

Introduction to science learning & Smartivity- 10 minutes

Introduce yourself. Tell the children your name, your field of study, and a list of superlatives they must use when addressing you, such as _____

Who is a smart kid?

Gather answers from students and then tell them **the definition of a smart kid.**

What is smartivity?

What is science?

Science refers to a system of acquiring knowledge. This system uses observation and experimentation to describe and explain natural phenomena.

What is technology?

Technology is the application of science, or scientific knowledge for everyday use... or what we call practical purposes.

What is engineering?

Engineering is the branch of science and technology that deals with the design, building, and use of engines, machines, and structures...

What is mathematics?

Mathematics is not just about numbers and addition and subtraction and multiplication and division... Math and science go hand in hand. Math is a subject that helps us think about and experiment with science, technology and engineering concepts, before we actually build something.

What is STEM?

STEM is a shortform of Science, Technology, Engineering and Math... all the modern advances that we as humans have made is a result of these four subjects. These four subjects not only help us discover and invent new things, but also help us look at life in a different way - help us question why and why not... show us a way to find new solutions.

What is a Scientist?

"A scientist is a person who asks questions and tries different ways to answer them."

Then I show a PowerPoint I made, **What is a Scientist?**

Science in Life- 10 minutes

Science has invaded every branch of modern life. It is the noise of machines, cars, mills and factories, etc. which awakens us every-day in the morning. The food we eat, the clothes we wear, the books and papers we read, the recreations we enjoy, the games we play – all have something or other to do with the application of science.

Every person feels the effects of science in every sphere of life. It is not merely the electric light or the electric fan, the radio or the cinema that displays the power of science in our daily life, but everything we do or is done to us is in some way or another connected with science.

The things that we use in our daily life are mostly due to science. Our forefathers put on clothes woven by hand. Our clothes are made in large factories where scientific methods are used. We get so much paper to write on only because the paper mills can turn out huge quantities of it. Cloth and paper we had even before science came on the scene but no one could then think of the huge quantities in which they are produced now.

Science has conquered time and distance. We can travel from one place to another with a quickness which our forefathers could not have dreamt of. In the morning, we get news of events that happened yesterday in all parts of the world. Why should we talk of yesterday? With the help of the radio, we can listen to an American speaking. It would seem that he is before us and we are part of his audience. If we want to send a message to a person in America, we can send an email and he will get it in a few hours. If we want to speak to our friends far from us, there is the telephone that will connect us.

Effect of science of human life: It is, indeed, true that science has added tremendously to the comforts and conveniences of mankind. Unless one is an ascetic, one has no reason to reject the things science offers. By conquering time and distance science has brought mankind together and so far made life richer. By inventing medicines it has made our day-to-day existence relatively free from disease, and has, indeed, added to our length of life.

Examples of use of Science in everyday life: This fan and light works from the application of electricity. Electricity is one of the wonders of modern science. The bus which has an engine works with petroleum. The train is driven by the power of coal. This is possible only because of the application of science. My doctor gives certain injections and the patient soon well enough to come here. Medical science is another achievement of modern science, the marvel of medicine.

From the above, it is clear that science is playing an important part in our everyday life.

Scientists Stay Safe

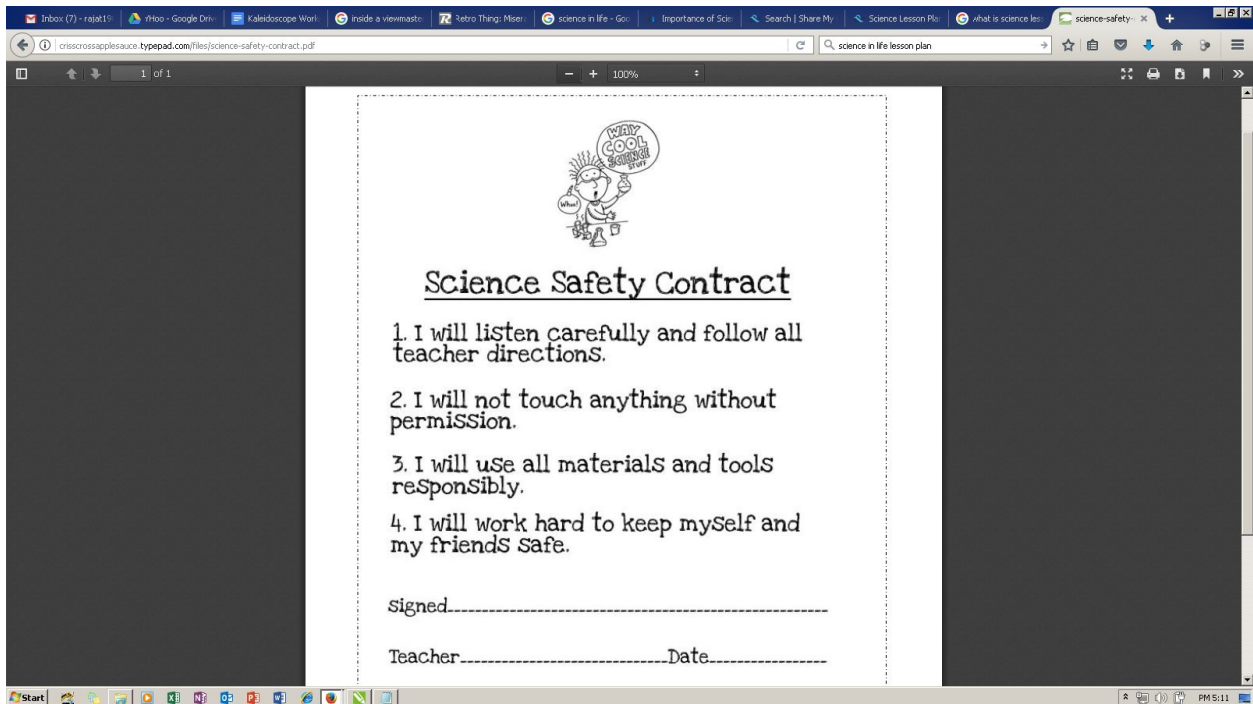
Today we take some time to go over all of the safety expectations in the [Science Safety Contract](#). I start by asking the kids "Why is it important for scientists stay safe? What kinds of things do scientists do to stay safe?"

We watch the PowerPoint [What is a Scientist?](#) again. I ask the kids to look for things that these scientists are doing to stay safe. (The chemist is wearing gloves and goggles; The geologist is wearing a hard hat; etc.)

Then I ask the kids about specific slides, for example-- "Do you think the volcanologist plays around with the hot lava? Do you think the chemist tastes the chemicals? Why not?"

We take a few minutes to discuss all the horrible catastrophes that could befall these scientists if they are not safe (the kids are very imaginative that way!) Then I tell the kids that, although we will not be near any volcanoes or tornados, it is still very important that **we** stay safe while doing science!

I hand out the [Science Safety contracts](#). We go over each expectation--one by one. We talk about why that expectation is important and what could happen if we didn't follow them. When we are done, we sign them and glue them in our notebooks!



CONCEPTS EXPLAINED - 10 Minutes

Guide students to the scientific concept they will be learning through the activity which is

Video: <https://www.youtube.com/watch?v=YImRa-9zDF8>

Today's lesson is all about Hydraulic Systems

The basic idea behind any hydraulic system is very simple; force that is applied at one point is transmitted to another point using a liquid (that can not be **compressed**). Pull out a syringe from your box and attach it to another syringe. Make sure that plunger of one syringe is completely inside and that of other syringe is completely outside. Now push the plunger of the syringe inside. What happens? The plunger of other syringe moves outside. Now apply force on the plunger that is moving outside so as to stop it from moving further. You will notice that still you are able to push the plunger of other syringe inside. This is because air is compressible. Meaning air can be compressed. But liquids or solids can not be compressed easily. Fill one syringe with water and now repeat the process. What happens? You are not able to push the plunger of other syringe inside and if you force it too much the water comes out of the connecting pipe. This happens because water is less compressible than air.

What you have built right now is a hydraulic system. Pushed water forces water in the connecting tube to move into the connected syringe. To make space for this water, plunger of the connected syringe moves outwards. This moving plunger then can be connected to a mechanism. Hence, pushing/pulling of plunger moves the mechanism forward/backward, up/down.

Reading Instruction Manual and identifying parts

(5 minutes)

Constructing the HYDRAULIC CRANE - 125 minutes

PLAYTIME - 15 minutes

CRANE - 5 minutes

<https://www.youtube.com/watch?v=bLfov3RhNhw>

A crane is a machine that is used to lift/lower/shift objects from one place to another. A crane has 4 main sections. First section, Base, has wheels or tracks attached to it. Second section, Mast, is supporting tower of the crane. Mast gives the crane its height. Third section, Boom, is arm of the crane. Last section, Hook, is used to pick up materials. In your crane Grabber holds the objects, lifts up using Boom Lines, and moves it to some other place using Mast's Rotation.

ACTIVITY -

Select materials of different weights. Try lifting and moving those objects with your Crane. Do you notice any difference? Do you have to push or pull the syringes harder to lift heavy objects?

ACTIVITY -

Did you notice that while lifting heavier objects, your crane tilts towards that object and tends to fall. Why so? Can you think of a solution to maintain crane's balance? Can revolving wheels of your crane's base help in expanding the base and balancing the structure?

RACK AND PINION - 5 minutes

Gears are toothed wheels that are used to transfer power from one part of a machine to another. For gears to work perfectly, their teeth must match with one another; too loose or too tight, and the teeth get stuck. In your crane, one of the gears is circular whereas the other one is straight. This straight gear is called RACK and the circular gear is called PINION. When the straight gear pushes forward, the circular gear rotates.

Pop Quiz - 10 minutes

- 1) Hydraulic systems is a force that is applied at one point is transmitted to another point using a _____. (c)
 - a) Gases
 - b) Solids
 - c) Liquids

- 2) What can be most easily compressed? (c)

- a) Solids
- b) Liquids
- c) Gases

3) A _____ is a machine that is used to lift/tower/shift objects from one place to another. (a)

- a) Crane
- b) Breaker
- c) Truck

4) How many sections does a crane have? (b)

- a) Seven
- b) Four
- c) Two
- d) Five

5) What is supporting tower of the crane called? (a)

- a) Mast
- b) Base
- c) Grabber

6) What is used to pick up materials? (c)

- a) Boom
- b) Mast
- c) Hook

7) Is it important for teeth in gears to match with one another? (a)

- a) Yes
- b) No

8) What is the straight gear in the crane called? (a)

- a) Rack
- b) Pinion
- c) Tether
- d) Stray

9) What is the circular gear in the crane called? (b)

- a) Rack
- b) Pinion
- c) Tether
- d) Stray

10) When does the circular gear rotate? (a)

- a) When the straight gear pushes forward
- b) When the straight gear stops
- c) When the straight gear pushes backward

