How does gravity pull things down to Earth?

By Monica Grady, The Conversation on 01.16.20
Word Count **743**
Level **MAX**

Image 1. Everything in the universe has its own gravitational pull. When you throw an apple into the air, the Earth's gravity pulls it back down. But that's not the only thing that's happening: The gravity of the apple is also pulling on the Earth. Image by: Westend61/Getty Images

Gravity is a force, which means that it pulls on things. But the Earth isn't the only thing which has gravity. In fact, everything in the universe, big or little, has its own pull because of gravity – even you.

Isaac Newton was one of the first scientists to figure out the rules of how gravity behaves. The story goes, he was sitting under an apple tree when one of the fruits fell off. As he saw the apple fall down to the ground, he started to wonder why it didn't go up to the sky instead.

After lots of experiments, and some very clever thinking, he worked out that the force of gravity depends on how heavy objects are, and that the pull of gravity between objects gets smaller the farther apart they are. To see how gravity works in our universe, we're going to take a journey, with a few stops along the way.

First off, we'll go to the park and play a game of football. When you kick the football into the air, the Earth's gravity pulls it back down. But that's not the only thing that's happening: The gravity of the football is also pulling on the Earth. The thing is, the Earth is very heavy – much heavier than

the football – so it's unaffected by the pull of the football, while the football itself is pulled back down to Earth.

Our next stop is the moon, and as we journey up into space, there's a good chance you'll see the sun. Now, the sun is much, much bigger than the Earth, which means its pull is very powerful indeed.

You might be wondering why the Earth (and all the other planets) don't just fall into the sun, the same way the football falls to Earth. The answer is that the planets are all moving, and the balance between the force of gravity and the speed of their movement (which comes from when they were first made, about 4.5 billion years ago) keeps them circling round the sun.

When we arrive on the moon, you'll see that the pull of gravity is not the same everywhere. It is related to how heavy – or how massive – an object is. If you jump on the moon, you'll be able to go much higher than you can on Earth. This is because the Earth is bigger than the moon, so the force between you and the Earth – which is what we call weight – is bigger than the force between you and the moon. On the moon, you seem to weigh less than on Earth, so you can jump higher.

Our final stop is the seaside. Sitting on the beach, you can see the sea gradually getting closer and closer to you – this is the tide coming in. After some time, the sea seems to get farther away – now, the tide is going out. But the sea is not actually moving in and out – it is moving up and down. As the sea level rises, the water gets closer to you, because the beach you are sitting on slopes upwards away from the sea. And as the sea level drops down, the water gets farther away from you.

This is also an effect of gravity, and it happens because the moon is close to the Earth. Unlike the football, the moon is heavy enough to have an effect – just a little one, because the Earth is still much heavier – but it's enough for us to notice when we watch the tides. As the water level rises, it is being pulled toward the moon, and the tide comes in. Then the tide goes out, and the water level drops, as the moon rotates around the Earth.

An interesting question is why we don't have enormous tides caused by the sun pulling on the Earth. We know that the sun is much bigger than the moon – so surely it ought to be able to pull water toward it? Actually, it does – but much less than the moon. This is because although the sun is much bigger than the moon, it is much, much farther away – and the pull of gravity gets weaker the bigger the distance between objects.

So, next time you're kicking a football around in the park, you'll know how gravity is bringing the football back down to Earth.

Quiz

1 Which statement BEST compares the force of gravity on a school bus on a school day and a weekend?

(A) The force would be lower on the school day than the weekend.

(B) The force would be higher on the school day than the weekend.

(C) The force would be different on the school day than the weekend.

(D) The force would stay the same on the school day and the weekend.

2 Which piece of evidence explains the cause of ocean tides?

(A) The planet's movement balances out the sun's gravity.

(B) The sun's gravity is strong enough to move the ocean water.

(C) The gravity from the moon pulls ocean water towards it.

(D) The Earth's gravity pulls the ocean back toward its surface.

3 When does a football hurled across a field have the lowest gravity force?

(A) when it has just left the quarterback's hand

(B) when it is traveling up the arc of its path

(C) when it is at its highest point on its path

(D) when it is on its way down the arc

4 Read the following paragraph from the article.

> *First off, we'll go to the park and play a game of football. When you kick the football into the air, the Earth's gravity pulls it back down. But that's not the only thing that's happening: The gravity of the football is also pulling on the Earth. The thing is, the Earth is very heavy – much heavier than the football – so it's unaffected by the pull of the football, while the football itself is pulled back down to Earth.*

What conclusion is BEST supported by the paragraph above?

(A) The force of gravity is relative to an object's mass.

(B) The force of gravity gets weaker as objects move apart.

(C) The pull of an object's gravity increases in the air.

(D) The Earth has the strongest known gravitational pull.

5 Why can a person jump higher on the moon?

(A) The moon is faster than Earth.

(B) The moon is slower than Earth.

(C) The moon is larger than Earth.

(D) The moon is smaller than Earth.

6 Read the following paragraph from the article.

After lots of experiments, and some very clever thinking, he worked out that the force of gravity depends on how heavy objects are, and that the pull of gravity between objects gets smaller the farther apart they are. To see how gravity works in our universe, we're going to take a journey, with a few stops along the way.

Which answer choice is the BEST definition of the phrase "depends on" as used in the paragraph?

(A) is determined by

(B) is undecided about

(C) places trust in

(D) hangs down from

7 Why do the ocean tides ebb and flow on a regular cycle?

(A) The sun's gravitational pull changes with its rotation around Earth.

(B) The sun's gravitational pull changes with Earth's rotation around it.

(C) The moon's gravitational pull changes with its rotation around Earth.

(D) The moon's gravitational pull changes with Earth's rotation around it.

8 Read the following selection from the article.

Our final stop is the seaside. Sitting on the beach, you can see the sea gradually getting closer and closer to you – this is the tide coming in. After some time, the sea seems to get farther away – now, the tide is going out. But the sea is not actually moving in and out – it is moving up and down.

Which two words would BEST replace “gradually” and “actually” in the selection above?

(A) exactly; absolutely

(B) slowly; really

(C) finally; easily

(D) quickly; precisely

Answer Key

1 Which statement BEST compares the force of gravity on a school bus on a school day and a weekend?

(A) The force would be lower on the school day than the weekend.

(B) The force would be higher on the school day than the weekend.

(C) The force would be different on the school day than the weekend.

(D) The force would stay the same on the school day and the weekend.

2 Which piece of evidence explains the cause of ocean tides?

(A) The planet's movement balances out the sun's gravity.

(B) The sun's gravity is strong enough to move the ocean water.

(C) The gravity from the moon pulls ocean water towards it.

(D) The Earth's gravity pulls the ocean back toward its surface.

3 When does a football hurled across a field have the lowest gravity force?

(A) when it has just left the quarterback's hand

(B) when it is traveling up the arc of its path

(C) when it is at its highest point on its path

(D) when it is on its way down the arc

4 Read the following paragraph from the article.

> *First off, we'll go to the park and play a game of football. When you kick the football into the air, the Earth's gravity pulls it back down. But that's not the only thing that's happening: The gravity of the football is also pulling on the Earth. The thing is, the Earth is very heavy – much heavier than the football – so it's unaffected by the pull of the football, while the football itself is pulled back down to Earth.*

What conclusion is BEST supported by the paragraph above?

(A) The force of gravity is relative to an object's mass.

(B) The force of gravity gets weaker as objects move apart.

(C) The pull of an object's gravity increases in the air.

(D) The Earth has the strongest known gravitational pull.

5 Why can a person jump higher on the moon?

(A) The moon is faster than Earth.

(B) The moon is slower than Earth.

(C) The moon is larger than Earth.

(D) The moon is smaller than Earth.

6 Read the following paragraph from the article.

After lots of experiments, and some very clever thinking, he worked out that the force of gravity depends on how heavy objects are, and that the pull of gravity between objects gets smaller the farther apart they are. To see how gravity works in our universe, we're going to take a journey, with a few stops along the way.

Which answer choice is the BEST definition of the phrase "depends on" as used in the paragraph?

(A) is determined by

(B) is undecided about

(C) places trust in

(D) hangs down from

7 Why do the ocean tides ebb and flow on a regular cycle?

(A) The sun's gravitational pull changes with its rotation around Earth.

(B) The sun's gravitational pull changes with Earth's rotation around it.

(C) The moon's gravitational pull changes with its rotation around Earth.

(D) The moon's gravitational pull changes with Earth's rotation around it.

8 Read the following selection from the article.

Our final stop is the seaside. Sitting on the beach, you can see the sea gradually getting closer and closer to you – this is the tide coming in. After some time, the sea seems to get farther away – now, the tide is going out. But the sea is not actually moving in and out – it is moving up and down.

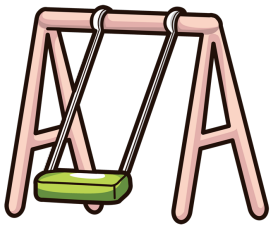
Which two words would BEST replace “gradually” and “actually” in the selection above?

(A) exactly; absolutely

(B) slowly; really

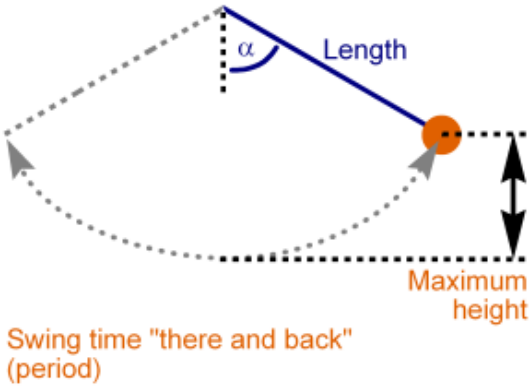
(C) finally; easily

(D) quickly; precisely



Gravity makes it Swing!

Did you know that playground swings provide a lesson in physics? A swing's motion is an example of a pendulum. A pendulum is an object hung from a fixed point. It swings back and forth under the action of gravity. Gravity is a pulling force that works across space. That is, objects do not have to touch for the force of gravity to affect them. Pendulums can do more than provide fun at recess. They can show that the Earth is huge! This is because a pendulum's motion is due to the force of gravity created by the Earth's size. A swing is supported by chains attached to the top of the swing set. When the swing is raised and released, it moves freely back and forth. It continues moving until friction slows and stops it. Friction is a push or a pull. It pulls on things moving past each other, such as the air and the swing. The time it takes a pendulum to return to its original position is called its period.



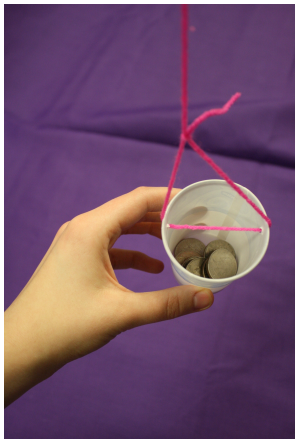
So the period is the time it takes from your release point (like when you hold it up to let it go) and when it gets back to the release point. It is basically the number of swings. Let's find out if changing the length of the string has any effect on how many swings or periods per minute. In other words, "Will the length of the string change how many times a pendulum will swing in one minute?"

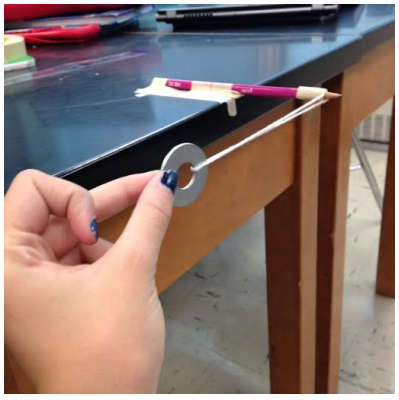
M. Palopoli – adapted and edited from Newsela, 2020

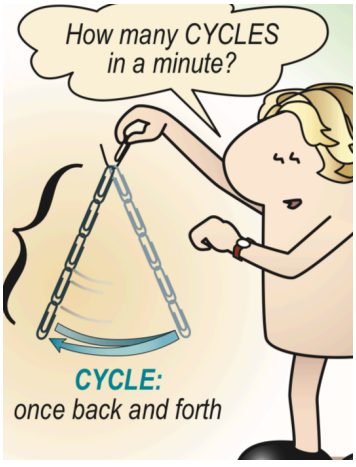
How to make a pendulum

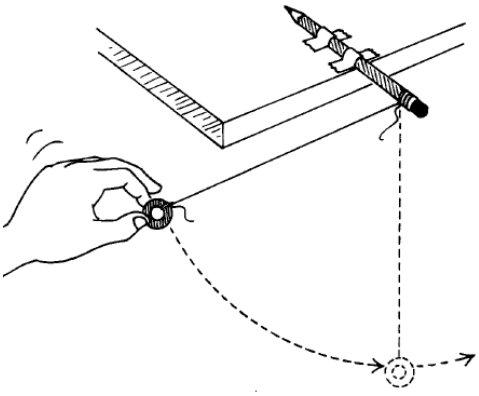
Basically, a pendulum is an object that hangs from a fixed point. That means you just need a piece of string, ribbon or yarn and some weight attached to the end. When you start the pendulum lab experiment, you need to make sure that your pendulum won't hit anything to slow it down once it is released. A piece of string hanging from a table with weights on the end will do just fine. You could also use a necklace or a yo-yo!

Here are some examples:









Pendulum Data

Number of Swings				
Test 1	Test 2	Test 3	Test 4	Average

Pendulum Experiment

Question: How will the length of string affect the number of swings of a pendulum?

A variable *is anything that can be changed in an experiment.*

- Independent variable: (what you are testing) **LENGTH OF STRING**
- Dependent variable: (what you measure) **NUMBER OF SWINGS**
- Constant variables: (what you keep the same)

  EXAMPLES:
  - **How it is released – Same release point and gentle letting go**
  - **The weights on the pendulum, How long you let it swing**
  - **Movement of air in the room - Person releasing the pendulum**

Procedure:

1. Set up your pendulum from the edge of a table and make sure when it is released, it won't hit anything.

2. Keep all of the constant variables the same. See above. You are ONLY testing the length of the string.

3. For each test, measure the length of the pendulum from the edge of the table to the weight of the pendulum. So if you are doing the 20 centimeter tests, the distance from the top of your string to the weight on the pendulum should be 20 cm.

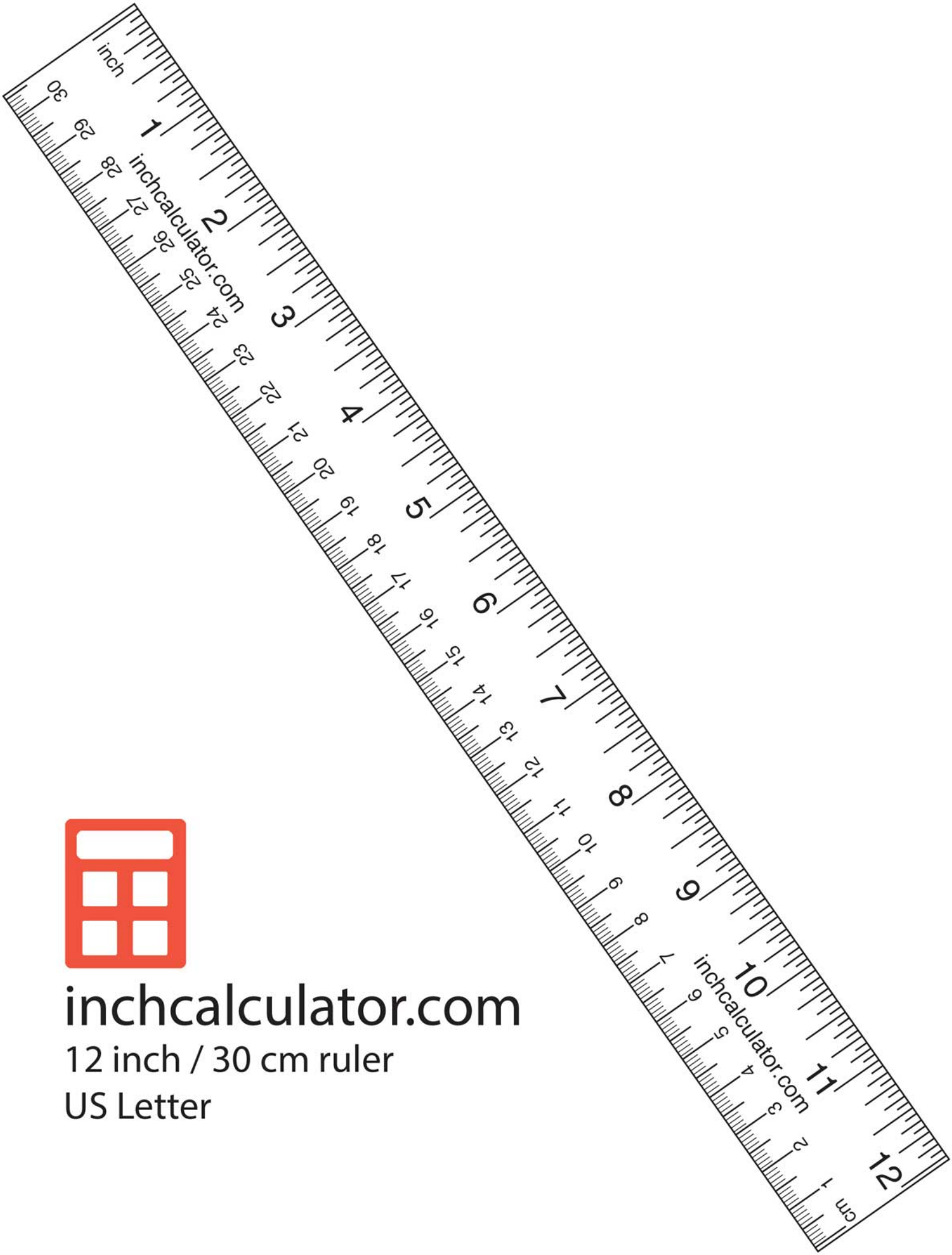
4. **For each test, count the number of swings for 1 minute and record the number on the table.**

Length of String	Trial 1 (# of Swings in 1 min)	Trial 2 (# of Swings in 1 min)	Trial 3 (# of Swings in 1 min)	Average*
20 centimeter				
15 centimeters				
10 centimeters				

*To get an average, add the three numbers and divide by three.

How did the length of the string affect the number of swings per minute?

What may happen if the string was 30 cm?



inchcalculator.com

12 inch / 30 cm ruler

US Letter

Name _____ # ____

Spelling Contracts

This is your spelling contract for the week. The best method for success would be to finish one activity per night. Please list the activities you have finished (at the end of the document).

Here is how your spelling will be graded:

50+ points = Exceeds expectations
40 - 50points = Meets expectations
21 to 40 points = Partially meets expectations
0 to 20 points = Does not meet expectations
Less than 20 = Does not meet expectations

WORTH 5 POINTS	Write your words using one color for vowels and another color for consonants.	Take a pre-test given to you by a parent or classmate signature.
Make two fractions from each word (Vowels/total # of letters in word and consonants/total # of letters in word.	Ladder words - write each word as show below. L La Lad Lady	Write each word neatly.

WORTH 10 POINTS	Write the words in reverse ABC order.	Write your words 3 times in 3 different colors.
Write each spelling word and the numbers you would press to text it to a friend.	Classify words according to part of speech (adjectives, nouns, adverbs, etc.)	Type your spelling words 4 times using a different font for each set.
Write at least 10 of the spelling words four times each.	Divide each word into syllables. Check the dictionary for help.	Write an antonym for ten words.
Write a synonym for ten words.	Write a really cool paragraph using 10 of your spelling words.	Make a set of flashcards for studying (for all the words.)
Design a pretty bookmark on thick paper. Write your list on the bookmark.	Make 7 of your words out of confetti.	Write a paragraph or two using your words that were cut out of a magazine.

WORTH 15 POINTS	Write a poem using at least 8 of your spelling words. Underline words.	Create a wordsearch for your words.

WORTH 15 POINTS

Write newspaper headlines using all of your spelling words.	Make up at least 10 Jeopardy questions using your spelling words.	Make a painting or poster showing all of your words in a creative way.
Cut letters out of magazines and newspapers to spell your words. Find the words in other places (Internet, magazine, book, etc.) and cut out the word or copy the sentence - and tell the source!	Make an acrostic with your words. Write each word up and down on your paper, one letter to a line. Find words that begin with each letter.	Write your words in shapes. Put all the shapes together to make a picture. Use at least 7 words to write one paragraph to summarize a book you've read.
Craft your words. Make 5 of your words come to life in 3 dimensions.	Make a picture out of all your spelling words.	

WORTH 20 POINTS	Create a game that can be used to practice your spelling/vocabulary words.	Make a crossword puzzle and give the answers - using all the words.
Look up the words in a dictionary and write their meanings. Write a song from your spelling words - that makes sense!	Draw a picture that represents each of your spelling words.	Choose ten words. For each word, draw a circle and divide it into fourths. In the sections, write the spelling word, its definition, its part of speech and a sketch to show the meaning.
Cut the words out of magazines/ newspapers and make a collage.	Cut out a picture from a magazine or newspaper and use 15 of your spelling words to write a story.	Write the alphabet on a piece of paper. Under A, write $1.00, under B write $2.00 and so on. Figure up the dollar amount of each of your spelling words.
Letter: Write a letter to someone using your spelling words. Underline all spelling words and the letter must make sense and include the words. naturally.	Write your letters in glue on heavy paper. Sprinkle jello, sparklies, bits of paper or other tiny items over the words.	Use some kind of clay source to create all of your words. Take a picture of them and bring it to school instead of bringing in all the clay.

Group A and B Words

1.astronomy

2.galaxy

3.universe

4.rocket

5.Mars

6.Earth

7.planet

8.constellation

9.comet

10.Pluto

11.lunar

12.orbit

13.axis

14.Saturn

15.satellite