

Have you ever wondered why you don't bounce when you step gently onto a trampoline? Many people assume that trampolines are extremely bouncy due to the material being **innately** elastic and that this is what allows people to jump so high on them. This is, however, not the case. Most of the work is in fact done by the springs holding the material very tightly and a mixture of various elements of physics including: gravity, Newton's three laws of motion and Hooke's Law. To see the magic behind how trampolines work, we will look below at each of these **principles** and how they come together when bouncing on a trampoline.

Gravity

Gravity is a force which attracts all objects towards each other; the larger the mass of an object, the larger the force of gravity is. Its **existence** was **conceived** around 300 years ago by sir Isaac Newton as he witnessed an apple falling out of a tree and pondered over why it fell towards the ground. Scientists and Newton's **colleagues** have been **captivated** by this **occurrence** ever since and a vast amount of research has been **conducted** to uncover how gravity works. Put simply, the reason the apple fell towards the ground relates to the mass of the object. Small objects like the apple, people or even things we might consider to be big like buildings are too small for anyone to really feel the effects of their gravitational pull. The Earth, however, is large enough to feel the effects of gravity. We see this in the same way Isaac Newton seen the apple fall from the tree: small objects fall **towards** the ground. This is our first part of the puzzle behind trampolines: when you jump up into the air, gravity pulls you back down towards Earth.

Newton's Three Laws of Motion

Newton's Three Laws of Motion are very simple ideas about physics which are central to how trampolines work. The first law, called the law of **inertia**, states that an object at rest will stay at rest and an object in motion will stay in motion unless acted upon by an external force. This explains why you don't get sprung upwards by gently stepping onto a trampoline (you are an object at rest) and why you don't get flung into outer space by bouncing on a trampoline (the external force of gravity acts as a **hindrance** on you to pull you back down to Earth).

The second law, called the law of **acceleration**, states that the acceleration of an object depends upon its mass and the amount of force acting upon it. Very simply, this means that larger and heavier objects require more force to move. This is why adults spend more energy jumping on a trampoline than a child and require a larger amount of gravitational force acting upon them to bring them back down when they jump.

Newton's third law is the highly **infamous** statement "For every action, there is an equal and opposite reaction." This helps to explain where the 'bounce' comes from when using a trampoline. As your feet fall down onto the base of the trampoline they **exert** force onto the springs, which then stretch and exert an equal force pushing you back up in the opposite direction to which you fell: into the air.

Hooke's Law

Hooke's **hypothesis** relates to how springs work when force is applied to them. It states that the force needed to extend a spring is related to the length which the spring is extended or pulled. The heavier the object on the trampoline, the further the springs extend and the more force they push back with. Hooke's Law interacts with Newton's third law to create the bounce of a trampoline. As you jump and **descend**, you exert **considerable** force on the springs which causes them to extend. This causes "an equal and opposite reaction" in the springs which then pushes back with the same force that was exerted on them – causing the person to be pushed back into the air.

When was gravity first discovered, and who by?

Explain what Gravity is.

Find and copy Newton's first law of motion.

According to the text, which part of a trampoline does 'most of the work'?

What type of text is this and how do you know?

Why do you think the author chose to use subheadings?

Does the text suggest that the idea of gravity is a fact or an opinion? How can you tell?

Find and copy an example of a quote used in the text.

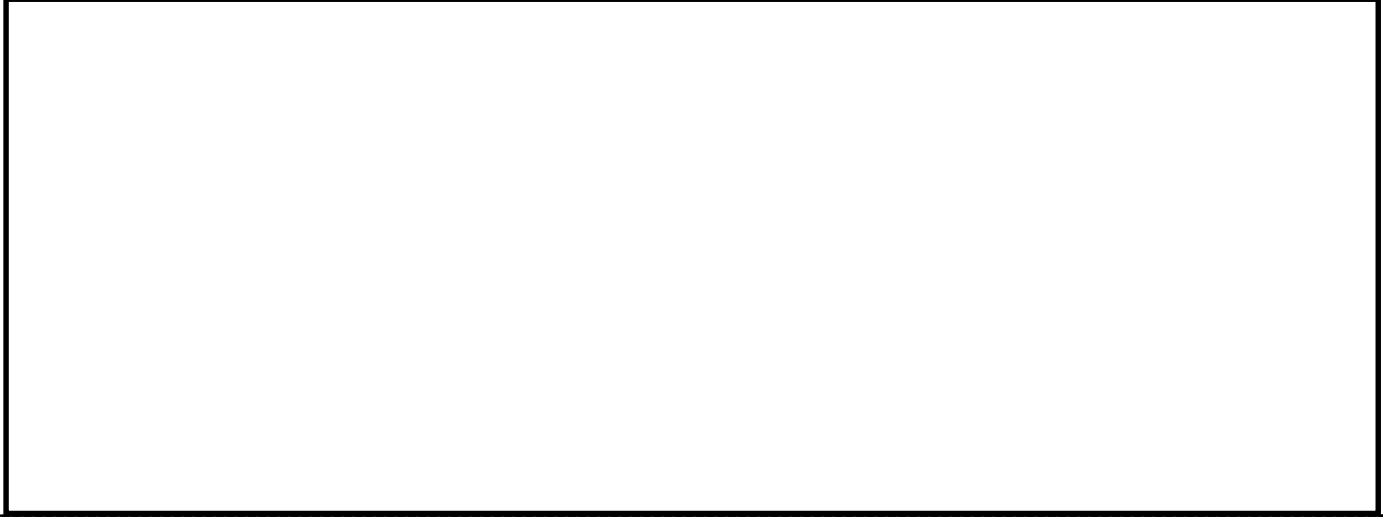
Find and copy an example of rhetoric used in the text.

Why do you think the author chose to open the text with a question?

Give a brief summary of how trampolines work using the information from the text.

Draw and label a diagram showing the processes at work when using a trampoline.

Give a brief explanation of what is happening below.



The Science Behind Trampolines – Vocab 1

Write down the meanings of these words which are highlighted in the text.

- innately _____
- principles _____
- existence _____
- conceived _____
- colleagues _____
- captivated _____
- occurrence _____
- conducted _____
- inertia _____
- hindrance _____
- acceleration _____
- infamous _____
- exert _____
- hypothesis _____
- descend _____
- considerable _____

Find the words from vocab 1 in the word search below.

r c o l l e a g u e s h
b a m k x f w y t g b n
d p k h k l f a q i p i
a t s d e s c e n d l n
z i g t y o d j q s c e
x v n w g j s h u h k r
c a r l d q w e v g f t
h t w j s w z g x k s i
o e x i s t e n c e w a
p d q g c v b f e w r y
g u h d q s a x f t f t
i n n a t e l y e i p o

inertia	captivated	innately	exert
colleagues	existence	descend	

Choose some of these words and write some complex sentences using them.

Circle the correct spellings

dominering	erratic	incandescent	onerous	permissable
sweltering	occupationel	trite	inersha	particle
gravity	scientific	emphasise	ascend	penitent

Rewrite the following words with an added prefix and suffix to make a new word. The first one has been done for you.

honest dishonestly

trust _____

accept _____

use _____

new _____

repeat _____

Which part of the sentence should be enclosed in brackets? Tick one box.

Many scientists including sir Isaac Newton study gravity, some do so by also studying the solar
_____ | _____ | _____ | _____

system.

The Science Behind Trampolines – Oral Teacher Questions

When was gravity first discovered, and who by? **Around 300 years ago by sir Isaac Newton.**

Explain what Gravity is. **A force which attracts all objects towards each other.**

Find and copy Newton's first law of motion. **The law of inertia; an object at rest will stay at rest and an object in motion will stay in motion unless acted upon by an external force.**

According to the text, which part of a trampoline does 'most of the work'? **The springs**

What type of text is this and how do you know? **A non-chronological report because it gives information/facts, organised into subheadings, present tense and uses technical vocabulary**

Why do you think the author chose to use subheadings? **To make it clear where to find certain information.**

Does the text suggest that the idea of gravity is a fact or an opinion? How can you tell? **Fact because the text refers to evidence and research to prove it exists.**

Find and copy an example of a quote used in the text. **"For every action there is an equal and opposite reaction."**

Find and copy an example of rhetoric used in the text. **"Have you ever wondered why you don't bounce when you step gently onto a trampoline?"**

Why do you think the author chose to open the text with a question? **To capture the interest of the audience.**

Give a brief summary of how trampolines work using the information from the text. **As you jump and land, you exert force on the springs which causes them to extend, the heavier the person jumping on the trampoline is – the further the springs will extend. This causes "an equal and opposite reaction" in the springs which then pushes back with the same force that was exerted on them. Causing the person to be pushed back into the air.**

Draw and label a diagram showing the processes at work when using a trampoline. Give a brief explanation of what is happening below. **Accept any response which shows adherence to the processes described in the text.**

Write down the meanings of these words which are highlighted in the text.

innately – **inherent in the essential character of something**

principles – **an accepted or professed rule of action or conduct**

existence – **the state or fact of existing or being**

conceived – **to form a notion, opinion or purpose**

colleagues – **associates**

captivated – **to attract and hold attention**

occurrence – **the action, fact or instance of occurring**

conducted – **to direct in action**

inertia – **a state of matter or velocity**

hindrance – **impeding, stopping or preventing**

acceleration – **an increase of speed**

infamous – **deserving of a reputation**

exert – **to put forth or into use power or influence**

hypothesis – **a proposition set forth as an explanation**

descend – **to pass from a higher to a lower place**

considerable – **large or great in size**

The Science Behind Trampolines – Vocab 2

Find the words from vocab 1 in the word search below.

r c o l l e a g u e s h
b a m k x f w y t g b n
d p k h k l f a q i p i
a t s d e s c e n d l n
z i g t y o d j q s c e
x v n w g j s h u h k r
c a r l d q w e v g f t
h t w j s w z g x k s i
o e x i s t e n c e w a
p d q g c v b f e w r y
g u h d q s a x f t f t
i n n a t e l y e i p o

inertia

captivated

innately

exert

colleagues

existence

descend

Choose some of these words and write some complex sentences using them.

Accept complex sentences which use the words from above.

Circle the correct spellings

dominering	erratic	incandescent	onerous	permissable
sweltering	occupationel	trite	inersha	particle
gravity	scientific	emphasise	ascend	penitent

Rewrite the following words with an added prefix and suffix to make a new word. The first one has been done for you. **The answers are examples only.**

honest dishonestly

trust **untrustworthy**

accept **unacceptable**

use **unusable**

new **renewable**

repeat **rerepeated**

Which part of the sentence should be enclosed in brackets? Tick one box.

Many scientists including sir Isaac Newton study gravity, some do so by also studying the solar
| | | |

system.
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