you take the measurements?
6. **How** will you record your results?
7. **Where** will you do the experiment?
8. **What** apparatus will you need?

etc.



PLAN THE INVESTIGATION

These planning questions should help you consider the **basic setup** of your investigation...



PLAN THE INVESTIGATION

These planning questions should help you consider the **basic setup** of your investigation...

...which should look something like this...



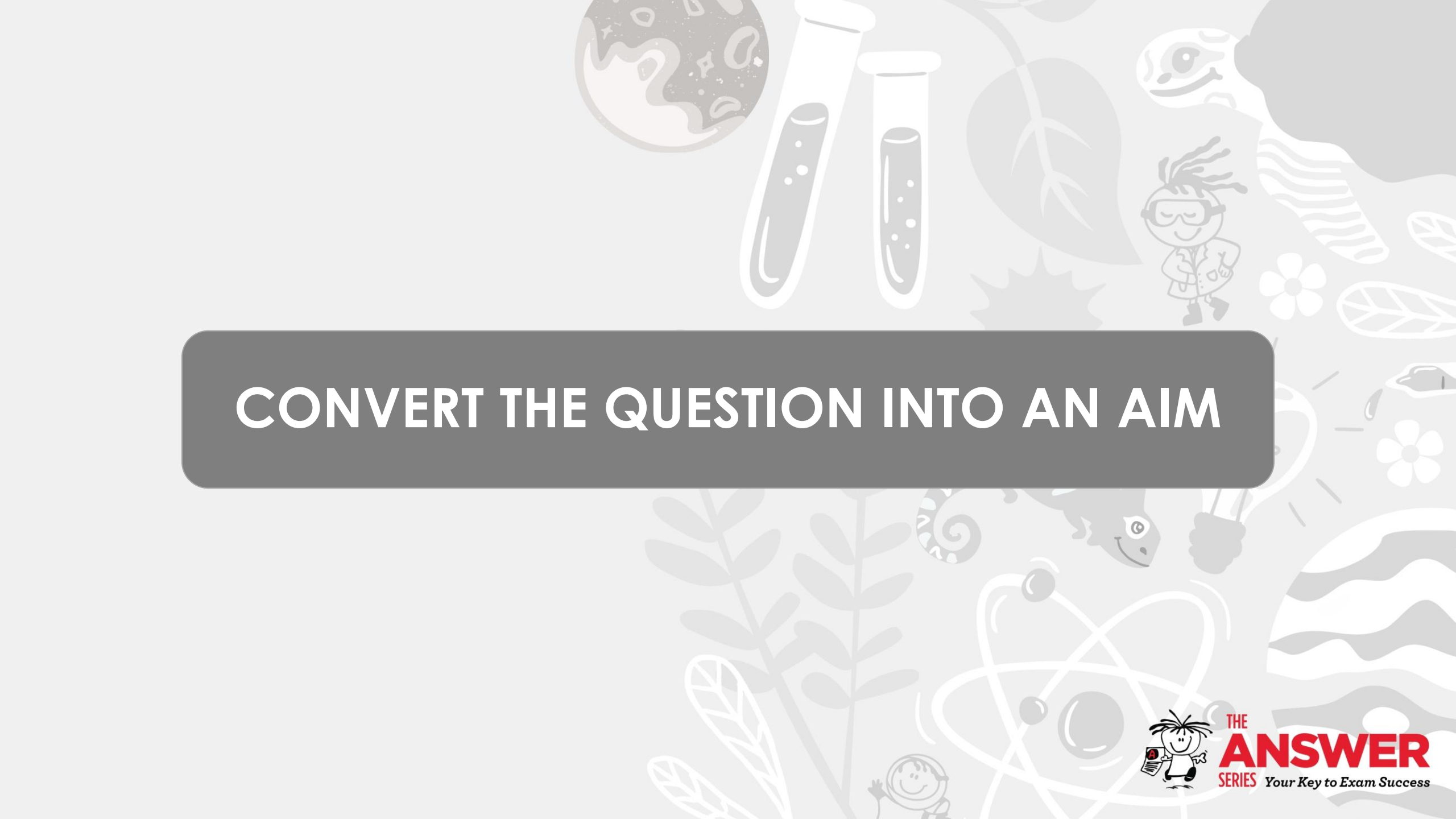
PLAN THE INVESTIGATION

These planning questions should help you consider the **basic setup** of your investigation...

...which should look something like this...

...you will bake at least 2 cakes and use different types of baking powder in each.



The background is a light gray collage of various science and nature-related icons. These include a planet with rings, two test tubes with liquid and bubbles, a large green leaf, a cartoon scientist with glasses and a lab coat, a dinosaur, a flower, a sun, a spiral shell, a cartoon boy, and an atomic model with a central nucleus and orbiting electrons.

CONVERT THE QUESTION INTO AN AIM

CONVERT THE QUESTION INTO AN AIM

Which type of baking powder will cause a cake to rise higher?



An aim always starts with 'TO'

To determine ...

To investigate ...

To compare ...



THE
ANSWER
SERIES Your Key to Exam Success

CONVERT THE QUESTION INTO AN AIM

Which type of baking powder will cause a cake to rise higher?

To determine which type of baking powder will cause a cake to rise higher.



An aim always starts with 'To'
To determine ...
To investigate ...
To compare ...



CONVERT THE QUESTION INTO AN AIM

To determine which type of baking powder will cause a cake to rise higher.



The aim will always contain
two variables...

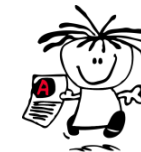


CONVERT THE QUESTION INTO AN AIM

To determine which type of baking powder will cause a cake to **rise higher**.



The **dependent** variable ...

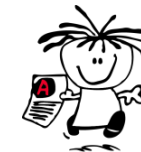


CONVERT THE QUESTION INTO AN AIM

To determine which type of baking powder will cause a cake to rise higher.



... and the **independent** variable.



CONVERT THE QUESTION INTO AN AIM

To determine which type of baking powder will cause a cake to rise higher.



Now, why on Earth are these 'variables' and what does the word mean?



UNDERSTANDING VARIABLES

UNDERSTANDING VARIABLES

A **variable** is something that can change.

There are **THREE** types that are important in scientific investigations:

independent variable

dependent variable

constant variable



THE
ANSWER
SERIES Your Key to Exam Success

UNDERSTANDING VARIABLES

A **variable** is something that can change.

There are **THREE** types that are important in scientific investigations:

independent variable

dependent variable

constant variable



Let's take a closer look...



THE
ANSWER
SERIES Your Key to Exam Success

UNDERSTANDING VARIABLES

independent variable

- controlled by the investigator
- has set/predetermined values
- is **different** between setups
- happens first

UNDERSTANDING VARIABLES

independent variable

- controlled by the investigator
- has set/predetermined values
- is **different** between setups
- happens first

... this variable is
not affected by the
other variables i.e.
it is **independent**



UNDERSTANDING VARIABLES

independent variable

- controlled by the investigator
- has set/predetermined values
- is **different** between setups
- happens first

... this variable is not affected by the other variables i.e. it is **independent**

dependent variable

- changes because of the independent variable
- it is what is being **measured**
- happens second



UNDERSTANDING VARIABLES

independent variable

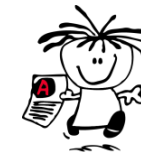
- controlled by the investigator
- has set/predetermined values
- is **different** between setups
- happens first

... this variable is not affected by the other variables i.e. it is **independent**

dependent variable

- changes because of the independent variable
- it is what is being **measured**
- happens second

... this variable is affected by the other variables i.e. it **depends** on them



UNDERSTANDING VARIABLES

independent variable

- controlled by the investigator
- has set/predetermined values
- is **different** between setups
- happens first

... this variable is not affected by the other variables i.e. it is **independent**

dependent variable

- changes because of the independent variable
- it is what is being **measured**
- happens second

... this variable is affected by the other variables i.e. it **depends** on them

constant variables

- can affect the results of the investigation
- must be controlled so that they do not interfere
- also known as **fixed** or **controlled** variables



UNDERSTANDING VARIABLES

independent variable

- controlled by the investigator
- has set/predetermined values
- is **different** between setups
- happens first

... this variable is not affected by the other variables i.e. it is **independent**

dependent variable

- changes because of the independent variable
- it is what is being **measured**
- happens second

... this variable is affected by the other variables i.e. it **depends** on them

constant variables

- can affect the results of the investigation
- must be controlled so that they do not interfere
- also known as **fixed** or **controlled** variables

... these variables must be **kept the same** so that their effect is not measured

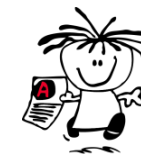


UNDERSTANDING VARIABLES

To determine which type of baking powder will cause a cake to rise higher.

dependent variable

What are we measuring?



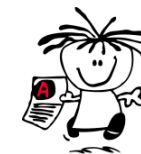
UNDERSTANDING VARIABLES

To determine which type of baking powder will cause a cake to rise higher.

dependent variable

What are we measuring?

the height of the cake



UNDERSTANDING VARIABLES

To determine which type of baking powder will cause a cake to rise higher.

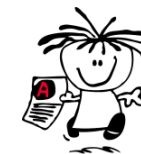
dependent variable

What are we measuring?

the height of the cake

independent variable

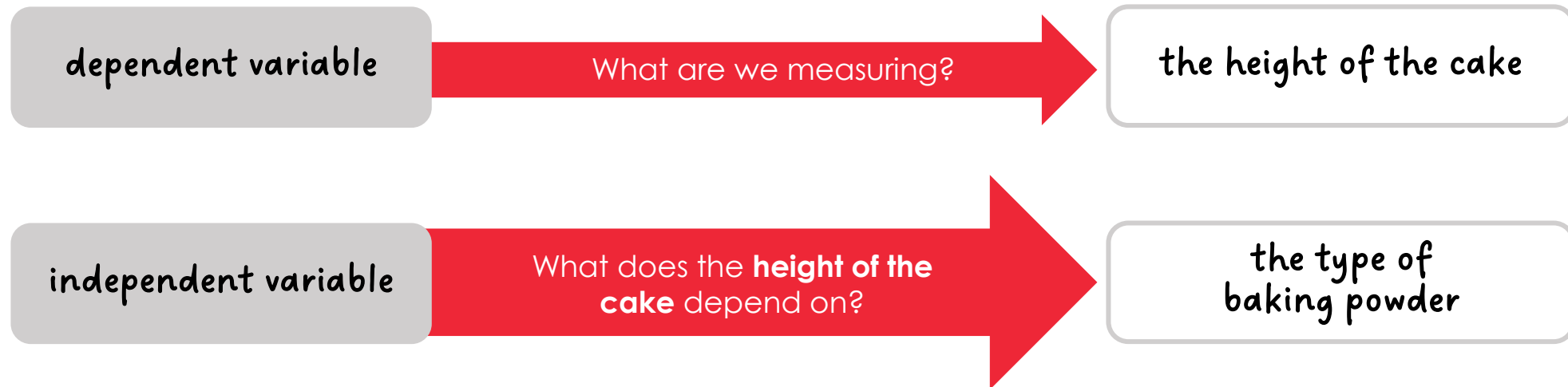
What does the **height of the cake** depend on?



THE
ANSWER
SERIES Your Key to Exam Success

UNDERSTANDING VARIABLES

To determine which type of baking powder will cause a cake to rise higher.



UNDERSTANDING VARIABLES

To determine which type of baking powder will cause a cake to rise higher.

dependent variable

What are we measuring?

the height of the cake

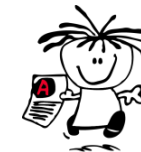
independent variable

What does the **height of the cake** depend on?

the type of baking powder

constant variables

What **other factors** could influence the height of the cake?



THE
ANSWER
SERIES Your Key to Exam Success

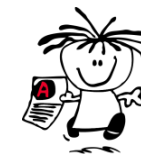
UNDERSTANDING VARIABLES



Let's brainstorm...

...think of a list of things that could also potentially affect the height of the cake **BESIDES** the type of baking powder.

Want to look at the recipe again?



THE
ANSWER
SERIES Your Key to Exam Success

UNDERSTANDING VARIABLES



Eggs

same size

same brand

same age

same type

same number

INGREDIENTS



THE
ANSWER
SERIES *Your Key to Exam Success*

UNDERSTANDING VARIABLES



Eggs

same size
same brand
same age
same type
same number



Flour

same amount
same brand

INGREDIENTS



UNDERSTANDING VARIABLES

INGREDIENTS



Eggs

same size
same brand
same age
same type
same number



Flour

same amount
same brand



Sugar

same amount
same brand



UNDERSTANDING VARIABLES

INGREDIENTS



Eggs

same size
same brand
same age
same type
same number



Flour

same amount
same brand



Sugar

same amount
same brand



Water

same volume
same temperature



UNDERSTANDING VARIABLES

INGREDIENTS



Eggs

same size
same brand
same age
same type
same number



Flour

same amount
same brand



Sugar

same amount
same brand



Water

same volume
same temperature



Vanilla

same volume
same brand



UNDERSTANDING VARIABLES

INGREDIENTS



Eggs

same size
same brand
same age
same type
same number



Flour

same amount
same brand



Sugar

same amount
same brand



Water

same volume
same temperature



Vanilla

same volume
same brand



Butter

same amount
same brand

What else could affect how each cake bakes?



UNDERSTANDING VARIABLES

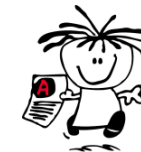


Oven

same oven

same
temperature

MATERIALS & METHOD



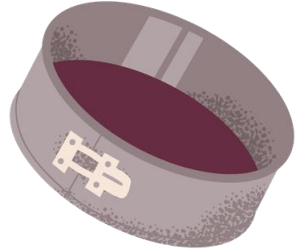
THE
ANSWER
SERIES *Your Key to Exam Success*

UNDERSTANDING VARIABLES



Oven

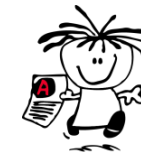
same oven
same
temperature



Pan

same sized
cake pan

MATERIALS & METHOD



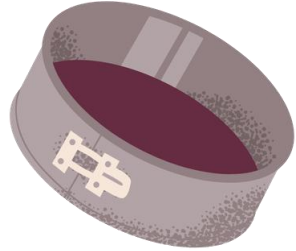
UNDERSTANDING VARIABLES

MATERIALS & METHOD



Oven

same oven
same
temperature



Pan

same sized
cake pan



Time

same baking time
placed in oven at
the same time



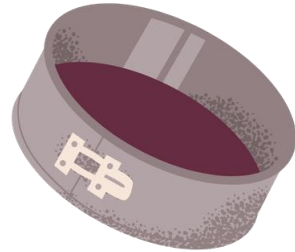
UNDERSTANDING VARIABLES

MATERIALS & METHOD



Oven

same oven
same
temperature



Pan

same sized
cake pan



Time

same baking time
placed in oven at
the same time



Measuring

same amount of
each type of
baking powder



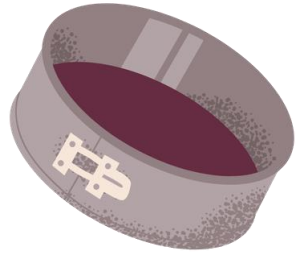
UNDERSTANDING VARIABLES

MATERIALS & METHOD



Oven

same oven
same
temperature



Pan

same sized
cake pan



Time

same baking time
placed in oven at
the same time



Measuring

same amount of
each type of
baking powder



But why are any of these factors important?



VALIDITY

VALIDITY

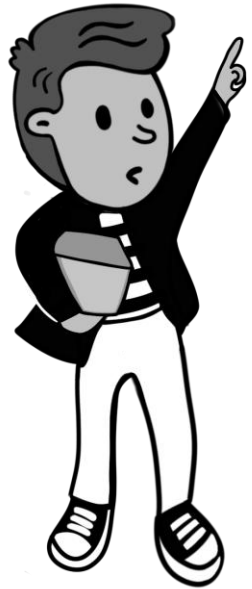


That's such a lot
of stuff to try
and control!



THE
ANSWER
SERIES *Your Key to Exam Success*

VALIDITY

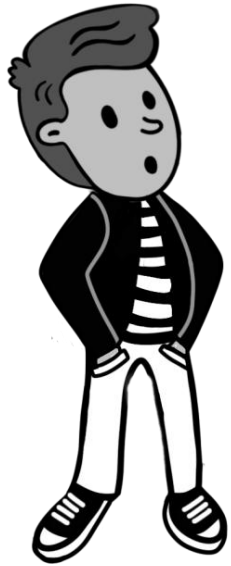


That's such a lot of stuff to try and control!

Why can't I just bake two cakes with **different** types of **baking powder** AND **different** numbers of **eggs**?



VALIDITY



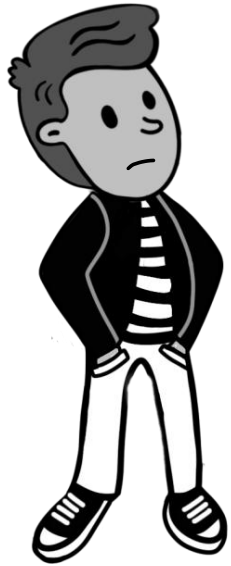
That's such a lot of stuff to try and control!

Why can't I just bake two cakes with **different** types of **baking powder** AND **different** numbers of **eggs**?

Surely there will still be a difference in the height of each cake?



VALIDITY



That's such a lot of stuff to try and control!

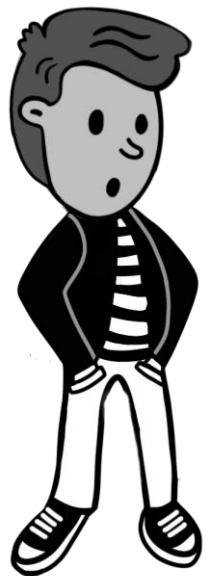
Why can't I just bake two cakes with **different** types of **baking powder** AND **different** numbers of **eggs**?

Surely there will still be a difference in the height of each cake?

Of course!



VALIDITY



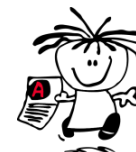
That's such a lot of stuff to try and control!

Why can't I just bake two cakes with **different** types of **baking powder** AND **different** numbers of **eggs**?

Surely there will still be a difference in the height of each cake?

Of course!

But then what caused the difference in height? The eggs or the baking powder?



VALIDITY



I don't know. It
could be either.



THE
ANSWER
SERIES *Your Key to Exam Success*

VALIDITY



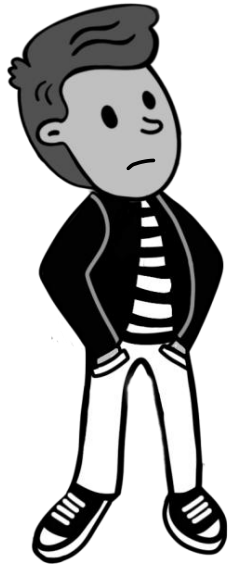
I don't know. It could be either.

Exactly! That's because the investigation will then not be **VALID**.



THE
ANSWER
SERIES Your Key to Exam Success

VALIDITY



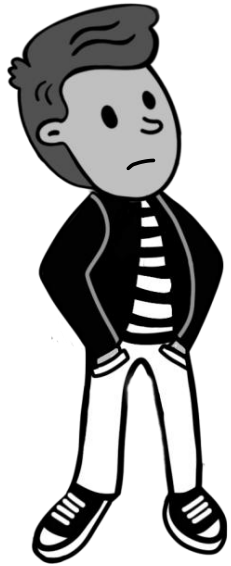
I don't know. It could be either.

Exactly! That's because the investigation will then not be **VALID**.

You are allowing too many variables to affect the investigation at the same time.



VALIDITY



I don't know. It could be either.

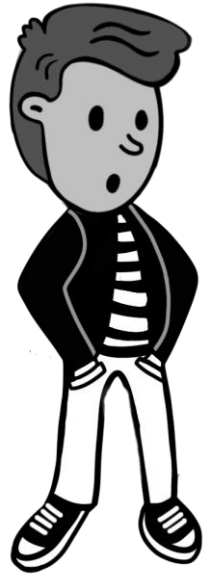
Exactly! That's because the investigation will then not be **VALID**.

You are allowing too many variables to affect the investigation at the same time.

So you don't know which one caused the dependent variable to change.



VALIDITY



I don't know. It could be either.

Exactly! That's because the investigation will then not be **VALID**.

You are allowing too many variables to affect the investigation at the same time.

So you don't know which one caused the dependent variable to change.

Oops.



VALIDITY



By keeping unwanted variables constant, you ensure the validity of an investigation.



THE
ANSWER
SERIES *Your Key to Exam Success*

VALIDITY

Validity refers to whether the investigation tested what it **aimed** to test.



By keeping unwanted variables constant, you ensure the validity of an investigation.



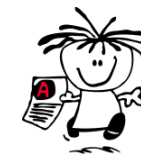
VALIDITY

Validity refers to whether the investigation tested what it **aimed** to test.



By keeping unwanted variables constant, you ensure the validity of an investigation.

Remember the **V** in **V**alidity for **V**ariables that should be kept constant.





TEST YOUR UNDERSTANDING



THE
ANSWER
SERIES *Your Key to Exam Success*

WHAT IS HAPPENING HERE?



5 ml baking
powder

10 ml baking
powder

15 ml baking
powder

No baking
powder

WHAT IS HAPPENING HERE?

What is different
between the cupcake
setups?



Over time in the oven

5 ml baking
powder

10 ml baking
powder

15 ml baking
powder

No baking
powder

WHAT IS HAPPENING HERE?

The **amount** of
baking powder

What do we call
that variable?



5 ml baking
powder

10 ml baking
powder

15 ml baking
powder

No baking
powder

Over time in the oven

WHAT IS HAPPENING HERE?

The **amount** of
baking powder

The **independent**
variable

What are we
measuring?



5 ml baking
powder

10 ml baking
powder

15 ml baking
powder

No baking
powder

Over time in the oven

WHAT IS HAPPENING HERE?

The **amount** of
baking powder

The **independent**
variable

The **height** of the
cupcake

What do we call
that variable?



5 ml baking
powder

10 ml baking
powder

15 ml baking
powder

No baking
powder

Over time in the oven

WHAT IS HAPPENING HERE?

The **amount** of
baking powder

The **independent**
variable

The **height** of the
cupcake

The **dependent**
variable



5 ml baking
powder

10 ml baking
powder

15 ml baking
powder

No baking
powder

Over time in the oven

WHAT IS HAPPENING HERE?

EXPERIMENTAL SETUP



WHAT IS HAPPENING HERE?

What is different
between the plant
setups?

EXPERIMENTAL SETUP



WHAT IS HAPPENING HERE?

EXPERIMENTAL SETUP

The **type** of liquid

What do we call
that variable?



WHAT IS HAPPENING HERE?

EXPERIMENTAL SETUP

The **type** of liquid

The **independent**
variable

What are we
measuring?



WHAT IS HAPPENING HERE?

EXPERIMENTAL SETUP

The **type** of liquid

The **independent**
variable

How **high** each
plant grows

What do we call
that variable?



WHAT IS HAPPENING HERE?

EXPERIMENTAL SETUP

The **type** of liquid

The **independent**
variable

How **high** each
plant grows

The **dependent**
variable



WHAT IS HAPPENING HERE?

EXPERIMENTAL SETUP

What other factors must be kept the same?



WHAT IS HAPPENING HERE?

EXPERIMENTAL SETUP

The SAME ...

type of
plant

volume (ml) of
liquid given

person taking
the
measurements

age of
plant

sized pot

timeframe

etc. ...



WHAT IS HAPPENING HERE?

EXPERIMENTAL SETUP

The SAME ...

type of
plant

volume (ml) of
liquid given

person taking
the
measurements

age of
plant

sized pot

timeframe

etc. ...



What do we call these factors that should stay the same?

WHAT IS HAPPENING HERE?

EXPERIMENTAL SETUP

The SAME ...

type of
plant

volume (ml) of
liquid given

person taking
the
measurements

age of
plant

sized pot

timeframe

etc. ...



constant/fixed/controlled variables

WHAT IS HAPPENING HERE?

EXPERIMENTAL SETUP

The SAME ...

type of
plant

volume (ml) of
liquid given

person taking
the
measurements

age of
plant

sized pot

timeframe

etc. ...



Why should these variables be kept constant?

WHAT IS HAPPENING HERE?

EXPERIMENTAL SETUP

The SAME ...

type of
plant

volume (ml) of
liquid given

person taking
the
measurements

age of
plant

sized pot

timeframe

etc. ...

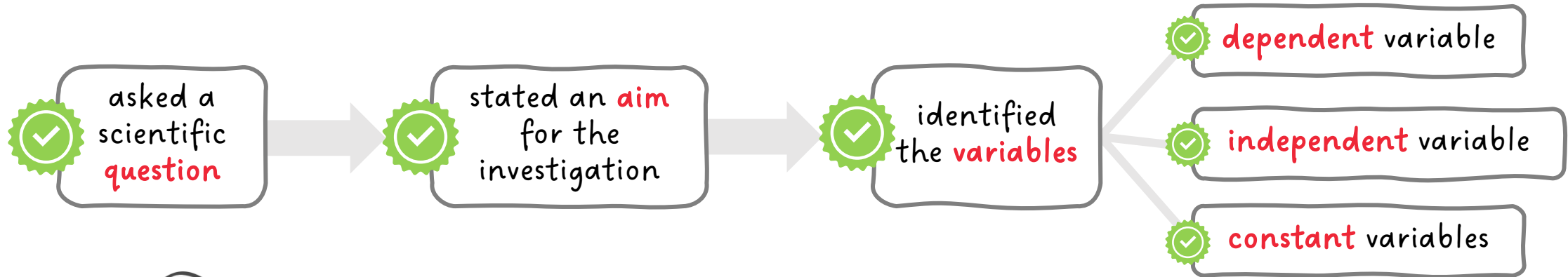


To ensure the **validity** of the investigation



BACK TO THE CAKE

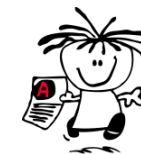
WHAT HAVE WE DONE SO FAR?



WRITE A HYPOTHESIS

WRITE A HYPOTHESIS

A hypothesis must contain the
independent & **dependent** variables...



THE
ANSWER
SERIES *Your Key to Exam Success*

WRITE A HYPOTHESIS

A hypothesis must contain the **independent** & **dependent** variables...

...give a possible **prediction/explanation** of the **relationship** between these two variables...

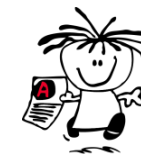


WRITE A HYPOTHESIS

A hypothesis must contain the **independent** & **dependent** variables...

...give a possible **prediction/explanation** of the **relationship** between these two variables...

...it must be a **statement**...



WRITE A HYPOTHESIS

A hypothesis must contain the **independent** & **dependent** variables...

...give a possible **prediction/explanation** of the **relationship** between these two variables...

...it must be a **statement**...

~~HOW~~...?
~~WHAT~~...?
~~WHICH~~...?



THE
ANSWER
SERIES Your Key to Exam Success

WRITE A HYPOTHESIS

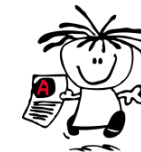
A hypothesis must contain the **independent** & **dependent** variables...

...give a possible **prediction/explanation** of the **relationship** between these two variables...

...it must be a **statement**...

~~HOW~~...?
~~WHAT~~...?
~~WHICH~~...?

...it must be **testable**.



THE
ANSWER
SERIES Your Key to Exam Success

WRITE A HYPOTHESIS

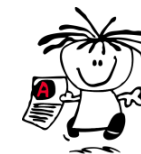
DIFFERENT TYPES OF HYPOTHESES

WRITE A HYPOTHESIS

DIFFERENT TYPES OF HYPOTHESES

A hypothesis can be stated **positively**.

'Best' baking powder will cause the cake to rise higher than 'No Name' baking powder.



WRITE A HYPOTHESIS

DIFFERENT TYPES OF HYPOTHESES

A hypothesis can be stated **positively**.

'Best' baking powder will cause the cake to rise higher than 'No Name' baking powder.

A hypothesis can be stated **negatively**.

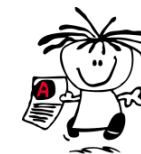
'Best' baking powder will **not** cause the cake to rise higher than 'No Name' baking powder.



WRITE A HYPOTHESIS

DIFFERENT TYPES OF HYPOTHESES

BUT it is always best to state a **general** hypothesis.



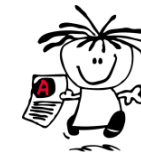
WRITE A HYPOTHESIS

DIFFERENT TYPES OF HYPOTHESES

BUT it is always best to state a **general** hypothesis.

The type of baking powder will affect the height of a cake.

OR



WRITE A HYPOTHESIS

DIFFERENT TYPES OF HYPOTHESES

BUT it is always best to state a **general** hypothesis.

The type of baking powder will affect the height of a cake.

OR

Different types of baking powder
will affect the height a cake rises.



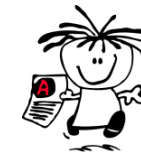
WRITE A HYPOTHESIS

A hypothesis should always contain both the **independent** and **dependent** variables.

The **type of baking powder** will affect the **height of a cake**.

OR

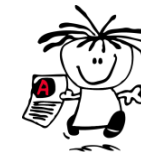
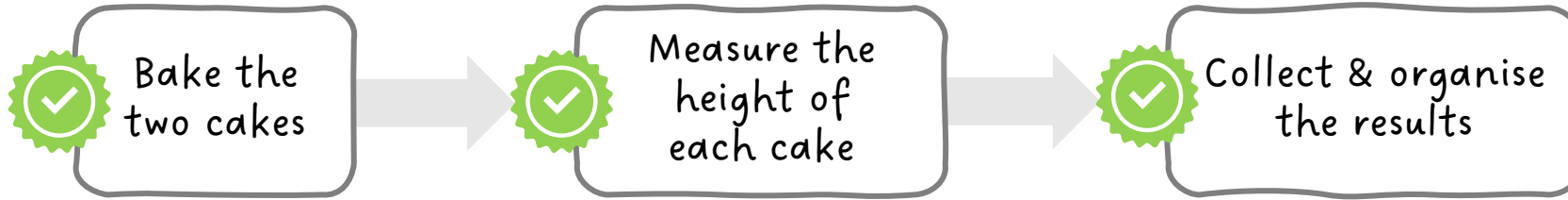
Different **types of baking powder** will affect the **height a cake rises**.



The background is a light gray collage of various science and nature-related icons. At the top left is a planet with craters. Next to it are two test tubes containing liquid with bubbles. To the right is a large green leaf. Further right is a cartoon character with glasses and a lab coat. Below the planet is a small cartoon character. At the bottom left is a branch with leaves. At the bottom center is a cartoon character with a lightbulb above their head. At the bottom right is a diagram of an atom with a central nucleus and orbiting electrons. The text 'PERFORM THE INVESTIGATION & COLLECT RESULTS' is centered in a dark gray rounded rectangle.

PERFORM THE INVESTIGATION & COLLECT RESULTS

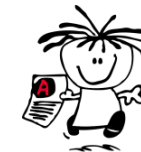
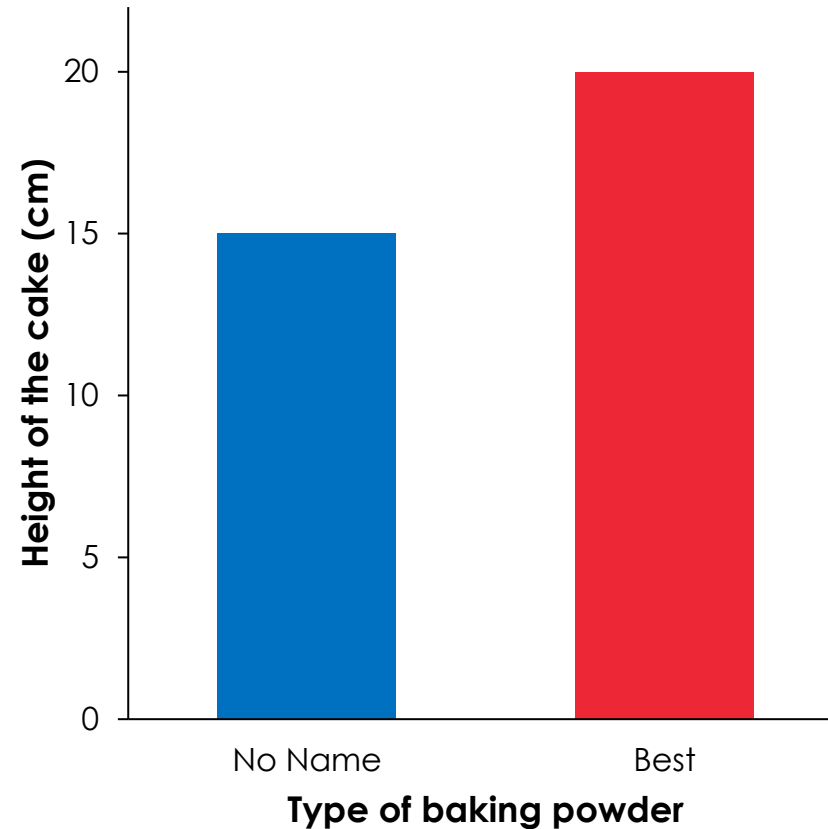
PERFORM THE INVESTIGATION & COLLECT RESULTS

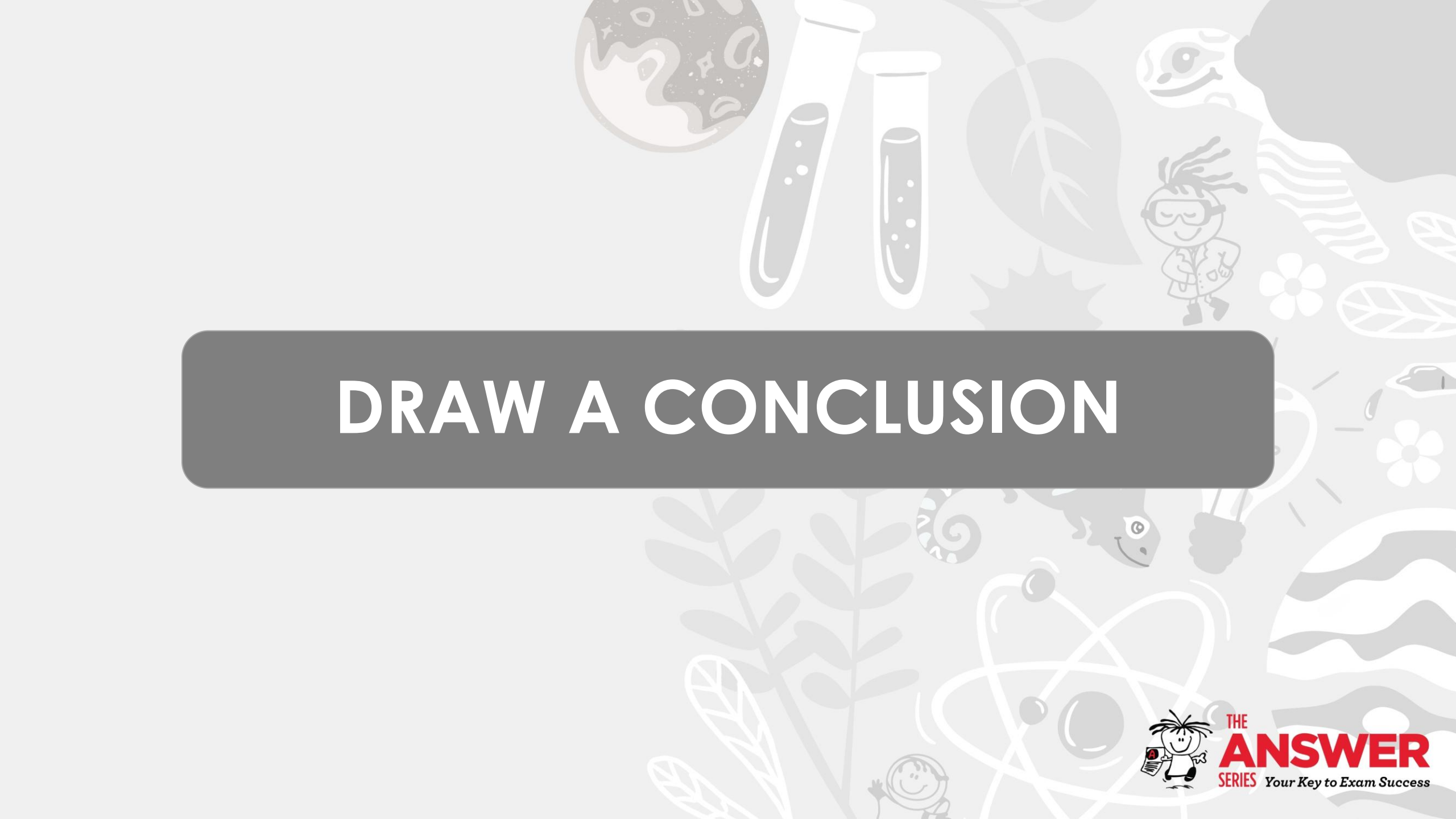


PERFORM THE INVESTIGATION & COLLECT RESULTS

RESULTS	
Type of baking powder	Height of the cake (cm)
'No Name'	15
'Best'	20

OR



The background features a light gray collage of various scientific and nature-related icons. These include a planet with rings, two test tubes with liquid and bubbles, a large green leaf, a cartoon scientist with glasses and a lab coat, a dinosaur, a flower, a sun, a spiral shell, a cartoon boy, a molecular model, and a hand holding a test tube.

DRAW A CONCLUSION

DRAW A CONCLUSION

Study the results and look for a general **relationship** that can be deduced.

Refer back to the **aim** or **hypothesis*** to make a conclusion.

RESULTS	
<i>Type of baking powder</i>	<i>Height of the cake (cm)</i>
'No Name'	15
'Best'	20



DRAW A CONCLUSION

Study the results and look for a general **relationship** that can be deduced.

Refer back to the **aim** or **hypothesis*** to make a conclusion.

RESULTS	
Type of baking powder	Height of the cake (cm)
'No Name'	15
'Best'	20



*Be careful of merely quoting the results
- rather state a relationship that can be
observed between the variables.



DRAW A CONCLUSION

AIM

To determine which type of baking powder will cause a cake to rise higher.

RESULTS

<i>Type of baking powder</i>	<i>Height of the cake (cm)</i>
'No Name'	15
'Best'	20



DRAW A CONCLUSION

AIM

To determine which type of baking powder will cause a cake to rise higher.

HYPOTHESIS

Different types of baking powder will affect the height a cake rises.

RESULTS

<i>Type of baking powder</i>	<i>Height of the cake (cm)</i>
'No Name'	15
'Best'	20



DRAW A CONCLUSION

AIM

To determine which type of baking powder will cause a cake to rise higher.

HYPOTHESIS

Different types of baking powder will affect the height a cake rises.

CONCLUSION

'Best' baking powder caused the cake to rise higher than **'No Name'** baking powder.

RESULTS

<i>Type of baking powder</i>	<i>Height of the cake (cm)</i>
'No Name'	15
'Best'	20

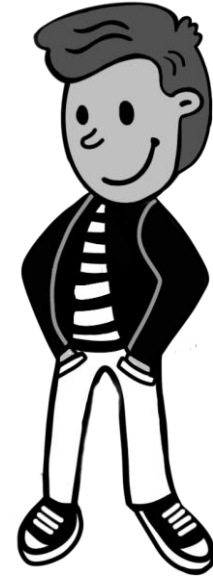


RELIABILITY

RELIABILITY



Great!



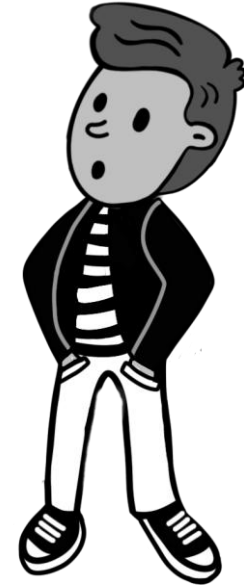
THE
ANSWER
SERIES *Your Key to Exam Success*

RELIABILITY



Great!

But how sure are you that 'Best' baking powder always 'wins'?



RELIABILITY



Great!

But how sure are you that 'Best' baking powder always 'wins'?

Well, it did this time.



THE
ANSWER
SERIES *Your Key to Exam Success*

RELIABILITY

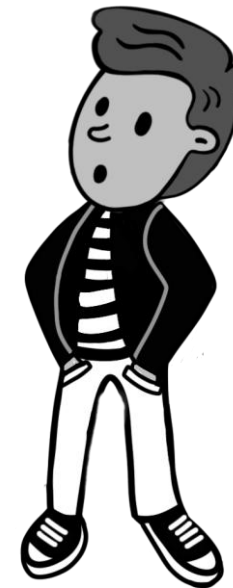


Great!

But how sure are you that 'Best' baking powder always 'wins'?

Well, it did this time.

But if I were to repeat your investigation, how sure are you that I would get the same results?



RELIABILITY



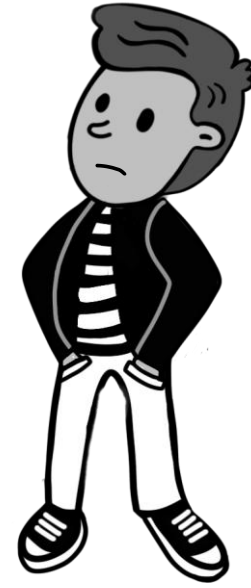
Great!

But how sure are you that 'Best' baking powder always 'wins'?

Well, it did this time.

But if I were to repeat your investigation, how sure are you that I would get the same results?

Not very sure.



RELIABILITY



Great!

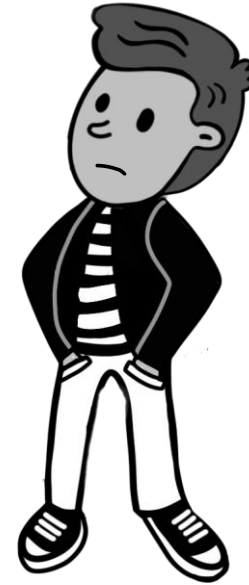
But how sure are you that 'Best' baking powder always 'wins'?

Well, it did this time.

But if I were to repeat your investigation, how sure are you that I would get the same results?

Not very sure.

Then your investigation is not very **reliable**.



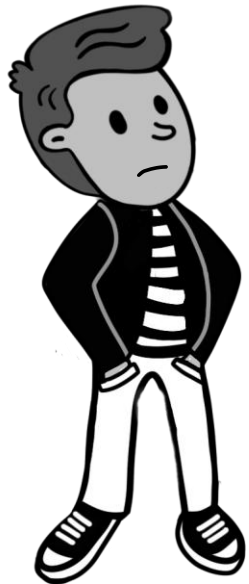
RELIABILITY

Reliability refers to whether the results of an investigation are **trustworthy** and **consistent**.



RELIABILITY

Reliability refers to whether the results of an investigation are **trustworthy** and **consistent**.



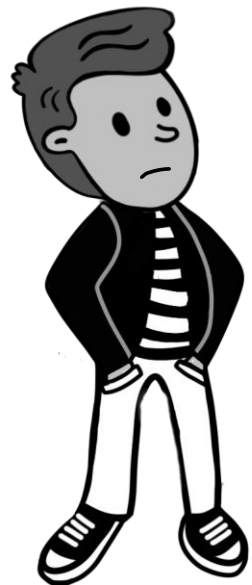
So how do I make my investigation more reliable?



THE
ANSWER
SERIES *Your Key to Exam Success*

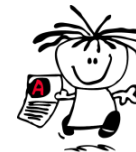
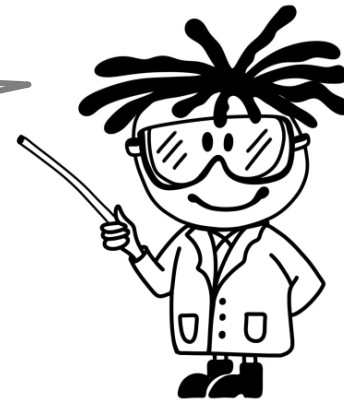
RELIABILITY

Reliability refers to whether the results of an investigation are **trustworthy** and **consistent**.



So how do I make my investigation more reliable?

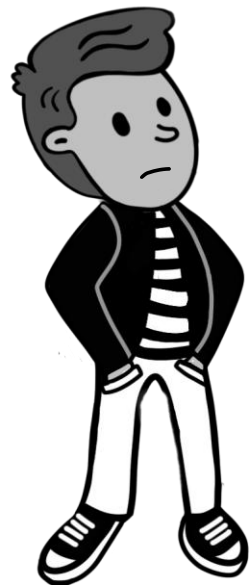
- 1 **Repeat** your investigation many times.



THE
ANSWER
SERIES Your Key to Exam Success

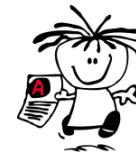
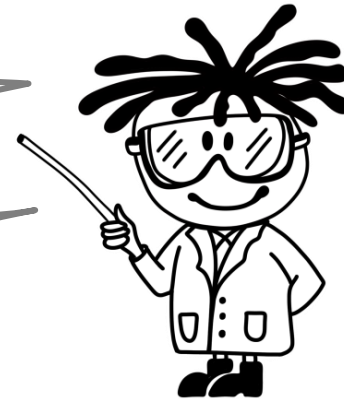
RELIABILITY

Reliability refers to whether the results of an investigation are **trustworthy** and **consistent**.



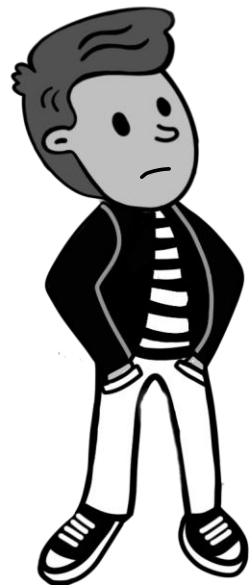
So how do I make my investigation more reliable?

- 1 **Repeat** your investigation many times.
- 2 Calculate an **average**.



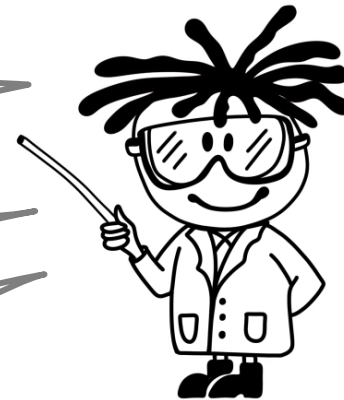
RELIABILITY

Reliability refers to whether the results of an investigation are **trustworthy** and **consistent**.



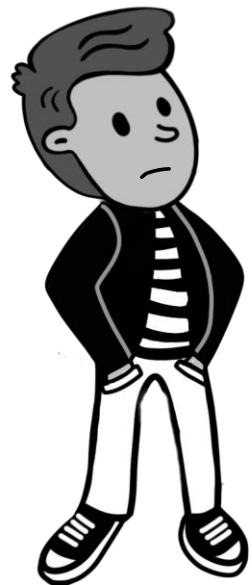
So how do I make my investigation more reliable?

- 1 **Repeat** your investigation many times.
- 2 Calculate an **average**.
- 3 Take a **random sample** (if applicable).



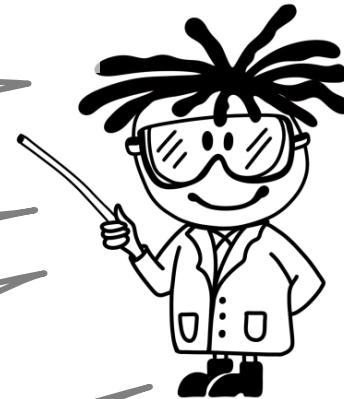
RELIABILITY

Reliability refers to whether the results of an investigation are **trustworthy** and **consistent**.



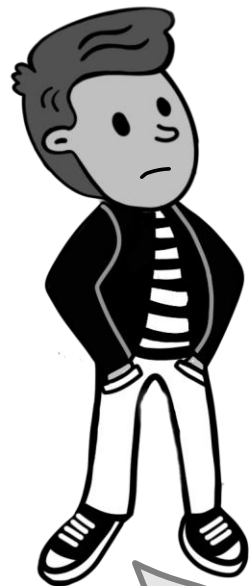
So how do I make my investigation more reliable?

- 1 **Repeat** your investigation many times.
- 2 Calculate an **average**.
- 3 Take a **random sample** (if applicable).
- 4 **Increase** the **sample size**.



RELIABILITY

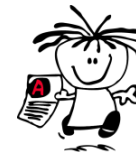
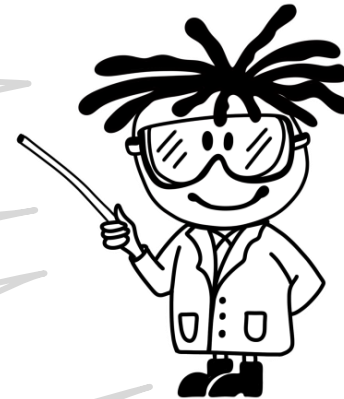
Reliability refers to whether the results of an investigation are **trustworthy** and **consistent**.



So how do I make my investigation more reliable?

- 1 **Repeat** your investigation many times.
- 2 Calculate an **average**.
- 3 Take a **random sample** (if applicable).
- 4 **Increase** the **sample size**.

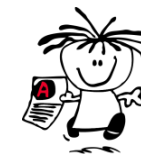
Why does this help with reliability?



RELIABILITY

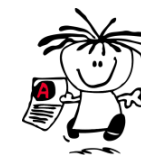
Repeat the investigation

Can confirm whether the results are consistent



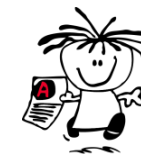
RELIABILITY

Repeat the investigation	Can confirm whether the results are consistent
Calculate an average	Can provide results that can be generalised to a larger group/phenomenon



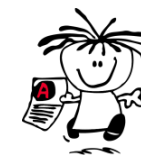
RELIABILITY

Repeat the investigation	Can confirm whether the results are consistent
Calculate an average	Can provide results that can be generalised to a larger group/phenomenon
Take a random sample	Removes the experimenter's bias



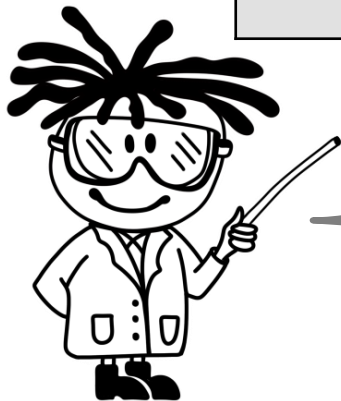
RELIABILITY

Repeat the investigation	Can confirm whether the results are consistent
Calculate an average	Can provide results that can be generalised to a larger group/phenomenon
Take a random sample	Removes the experimenter's bias
Increase the sample size	Provides more data that can be used to calculate an average OR generalise the results

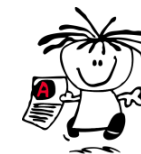


RELIABILITY

Repeat the investigation	Can confirm whether the results are consistent
Calculate an average	Can provide results that can be generalised to a larger group/phenomenon
Take a random sample	Removes the experimenter's bias
Increase the sample size	Provides more data that can be used to calculate an average OR generalise the results



Remember the **R** in **R**eliability for **R**eppeat, **R**aise the sample, take more **R**eadings and **R**andom sampling

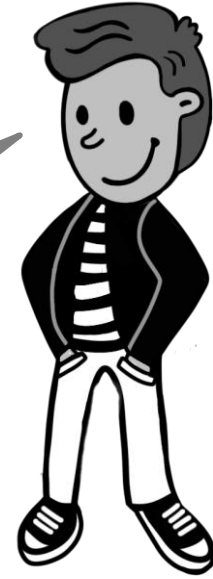


THE CONTROL SETUP

THE CONTROL SETUP



Okay, so if I bake MORE cakes, MANY TIMES, my investigation will be more reliable?

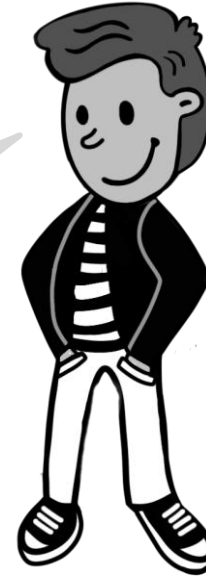


THE CONTROL SETUP



Yes!

Okay, so if I bake MORE cakes, MANY TIMES, my investigation will be more reliable?



THE
ANSWER
SERIES *Your Key to Exam Success*

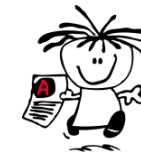
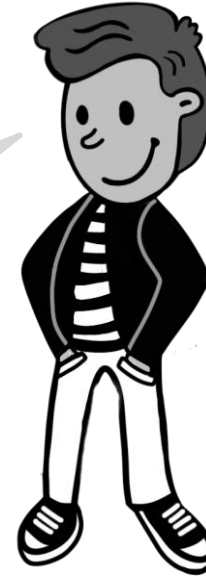
THE CONTROL SETUP



Yes!

Okay, so if I bake MORE cakes, MANY TIMES, my investigation will be more reliable?

But there is one more problem.



THE CONTROL SETUP

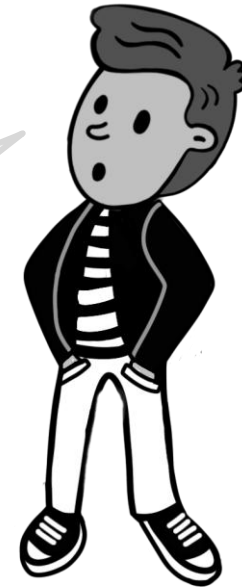


Yes!

Okay, so if I bake MORE cakes, MANY TIMES, my investigation will be more reliable?

But there is one more problem.

What?



THE CONTROL SETUP



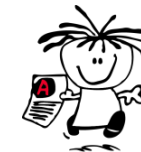
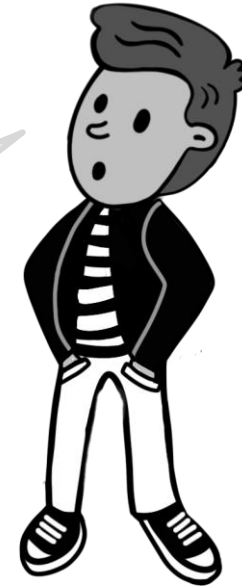
Yes!

Okay, so if I bake MORE cakes, MANY TIMES, my investigation will be more reliable?

But there is one more problem.

What?

How sure are you that **only the type of baking powder** affected the height of the cake?



THE CONTROL SETUP



Yes!

Okay, so if I bake MORE cakes, MANY TIMES, my investigation will be more reliable?

But there is one more problem.

What?

How sure are you that only the type of baking powder affected the height of the cake?

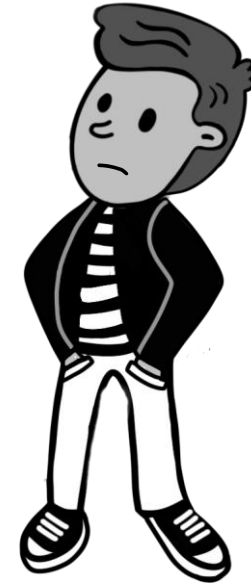
What do you mean? I thought I kept everything else constant?



THE CONTROL SETUP



Yes, but how much of the cake height was ONLY caused by the type of baking powder? Not the eggs/flour/sugar, etc.?

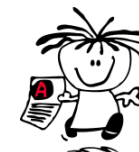
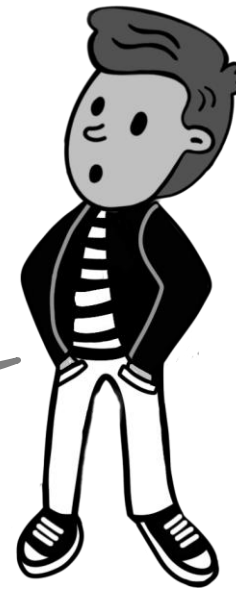


THE CONTROL SETUP



Yes, but how much of the cake height was **ONLY** caused by the type of baking powder? Not the eggs/flour/sugar, etc.?

I don't know.



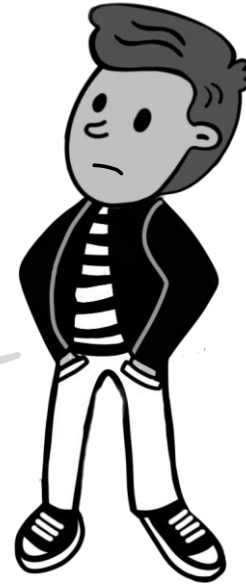
THE CONTROL SETUP



Yes, but how much of the cake height was ONLY caused by the type of baking powder? Not the eggs/flour/sugar, etc.?

I don't know.

That's why we use a **control setup**.



THE CONTROL SETUP

The **control Setup** provides a **comparison** with the experimental results.

It **confirms** that the independent variable caused the results and not some other factor.



In the control setup we **remove the independent variable** to observe, measure and compare its effect.



THE CONTROL SETUP

The **control Setup** provides a **comparison** with the experimental results.

It **confirms** that the independent variable caused the results and not some other factor.



In the control setup we **remove the independent variable** to observe, measure and compare its effect.

Remember the **C** in **C**ontrol setup - it provides the **C**omparison with the experiment and **C**onfirms the independent variable causes the results.



THE CONTROL SETUP

setup 1



setup 2

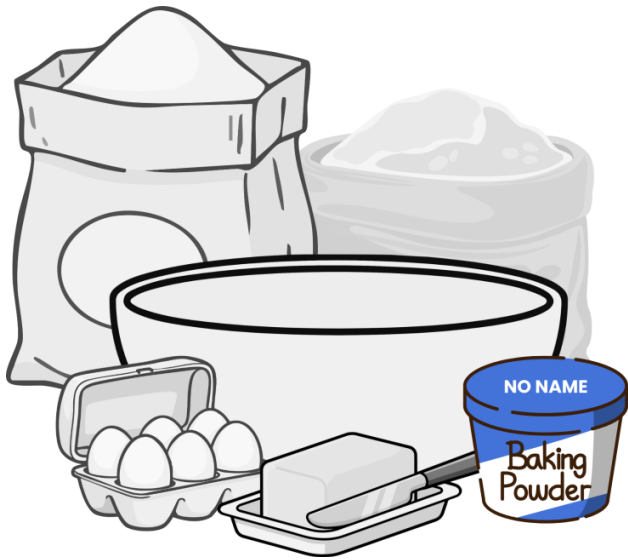


setup 3



THE CONTROL SETUP

experimental setups ① & ②



control setup ③



THE CONTROL SETUP

experimental setups 1 & 2



control setup 3



The control setup will have **all the same ingredients**, but **NO** baking powder.





TEST YOUR UNDERSTANDING



THE
ANSWER
SERIES *Your Key to Exam Success*

WHAT IS HAPPENING HERE?

AIM: To determine the optimum amount of baking powder for cupcakes to rise.

Write a hypothesis for this investigation.



5 ml baking powder

10 ml baking powder

15 ml baking powder

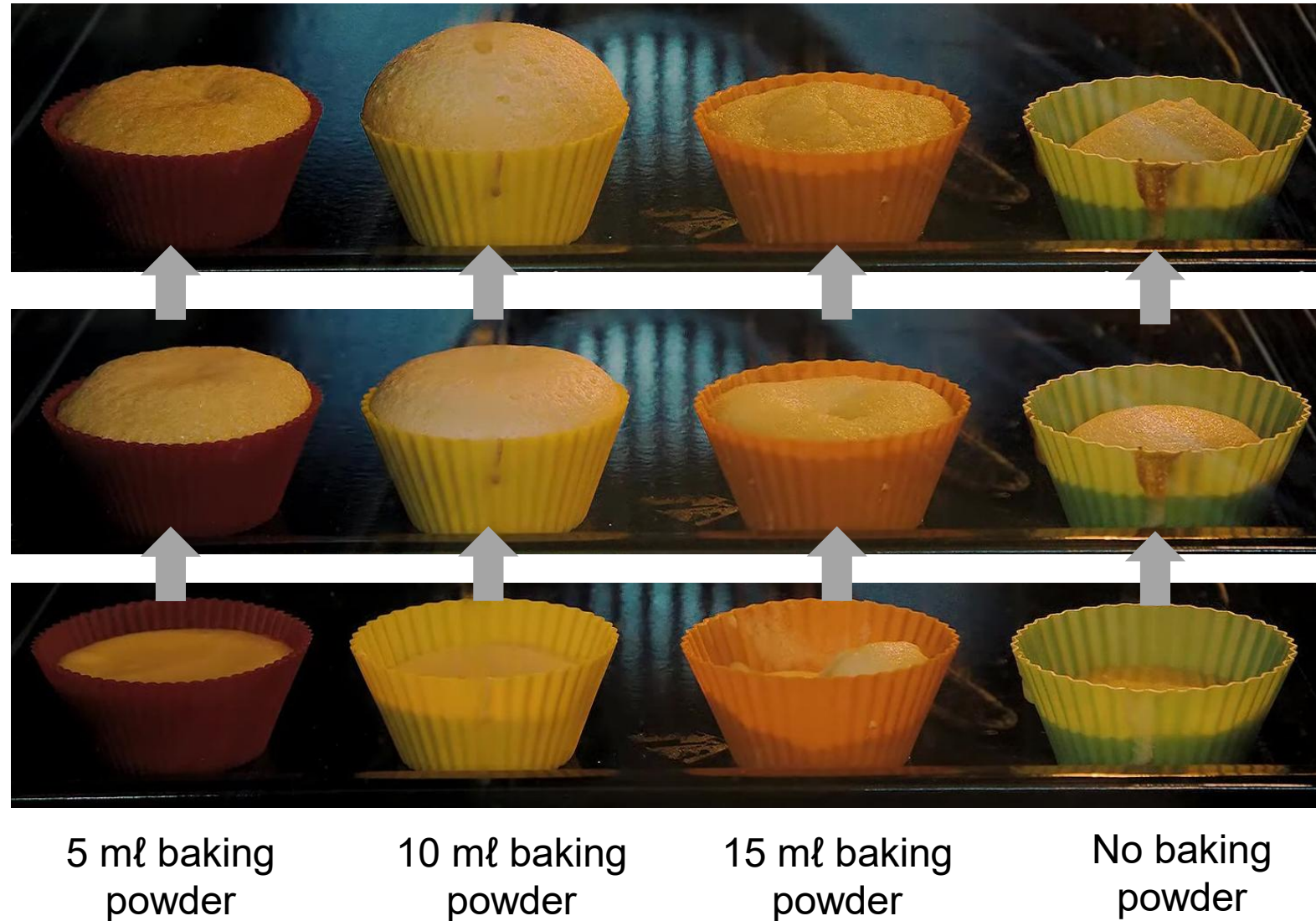
No baking powder

Over time in the oven

WHAT IS HAPPENING HERE?

AIM: To determine the optimum amount of baking powder for cupcakes to rise.

- 5ml / 10ml / 15 ml baking powder is the optimum amount for cupcakes to rise. OR
- A higher amount of (more) baking powder is more optimal for cupcakes to rise. OR
- A lower amount of (less) baking powder is more optimal for cupcakes to rise.



Over time in the oven

WHAT IS HAPPENING HERE?

Where is the control setup?



5 ml baking powder

10 ml baking powder

15 ml baking powder

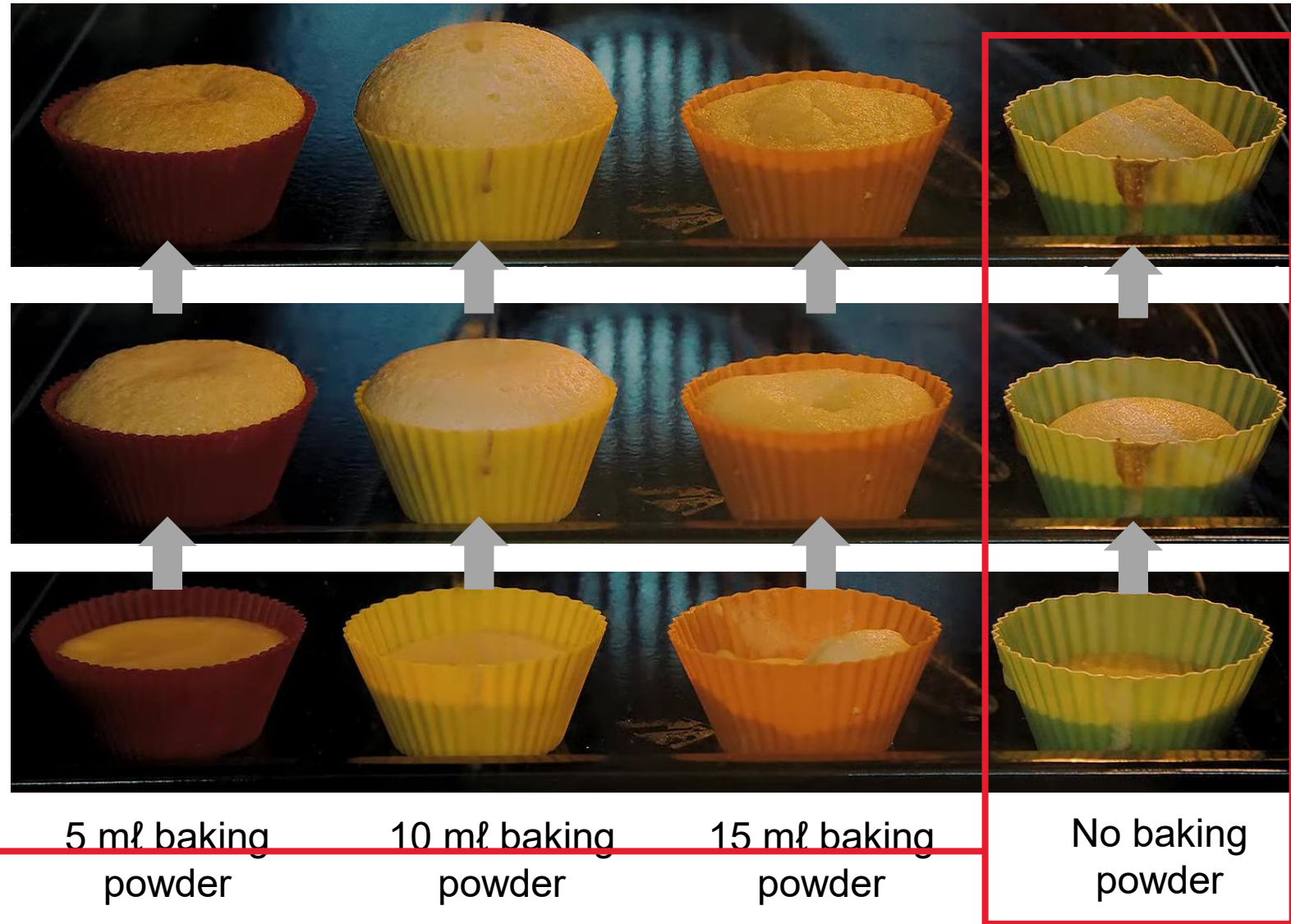
No baking powder

Over time in the oven

WHAT IS HAPPENING HERE?

Where is the control setup?

Control setup



5 ml baking powder

10 ml baking powder

15 ml baking powder

No baking powder

WHAT IS HAPPENING HERE?

AIM: To determine the optimum amount of baking powder for cupcakes to rise.

State a conclusion for this investigation.



5 ml baking powder

10 ml baking powder

15 ml baking powder

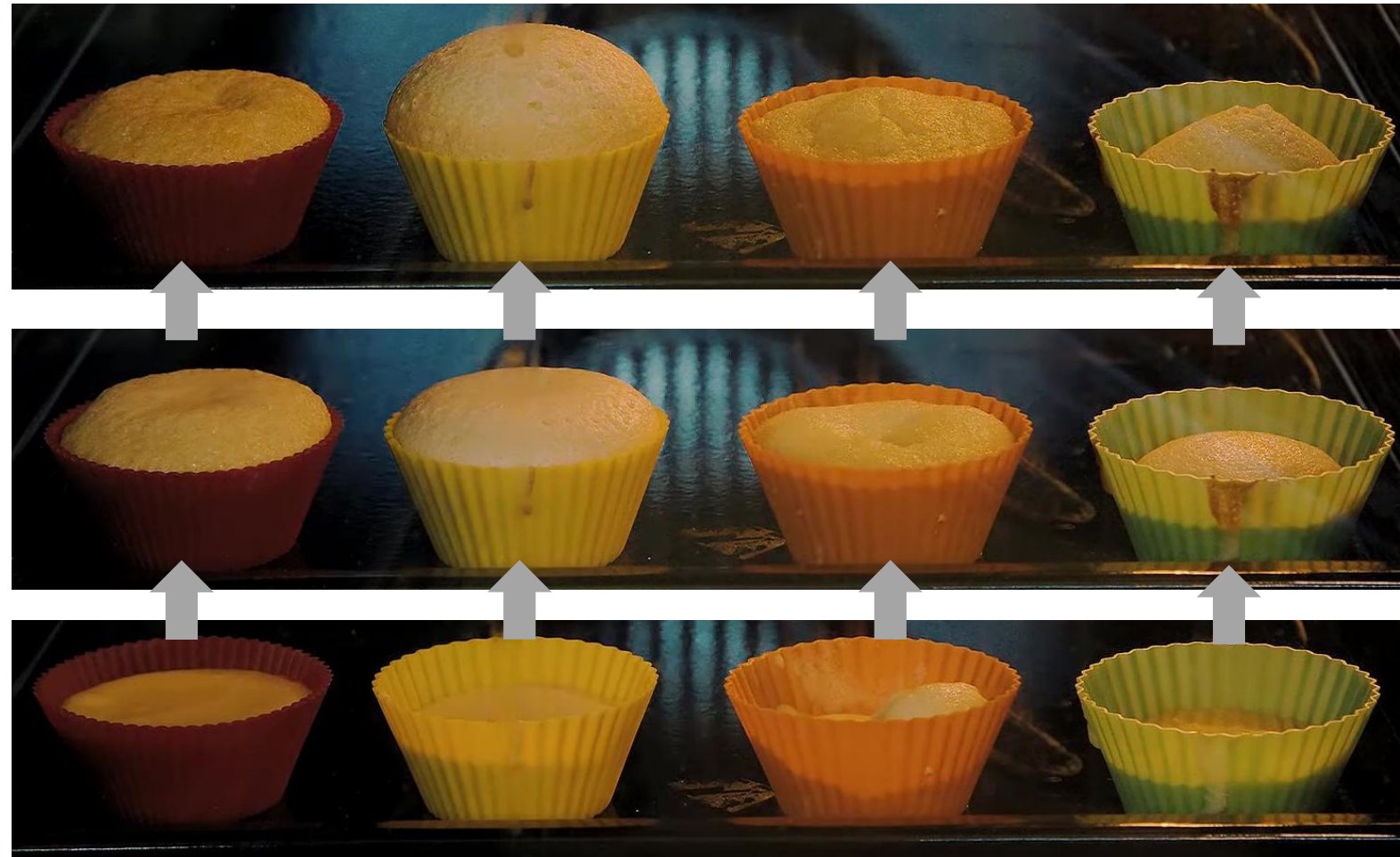
No baking powder

WHAT IS HAPPENING HERE?

AIM: To determine the optimum amount of baking powder for cupcakes to rise.

State a conclusion for this investigation.

10 ml baking powder is the optimum amount of baking powder because it caused the cupcakes to rise the highest.



5 ml baking powder

10 ml baking powder

15 ml baking powder

No baking powder

Over time in the oven

WHAT IS HAPPENING HERE?

AIM: To determine which type of liquid will cause the most plant growth.

Based on this AIM, state the...

Independent variable

Dependent variable

EXPERIMENTAL SETUP



WHAT IS HAPPENING HERE?

AIM: To determine
which type of
liquid will cause
the most plant
growth.

Based on this AIM,
state the...

type of liquid

Dependent variable

EXPERIMENTAL SETUP



WHAT IS HAPPENING HERE?

AIM: To determine
which type of
liquid will cause
the most plant
growth.

Based on this AIM,
state the...

type of liquid

plant growth

EXPERIMENTAL SETUP



WHAT IS HAPPENING HERE?

AIM: To determine
which type of
liquid will cause
the most plant
growth.

How is the
dependent variable
measured?

EXPERIMENTAL SETUP



WHAT IS HAPPENING HERE?

AIM: To determine which type of liquid will cause the most plant growth.

By determining the height (in cm) that each plant grows.

EXPERIMENTAL SETUP



WHAT IS HAPPENING HERE?

AIM: To determine which type of liquid will cause the most plant growth.

Write a suitable hypothesis for this investigation.

EXPERIMENTAL SETUP



WHAT IS HAPPENING HERE?

AIM: To determine
which type of
liquid will cause
the most plant
growth.

- The most plant growth will be caused by soda/juice/water.
- OR
- The type of liquid will affect the plant growth.

EXPERIMENTAL SETUP



WHAT IS HAPPENING HERE?

Where is the control setup?

EXPERIMENTAL SETUP

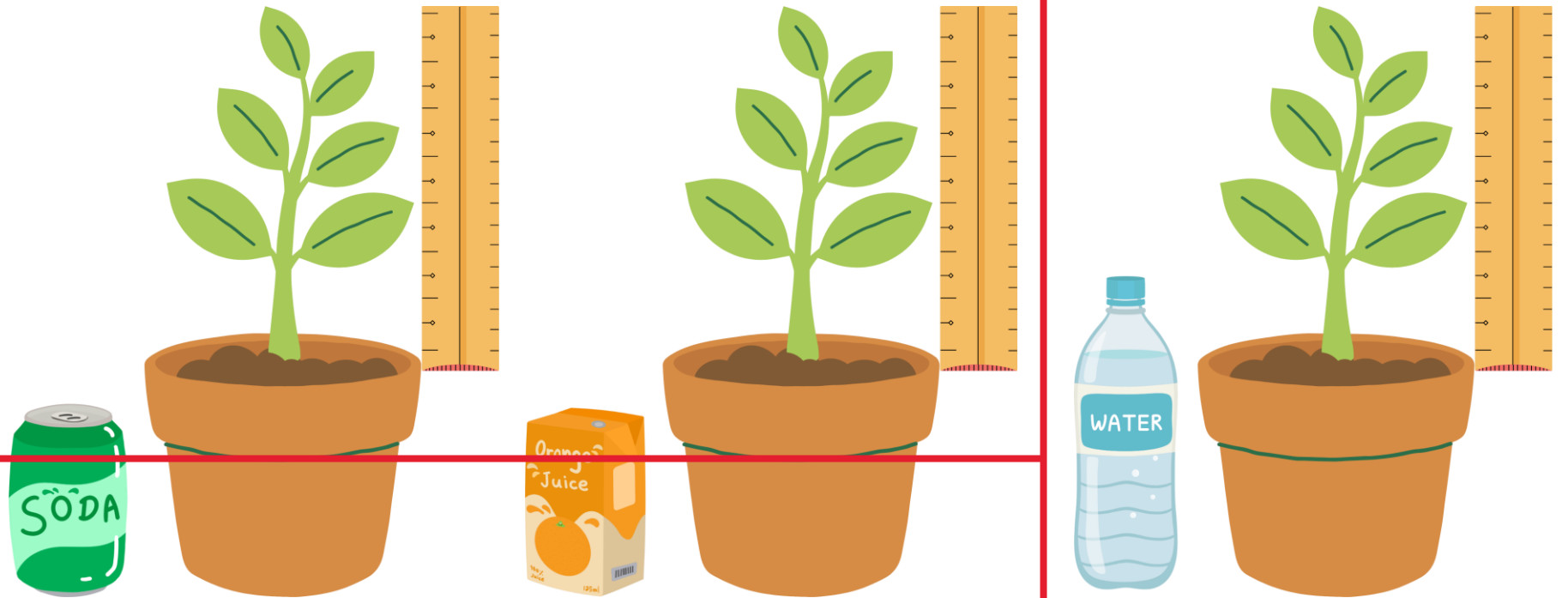


WHAT IS HAPPENING HERE?

EXPERIMENTAL SETUP

Where is the control setup?

Control setup



WHAT IS HAPPENING HERE?

AIM: To determine
which type of
liquid will cause
the most plant
growth.

Write a conclusion
for this
investigation.

EXPERIMENTAL SETUP

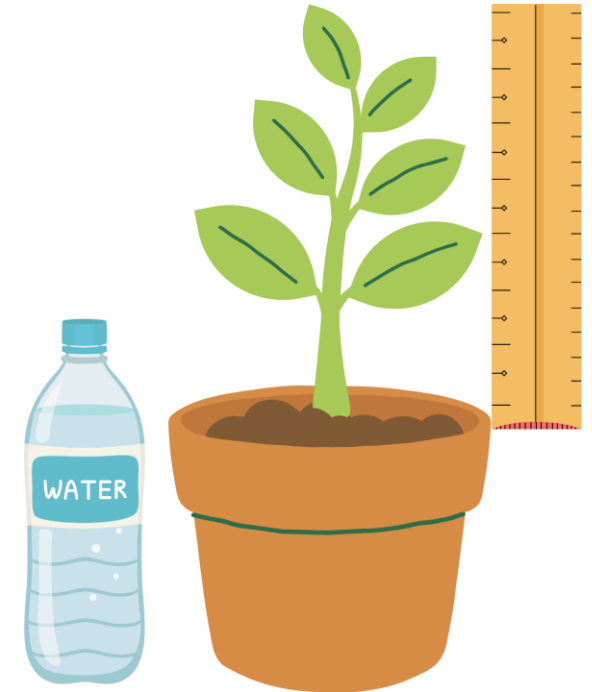
+ 5 cm in 1 week



+ 7 cm in 1 week



+ 12 cm in 1 week



WHAT IS HAPPENING HERE?

AIM: To determine which type of liquid will cause the most plant growth.

Water caused the most plant growth.

EXPERIMENTAL SETUP

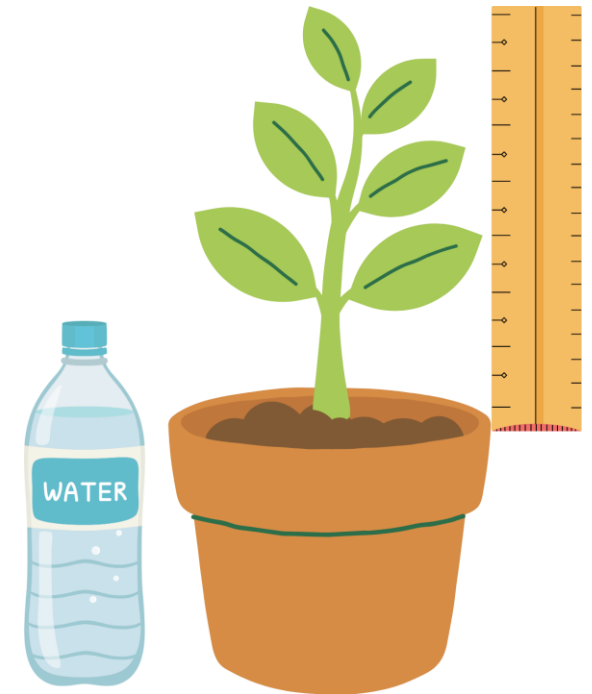
+ 5 cm in 1 week



+ 7 cm in 1 week



+ 12 cm in 1 week



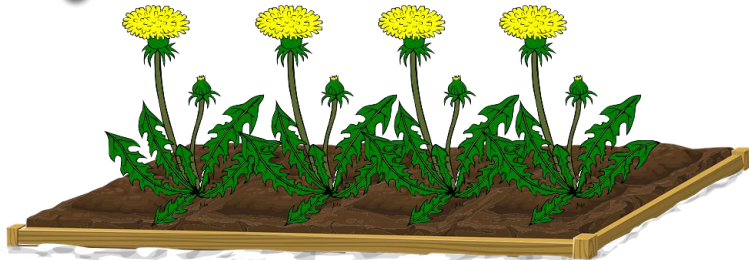
WHAT IS HAPPENING HERE?

QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

PROCEDURE / SETUP



15% solution



Field A



30% solution



Field B

no weed killer



Field C

WHAT IS HAPPENING HERE?

QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

RESULTS



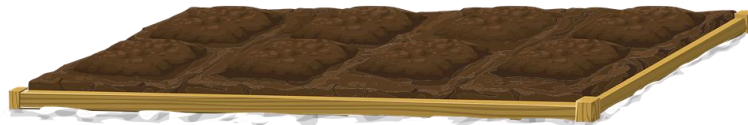
50% weeds
killed



Field A

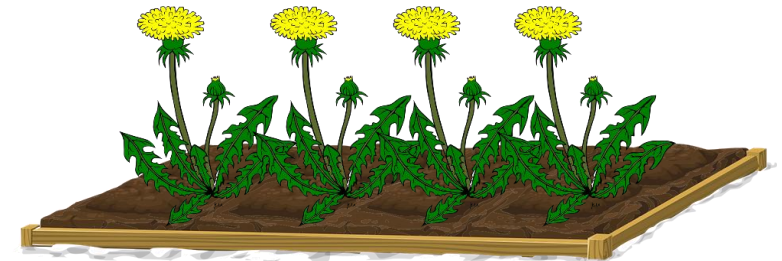


100% weeds
killed



Field B

0% weeds
killed



Field C

WHAT IS HAPPENING HERE?

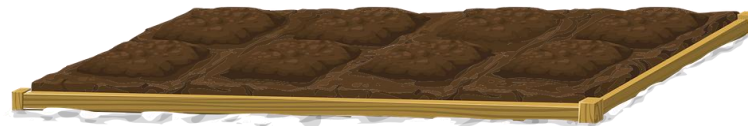
QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

RESULTS



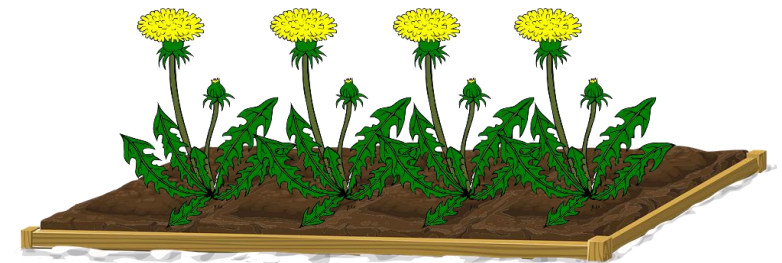
Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

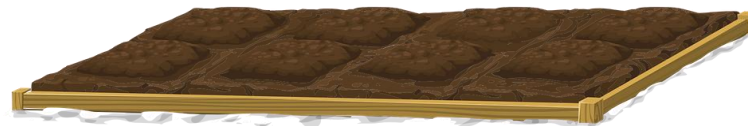
QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

What is the aim of this investigation?



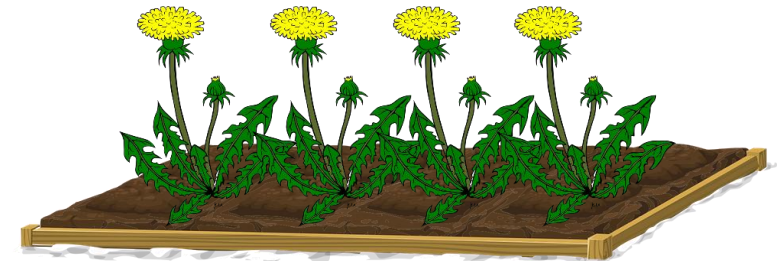
Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

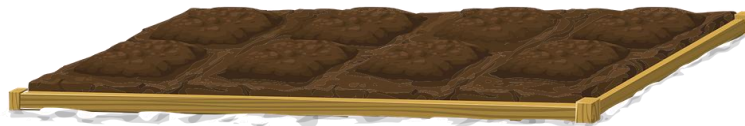
What is the aim of this investigation?

To determine what concentration of weed killer will kill the greatest percentage (%) of weeds.



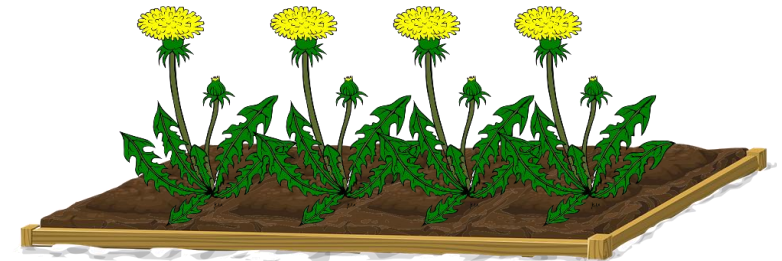
Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

What is the aim of this investigation?

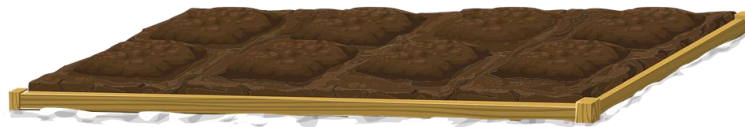
What is a suitable hypothesis for this investigation?

To determine what concentration of weed killer will kill the greatest percentage (%) of weeds.



Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

What is the aim of this investigation?

To determine what concentration of weed killer will kill the greatest percentage (%) of weeds.

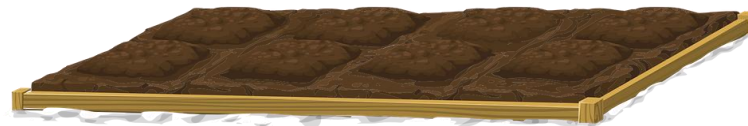
What is a suitable hypothesis for this investigation?

A higher **concentration of weed killer** will **kill more weeds**.



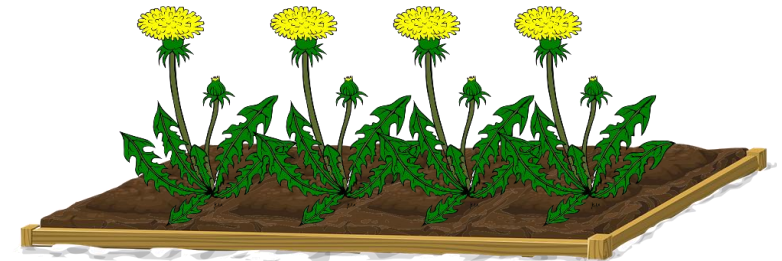
Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

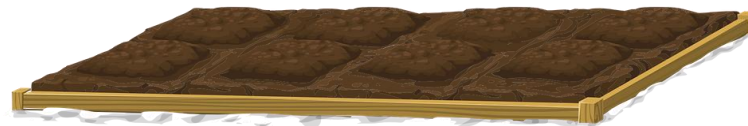
QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

What is the independent variable?



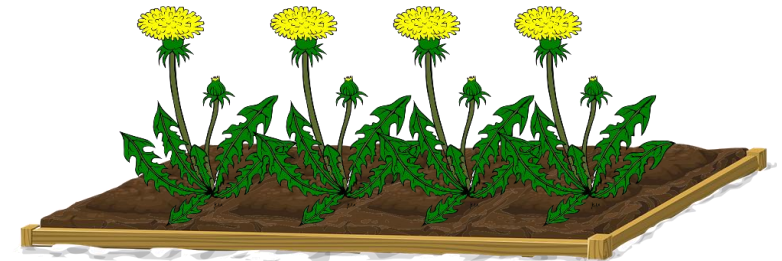
Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

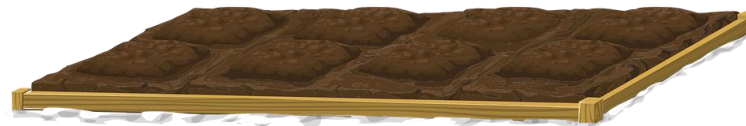
What is the independent variable?

The **concentration** of the **weed killer**.



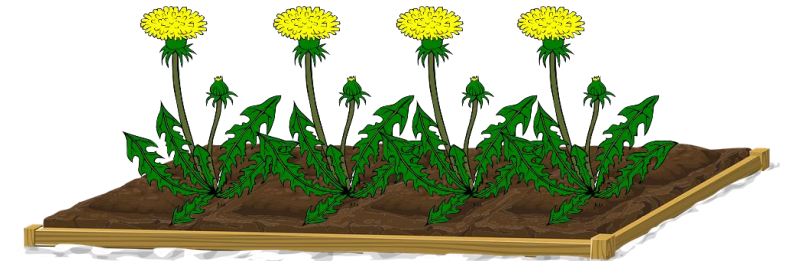
Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

What is the independent variable?

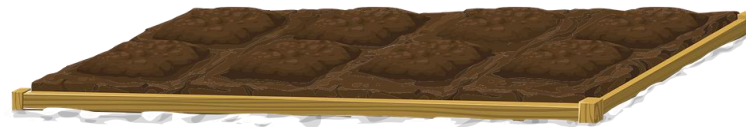
The **concentration** of the **weed killer**.

What is the dependent variable?



Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

What is the independent variable?

The **concentration** of the **weed killer**.

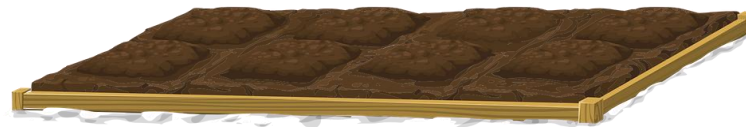
What is the dependent variable?

The **percentage** of **weeds killed**.



Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

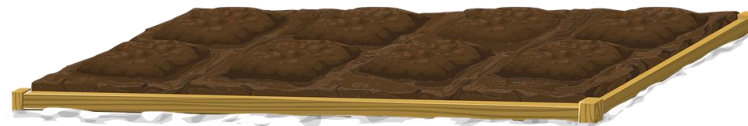
QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

Which field is the control setup?



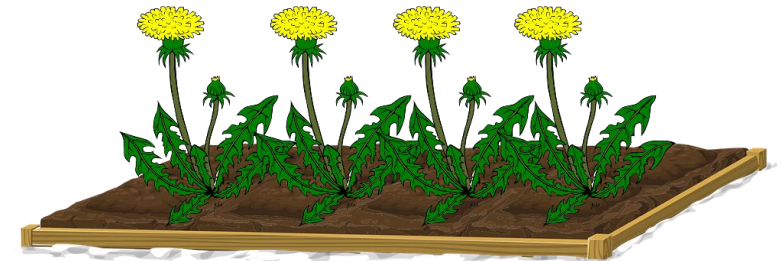
Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

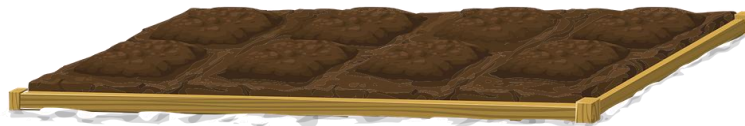
Which field is the control setup?

Field C with no weed killer



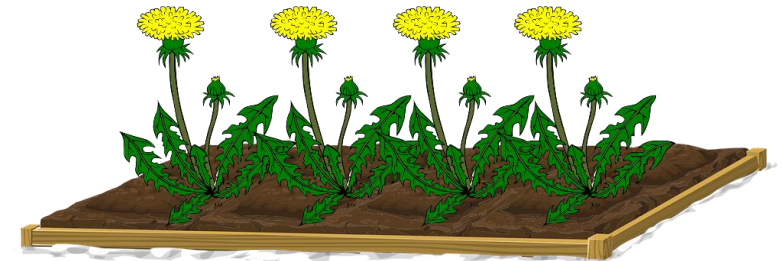
Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

Which field is the control setup?

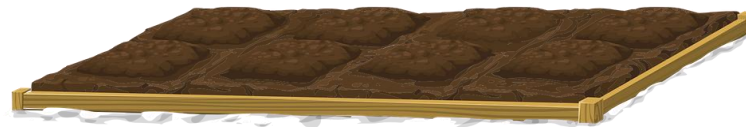
Field C with no weed killer

How can the reliability be increased?



Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

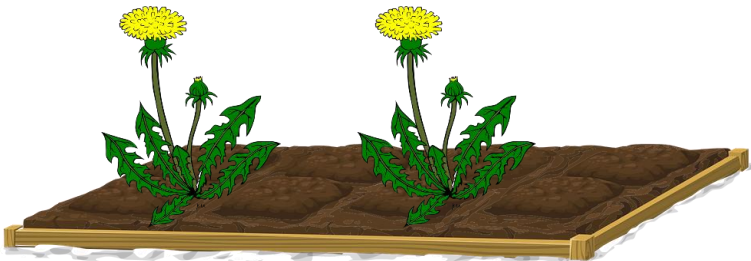
QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

Which field is the control setup?

Field C with no weed killer

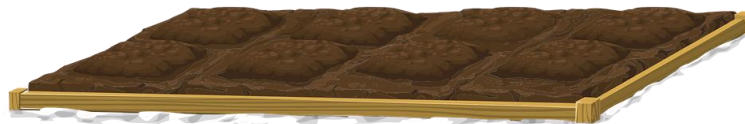
How can the reliability be increased?

Repeat the investigation or
Raise the sample size (use more fields)



Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

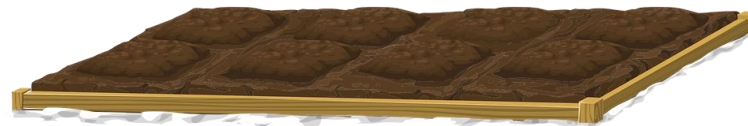
QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

How can the validity be ensured?



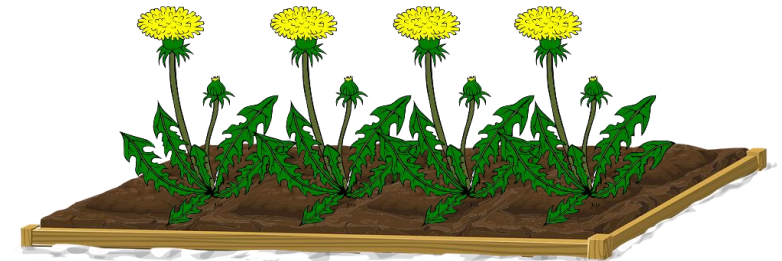
Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

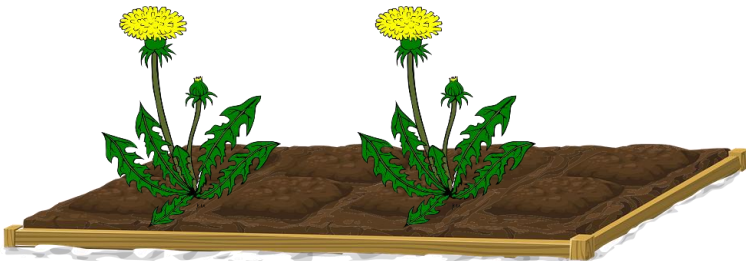
no weed killer – 0% weeds killed

WHAT IS HAPPENING HERE?

QUESTION: What concentration of weed killer will kill the greatest percentage (%) of weeds?

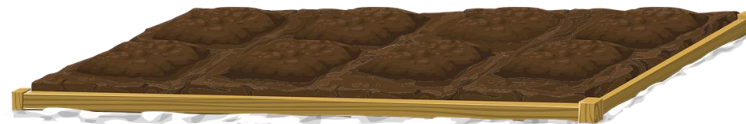
How can the validity be ensured?

Use the same type of weed killer
Over the same time frame
Same type of soil/same area
Same volume of weed killer applied
Same type of weeds, etc.



Field A

15% solution – 50% weeds killed



Field B

30% solution – 100% weeds killed



Field C

no weed killer – 0% weeds killed

END