NITI Aayog | ATAL INNOVATION MISSION

MAKER GHAT

ATL TINKERING CURRICULUM

LEVEL II

Message from Dr Chintan Vaishnav
Mission Director
Atal Innovation Mission

Our future generation will be the drivers of innovation and discovery and will set India's pace as a global powerhouse. Atal Tinkering Lab is Atal Innovation Mission (AIM), NITI Aayog's flagship initiative to promote innovation and creativity. ATLs are open innovation makerspaces where young minds give shape to their ideas through hands-on do-it-yourself mode. The program has become a national movement that is revolutionising the Education Ecosystem of India. When I meet students from different quarters of the country who come up with innovations regardless of how remote and resource-constrained they may be, I am filled with much hope for the future of our country.

I am thrilled to introduce the ATL Tinkering Curriculum, a hands-on learning program that empowers young people to build the skills and attributes required for success in the 21st century. This innovative curriculum provides students with the opportunity to understand the basics of emerging technologies and apply their learning to solve real-world problems.

The curriculum focuses on a wide variety of concepts, ranging from basic electronics, mechanics, data visualization, and woodworking, to more advanced technologies such as 3D printing, the Internet of Things, and design thinking. Through hands-on, experiential learning, students will be encouraged to identify and design creative solutions to everyday problems.

The aim of this curriculum is to provide stage-wise learning to meet the needs of students at different stages of their tinkering journey. This will help cultivate the next generation of entrepreneurs, engineers, and innovators, who will be equipped with the knowledge and skills to navigate the rapidly changing technological landscape of the 21st century. I am confident that the ATL Tinkering Curriculum will be a valuable resource for educators and students alike. This new initiative will help in achieving the goal of NEP of developing 21st-century skills in students and preparing them for the fourth Industrial Revolution.

Preface from Deepali Upadhyay
Program Director
Atal Innovation Mission

Under the aegis of Atal Innovation Mission, Atal Tinkering Labs were set up with the goal of inspiring a generation of neoteric innovators and entrepreneurs in India. The underlying philosophy of our ATLs has been to equip the young minds of India with all the knowledge and skills necessary to thrive in the twenty-first century. The idea is to allow children to explore the world of research and innovation, and contribute towards nation development, by developing innovative and disruptive solutions to India's biggest community problems.

In 2022, the Atal Tinkering Labs achieved the milestone of setting up 10,000 labs across India. Today over 75 lakh students in India get to learn in these ATLs. With this accomplished, in the next stage of development, our goal is to ensure that the ATL students have the best tools and resources to learn from.

I am honoured to introduce the ATL Tinkering Curriculum, which is designed to equip young people with the skills and attributes they need to thrive in the 21st century. This hands-on learning curriculum is built around the latest technologies and focuses on a wide range of concepts, from basic electronics and mechanics to advanced topics such as 3D printing, the Internet of Things, and design thinking.

This curriculum starts with basic concepts and hands-on activities in the early stages to introduce students to the subject matter and build their foundation in tinkering. As students progress, the curriculum introduces more advanced topics and projects that challenge them to apply their knowledge and skills in new and creative ways.

I look forward to seeing the impact this curriculum will have on the learning journey of the students in Atal Tinkering Labs. I strongly recommend this ATL Curriculum be used by all ATL schools across the country to learn tinkering.

Foreword by Azra Ismail
Co-Founder
MakerGhat

With the pace of technological innovation, our youth of today face an uncertain future. On one hand, technological progress has led to tools that promise healthier and more comfortable lives. On the other, youth face a future with widespread automation, and have to learn to use emerging technologies and adapt to meet the needs of a changing job market. No longer is it enough to be able to recall information and learn routine tasks that can be performed by a machine. Critical thinking, problem solving, collaboration, and communication skills, along with the ability to self-learn, are essential to stay relevant in the workplace, and to drive innovation and social change in the country over the next few decades.

These goals are laid out clearly in our National Education Policy (NEP) 2020, which aims to develop 'higher-order' cognitive capacities, such as critical thinking and problem solving, alongside social, ethical, and emotional capacities and dispositions. NEP also lays out a focus on experiential learning, and conceptual clarity over rote learning. The making or tinkering philosophy exemplifies such an approach, by centering learning through exploration, experimentation, and play. It also creates room for failure, encouraging youth to take risks and exercise their creativity without fear. The collaborative environment of a makerspace or tinkering lab also creates an opportunity to exercise socioemotional skills, and learn to communicate one's ideas effectively.

MakerGhat's collaboration with the Atal Innovation Mission at NITI Aayog is an exciting opportunity to realize the goals of NEP 2020 and put the tinkering philosophy into practice. The curriculum that we have developed emerged as a result of countless conversations with teachers across the country who expressed an interest in making, but lacked resources that could help them get started. The ATL Curriculum manual aims to fill that gap. It has been designed to support not just schools with access to an ATL, but any educator who is excited about tinkering and making. Many of our activities, particularly at Level I and II, can be performed with space and tools available at hand.

The development of this manual is only the beginning. MakerGhat is excited to support teachers in many other ways, through mentorship, training, and assessment resources. Over the next decade, we are committed to building a network and movement of makers—educators and youth—who can usher in change at a local, national, and global level. The pressing problems of our time need creative solutions from diverse communities. Our educators are the country's best resource to inspire and prepare youth to lead us into a better future, and we invite them to join hands with us to realize this vision.

Overview

The ATL Curriculum helps young people build skills and attributes required for success in the 21st Century. It provides students with the experience to understand the basics of all the emerging technologies and apply the learnings to solve the real-world problems. This is designed to be an hands-on learning program that empowers children to analyse the facts, connect the dots and apply what they learn in school rather than memorizing them which will lead to the creation of next generation of entrepreneurs, engineers and innovators.

This curriculum will enable the young learners to develop interest in Science, Technology, Engineering & Math through a hands-on experiential learning. It focuses on wide variety of concepts ranging from Basic electronics, Mechanics, Data visualisation and Wood working to other emerging technologies such as 3D Printing, Internet of Things and Design Thinking that culminates in building prototypes of their ideas. The aim of this curriculum is to lead the students to identify and design creative solutions to everyday problems.

Curriculum Objectives

Students will be able to:

- Turn ideas into reality by brainstorming, modelling and prototyping.
- Inculcate innovative and entrepreneurial mind-set through Design thinking and Hands-on Learning.
- Identify and research problems in their community and beyond, generate relevant and creative solutions, and develop sustainability plans for their solutions.
- Identify and self-learn for dignified career opportunities based on their skills and interests, particularly in STEM or entrepreneurship.
- Develop basic knowledge in electrical and mechanical engineering principles.
- Develop skills of using hand tools to construct a prototype of an engineering design.

Curriculum Structure

The ATL Curriculum engages students actively in the development of hands-on activities through a sequence of 3 Levels with incremental difficulty. Each level comprises of different modules, which are further subdivided into sessions. It is highly recommended to start the course with Level 1 and end the course with Level 3. The details of each level is as follows:

Level 1 comprises of 5 modules namely, Basic Electronics, Mechanics, 3D Design & Printing, Data Visualisation and Design & Entrepreneurial Thinking. All the 5 modules are further divided into 14 sessions. The duration of each session is 60 min.

Level 2 comprises of 4 modules namely, Electronics, Mechanics, 3D Design & Printing and Design & Entrepreneurial Thinking. All the 4 modules are further divided into 13 sessions. The duration of each session is 60 min.

Level 3 comprises of 5 modules namely, Electronics, IoT, 3D Design & Printing, Wood Working and Design & Entrepreneurial Thinking. All the 5 modules are further divided into 17 sessions. The duration of each session is 60 min.

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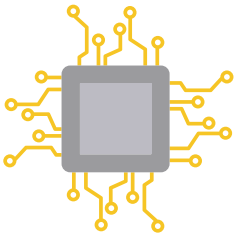

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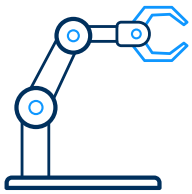

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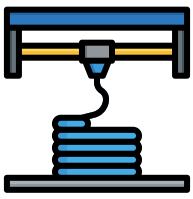

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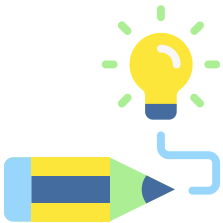

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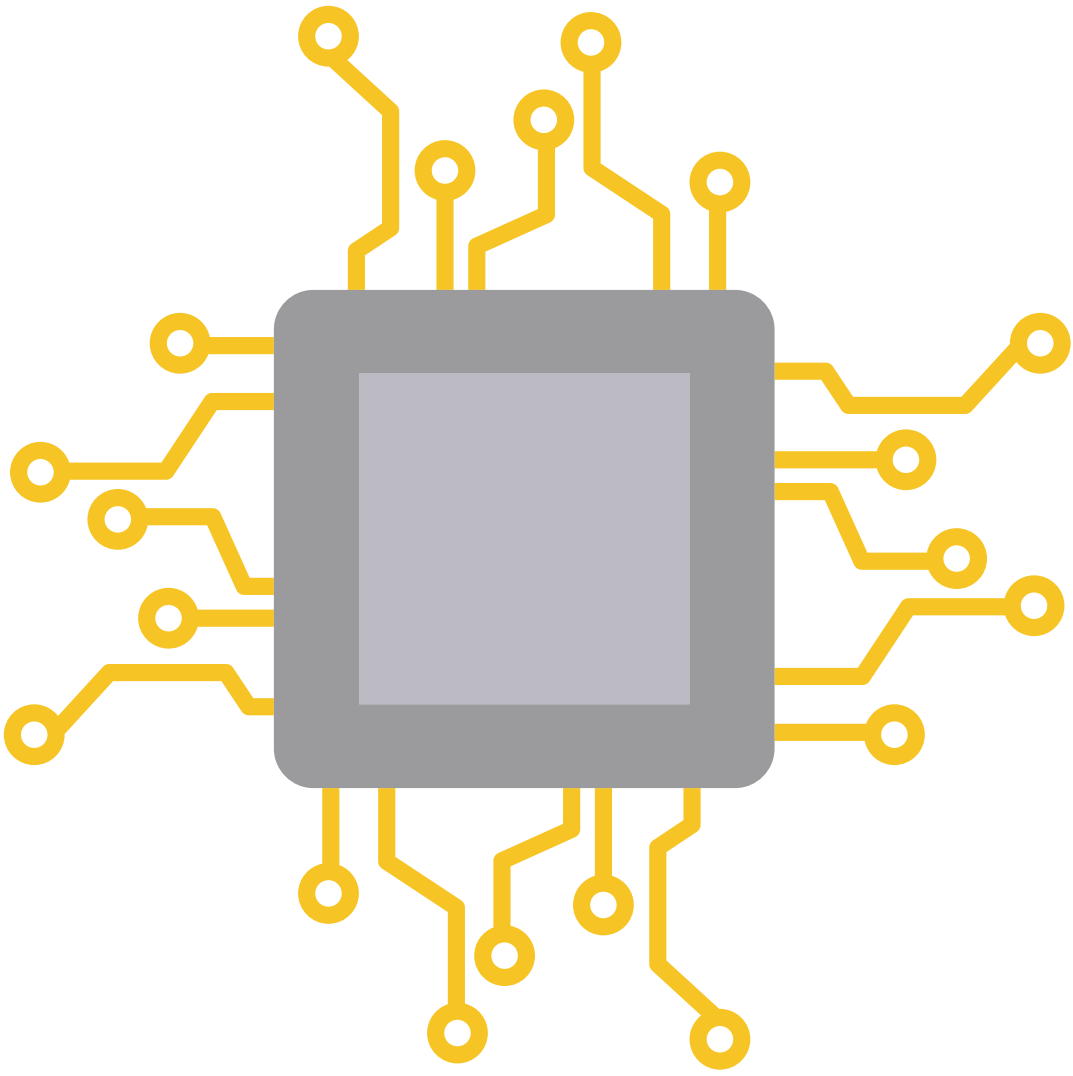
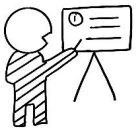
BASIC ELECTRONICS

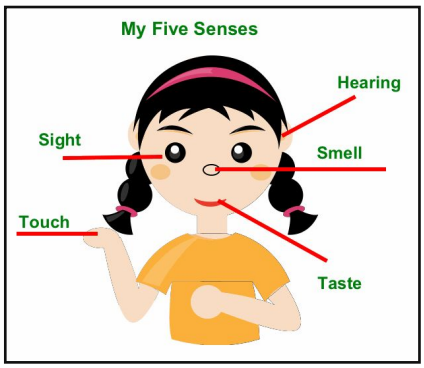


Introduction to Sensors (10 mins):



Let's take the word sensors. What do you mean by that? Before getting into what sensors are in the world of electronics, let's see the basic senses humans have to survive.

Just like we have our 5 senses that help us in our functioning, these sensors act as the eyes, nose, and ears of electronics projects, just as the human eye, nose, and ear do.



A sensor is typically a device that measures input from its environment and transfers that information into data we can use!

People use sensors to measure a myriad of things, can you name at least 5 sensors? Great, let's learn how a sensor works

Source: kidsunlimited.com.au

Materials Required :

1. Pencils
2. A4 Size sheet
3. LED
4. Coin Cell/Rechargeable 9 V batteries
5. Breadboard
6. Jumpers
7. Multimeter
8. Wire Stripper
9. Conductive (Copper) Tape
10. Resistors

: 60 minutes

Module: Basic Electronics

Grade: 6th to 9th

Importance/ Value:
The aim of this module is to provide basic electronics activities that explain the basic concepts associated with electronics. This enables the learners to understand more complex electronic concepts, technologies and ideas easily to use in the ATL Lab.

Learning Goals:
1. Understand the working of sensors.
2. Understand the working of a transistor and how a transistor works as a switch.
3. Understand the usage of LDR in circuits.

Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker
10 Min	Introduction to sensors
15 Min	Intro to transistors and LDR
20 Min	Activity- Automatic light using LDR light sensor
09 Min	Reflection and Learnings

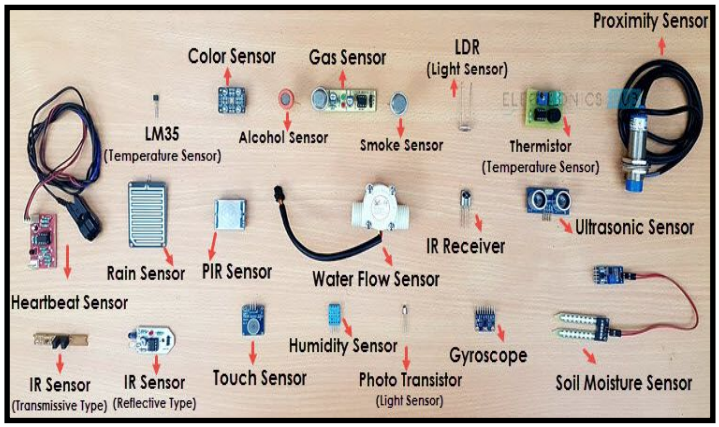
Icebreaker (5 mins):

Make enough room in your ATL Lab and form a circle. One person will start by saying their name and a food that begins with the first letter of their name, the next person repeats what the first person says and then adds their own food. Each child has to remember what everyone in front of themes food was. Whoever in the group can make it all the way around without breaking the flow wins.

What is a sensor?

A sensor is a device that detects and responds to specific changes in the environment.

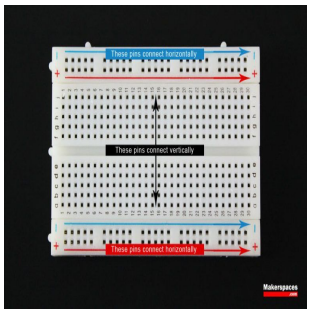
For example, some sensors react to light, temperature, sound, or pressure. These sensors then send this information to other electronic components. Can you think of different sensors?



Electrical Tools:

Working with electricity can be dangerous, if not done with proper tools. These tools are essential to safely build electronic devices. Let's take a look at a few of them.

1. Breadboard- This is an essential tool for prototyping and building temporary circuits. These boards contain holes for inserting wire and components.

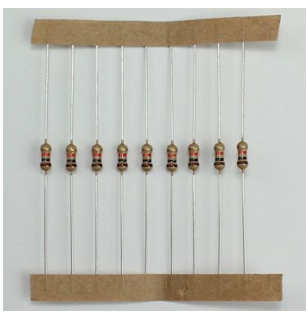


2. Digital Multimeter- This is a device that measures electric current (amps), voltage (volts), and resistance (ohms).

3. Battery Holders- A battery holder is a plastic case that holds batteries from 9V to AA.

4. Wire Cutter- Wire cutters are essential for stripping stranded and solid copper wire.

5. Light-Emitting Diode (LED)- A light-emitting diode is like a standard diode because electrical current only flows in one direction.



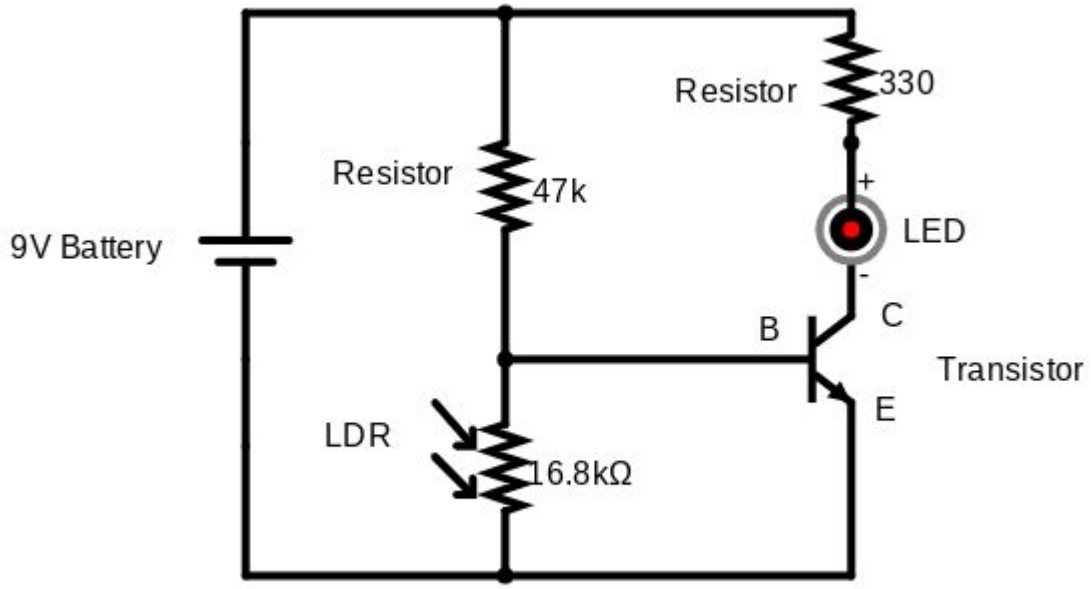
6. Resistor- Resistors are used to resist the flow of current or control the voltage in a circuit.

7. Heat Gun-
A heat gun is used to shrink plastic tubing, known as heat shrink, to help protect the exposed wire.

8. Soldering Iron-
When it is time to create a permanent circuit, this tool will solder the parts together.

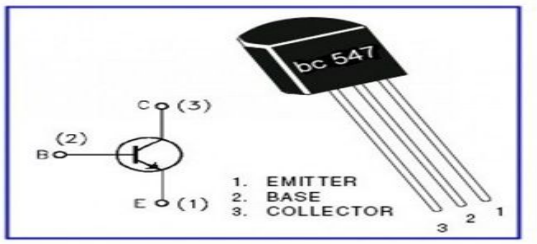
Circuit Diagram:

When sufficient light falling on LDR the resistance of LDR is very low, as a result, all current is flowing from resistor R2 and LDR so LED D1 is not glowing, When there is darkness, and no light is falling on LDR, so the LDR resistance became very high so, current will flow to the base of transistor Q1 BC547, so transistor became turn on and LED D1 to glow.

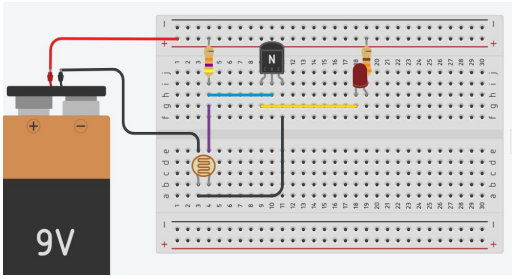


Steps to build an Automatic Street Light using LDR

Step 1: Identify the terminals of transistor as shown in the image.

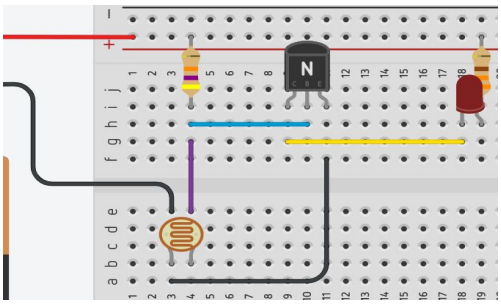


Step 2: Connect positive and negative terminal of the battery to breadboard as shown in the image..



Step 3: Place the LED, Resistors, Transistor and LDR in breadboard.

Step 4: Connect each components carefully as per the circuit.



Step 5: Check the working of circuit by placing the circuit in a dark area

Reflection and Learnings (9 mins):

1. Take the LDR Circuit to a dark place. Write down your observation in the space below.
2. What is the function of a LDR?
3. What did you or your team struggle with while doing this activity and why? How can you improve next time?
4. How did you contribute to the team and how do you think it helped? How else could you have contributed?
5. What communication challenges did you and your team face? How can your team communicate better next time?

Try it yourself!

Using the concepts you have learnt so far, Try creating a Street light system as shown in the image.

Use the space to draw or write your reflections and learnings

Introduction to Renewable Energy (05 mins):

Renewable sources of energy are helping people find a feasible solution to the climate crisis and environmental pollution. Solar-powered fans utilize solar energy to provide cooling. Many people have switched to using these fans since they reduce electricity bills.

A Solar fan, owing to its numerous advantages, has started replacing electrical fans. It's helping people use solar energy to keep their homes comfortable during the summer months. In this session, you will learn how to make a solar fan.

: 60 minutes

Module: Basic Electronics

Grades: 6th to 10th

Importance/ Value:
The main aim of this session is to give a basic understanding of renewable energy and how we can convert sunlight into electrical energy by using the equipment in the ATL Lab.

Learning Goals:
1. Learners will be able to understand the importance of renewable energy.
2. Learners will be able to make the solar powered electric fan.

Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker
05 Min	Introduction to Renewable Energy
15 Min	A brief on Renewable energy
25 MIn	Activity- Solar powered electric fan
05 Min	Reflection and Learnings

Materials Required :

1. Wooden Plank
2. Glue
3. Cardboard
4. Wood Piece
5. Small solar panel
6. Fan
7. Motor
8. Switch
9. Soldering iron

Icebreaker (5 mins):

Make enough room in your classroom and form a circle. The teacher will give you instructions, you will have to follow them. Sounds simple, doesn't it? Here is the twist! The instructions will be any of the following: Jump In, Jump Out, Jump Right or Jump Left.
But you have to do the opposite of what the teacher says.

What is a Renewable Energy?

Renewables are made from natural resources on our planet, like wind, water, and sunlight. They are incredibly valuable energy sources, also known as “clean energy” as they do not pollute the environment. Renewables come from our planet’s unlimited sources of energy, like wind, sunlight, waves, and the earth’s internal heat. Here are 5 main sources of renewable energy and why they are so important to us.

5 Main Sources of Renewable Energy

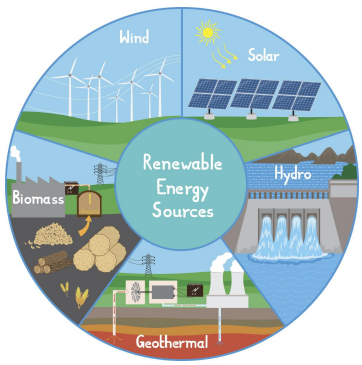
Solar Energy: This is energy produced directly from sunlight through smart solar panels placed outside of buildings facing the sun. Solar can be used to heat up buildings, water, and be turned into electricity.

Wind Energy: The blades of large windmills are moved by the power of the wind. These blades spin a turbine inside a generator to produce electricity. There are over 341,000 wind turbines on the planet spread across 83 countries.

Hydroelectric Power: Water from dams and rivers can be used to spin powerful turbines and generate what we call hydroelectricity. Several provinces in Canada produce over 90% of their energy through hydropower and the country is one of the largest global consumers of this energy source along with China and Brazil.

Geothermal Energy: Huge pumps extract the heat and steam from below the Earth – mainly from volcanoes and geysers – and use these to heat up homes and buildings as well as to generate electricity. About 25% of the total electricity of Iceland is produced by geothermal energy, thanks to the country’s several hot springs.

Biomass Energy: This is the oldest source of renewable energy on the planet. With biomass, we refer to all organic matter that has stored energy through the process of photosynthesis. Think wood, crops, seaweed, and animal wastes. This energy is converted to electricity and heat.



Why Is Renewable Energy so Important?

Renewables are an essential source of energy for the future and one of the world’s most important allies in the race to stop global warming and reach net-zero emissions. They are much cleaner sources and have a very minimal environmental footprint than fossil fuels like coal and natural gas. Another good thing about renewables is that they are endless: while resources of coal and gas are finite, the wind will never stop blowing and the sun will never stop shining! This is amazing news, as we can rely on these energy sources for a very long time.

Source: https://kids.earth.org/climate-change/renewable-energy-2/

Safety Measures:

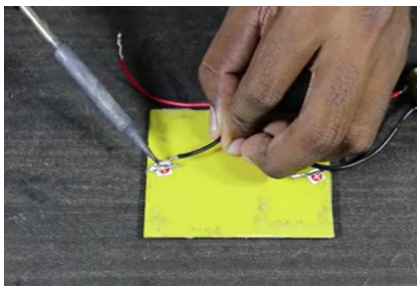
1. Do not touch any hot items with bare hands always use a small cloth
2. Hold the sharp tools carefully so that you don't cut yourself
3. Never touch electrical equipments with wet hands

Activity: Solar powered electric fan (30 mins)

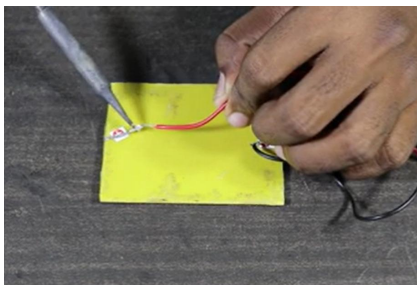
Now that you are well aware of energy, what is a renewable energy and its types. We will build a simple activity using solar energy which will allow you to know how to use a renewable energy efficiently.

Steps to make a Solar powered electric fan:

Step 1: Take a solar panel and connect black wire to the negative terminal of the panel using soldering.



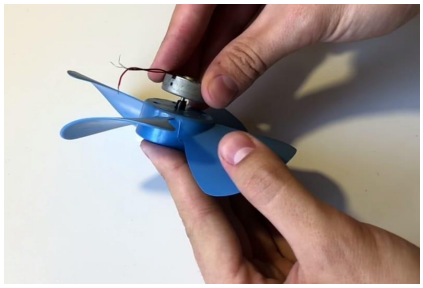
Step 2: Connect red wire to the positive terminal of the panel using soldering.



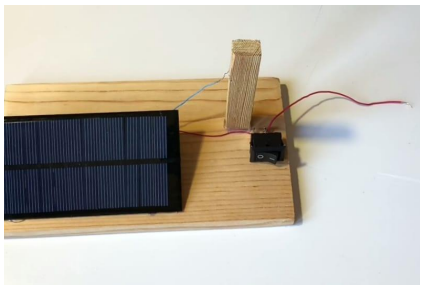
Step 3: Take a wooden plank and stick a small piece of cardboard on it and also stick the wooden piece.

Source: myprojectideas.com

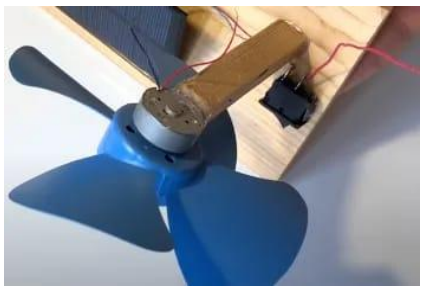
Step 4: Attach the DC motor with fan.



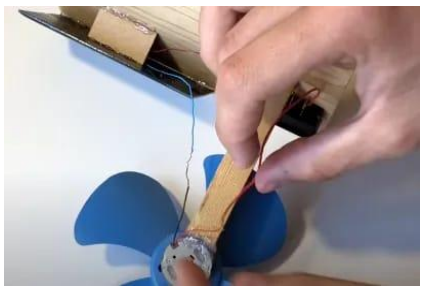
Step 5: Paste the solar panel on the wooden plank and connect red wire to the switch.



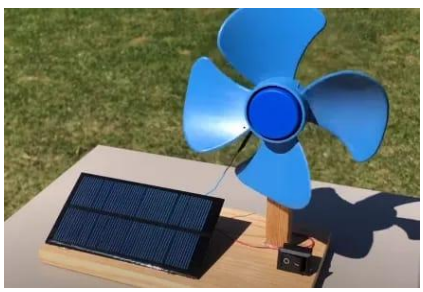
Step 6: Stick the fan on the wooden piece.



Step 7: Connect remaining end of the wires with the motor fan.



Step 8: Finally keep the model in the sunlight and switch on the fan.



Source: myprojectideas.com

Reflection and Learnings (9 mins):

1. Why do you think a fan has only 3 blades? Can you think of any logical reasons?
2. What is renewable energy and what are its uses?
3. What did you or your team struggle with while doing this activity and why? How can you improve next time?
4. How did you contribute to the team and how do you think it helped? How else could you have contributed?
5. What communication challenges did you and your team face? How can your team communicate better next time?

Try it yourself!

Using the concepts you have learnt so far, Try creating a Solar toy as shown in the image.

Use the space to draw or write your reflections and learnings

Introduction to Arduino (10 mins):

Arduino is an open-source electronics platform based on easy-to-use hardware and software. It's intended for anyone making interactive projects, You can connect various sensors to their input pin and get the output accordingly.

The Arduino hardware and software were designed for artists, designers, hobbyists, hackers, newbies, and anyone interested in creating interactive objects or environments. Arduino can interact with buttons, LEDs, motors, speakers, GPS units, cameras, the internet, and even your smartphone or your TV!

Materials Required:

1. Tinkercad (Online Software)
2. Arduino Uno Board
3. LED
4. 220 OHM Resistor
5. Breadboard
6. Jumper Wires(Male-Male) - 12 Nos

: 60 minutes

Module: Basic Electronics

Grade: 6th to 9th

Importance/ Value:

This session helps the students become familiar with the basics of electronics and design, while building electronics projects that are limited only by their imagination. After the initial introduction to a few new keywords and skills, the Arduino is an easy-to-use tool for beginners.

Learning Goals:

1. Learners will be able to understand the basics of Arduino programming.
2. Learners will be able to understand Tinkercad Simulation.

Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker- Focus Activity
10 Min	Introduction to Arduino
15 Min	Understanding Arduino and methods
20 Mln	Activity- Basics of programming
09 Min	Reflection and Learnings

Icebreaker (5 mins):

Scatter yourselves around the classroom and close your eyes once you have found your spot. The teacher will go around and tap one person on their shoulder and that student must make a noise (animal noises for example). The rest of the student must now find out who made the noise.

What is Tinkercad?

Tinkercad Circuits is an online software which is the easiest way to get students started with learning electronics. Using an interactive circuit editor, students can explore, connect, and code virtual projects with simulated components. Tinkercad helps students facilitate their learning virtually to understand and breakdown complex concepts.

Source: tinkercad.com

Types of Arduino:

Arduino's boards are available in different sizes, form factors, and different no. of I/O pins etc. Some commonly known and frequently used Arduino boards are Arduino UNO, Arduino Mega, Arduino Nano, Arduino Micro, and Arduino Lilypad.
The Uno is one of the more popular boards in the Arduino family and a great choice for beginners. Let's understand how to use Arduino using a small activity.

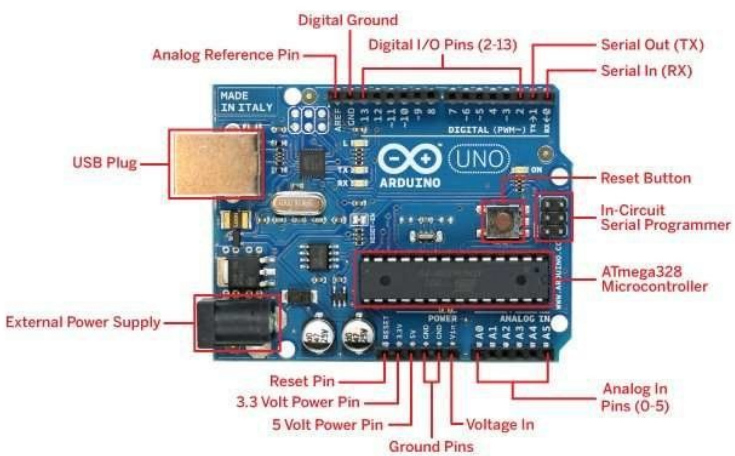
Arduino Uno
Arduino UNO is a basic and inexpensive Arduino board and is the most popular of all the Arduino boards. Arduino UNO is considered to be the best prototyping board for beginners in electronics and coding. Arduino Uno is a microcontroller board based on an 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists of other components such as a crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header, and a reset button.

We are going to use two methods for doing experiments with Arduino

Method 1 : Simulation using Tinkercad online software

Method 2 : Using physical Arduino Uno board

We will start with Tinkercad simulation for an easier understanding!

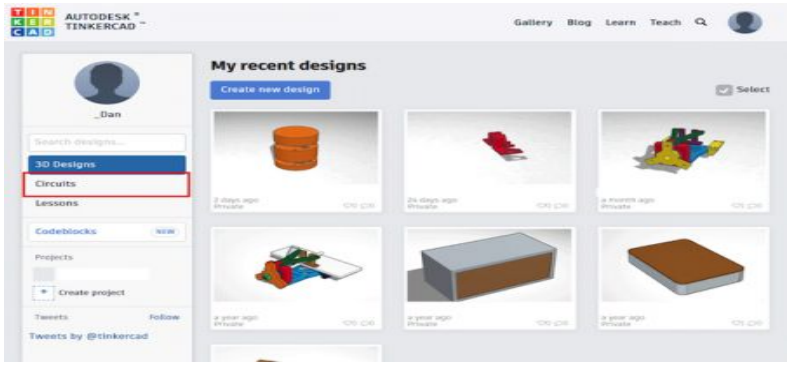


Arduino LED blinking activity:

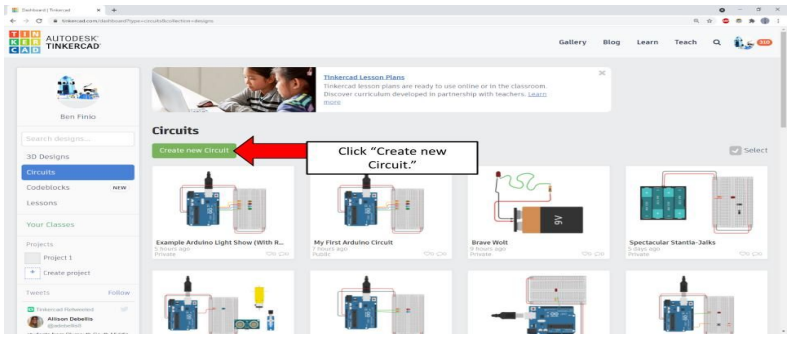
First we are going to simulate the Arduino LED blinking activity in Tinkercad. Then we will do the LED blinking using a physical Arduino Board, LED, Resistor, etc .

Part 1: LED Blinking Simulation using Tinkercad
Part 2 (Next Module): LED Blinking using Physical Arduino Board

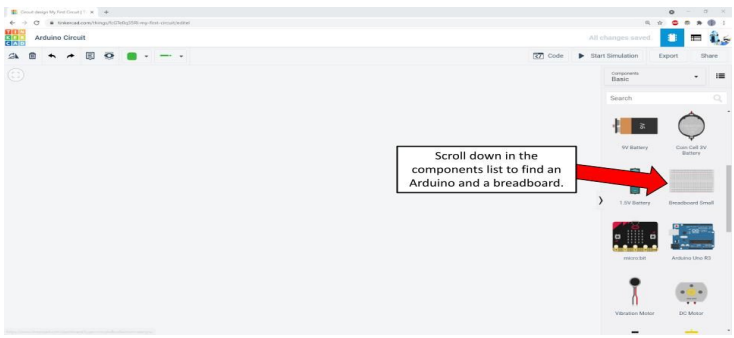
Step 1: Visit the Tinkercad website (https://tinkercad.com) and create an account or log into an existing one. Then select Circuits on the left side of the screen:

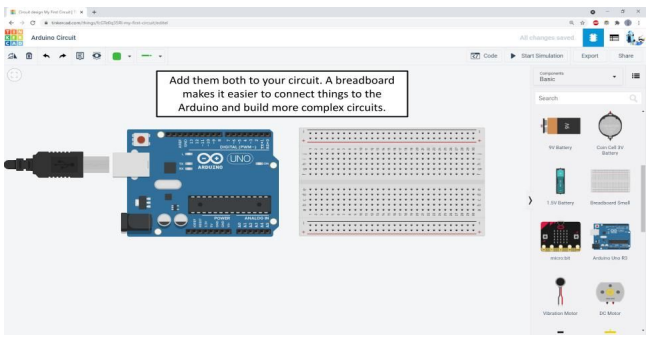


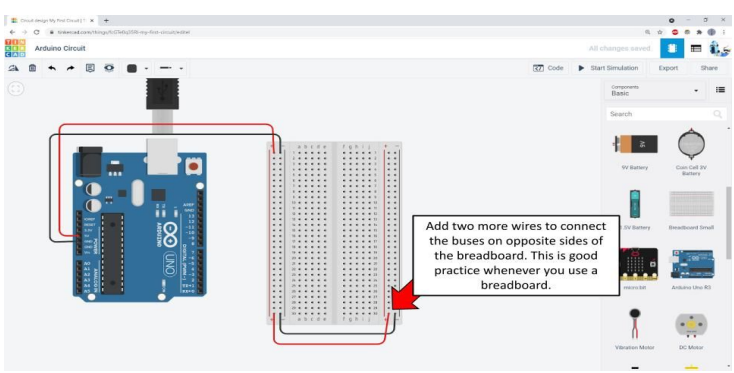
Step 2: Click on “Create new Circuit”.

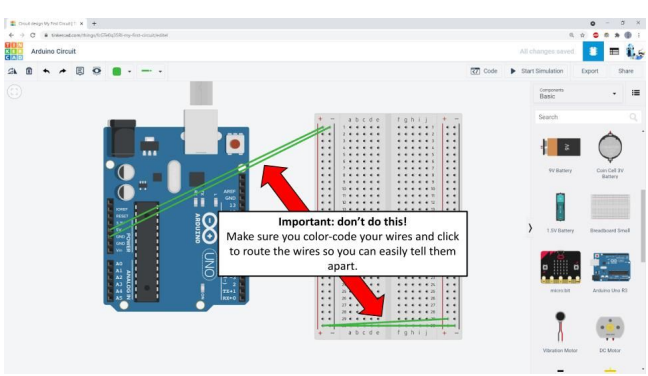


Step 3: Add the Breadboard and Arduino Uno

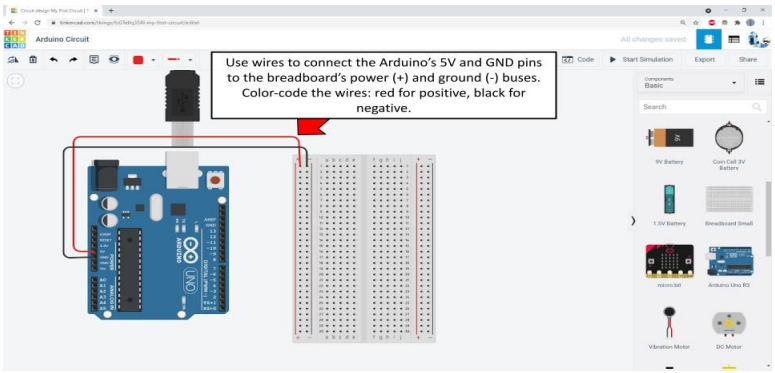


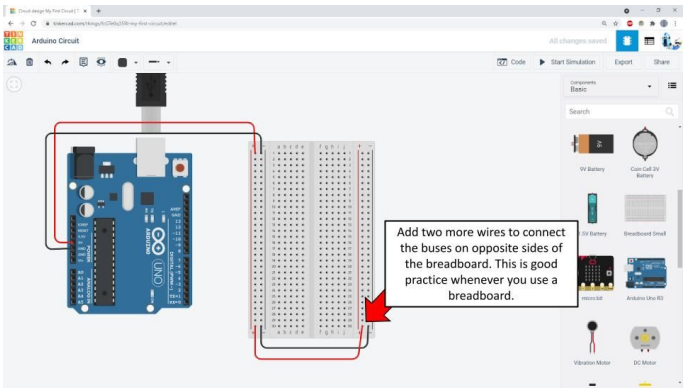


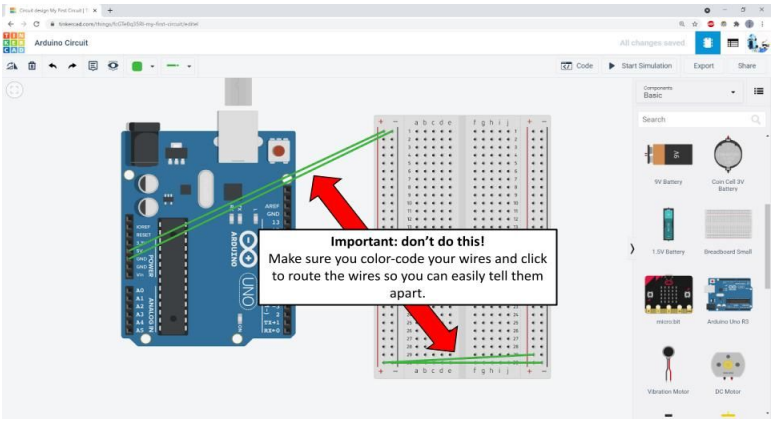




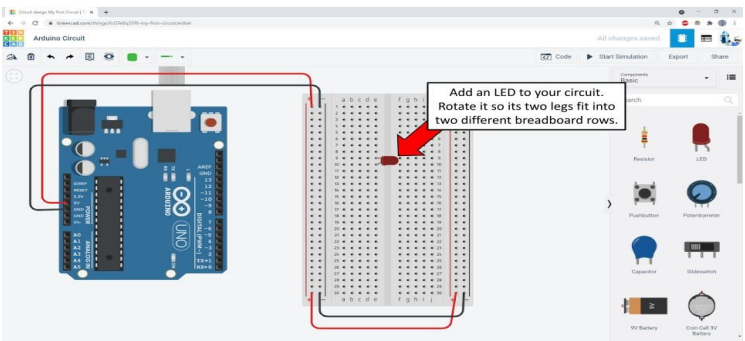
Step 4: Connect +ve and -ve wires to the breadboard.

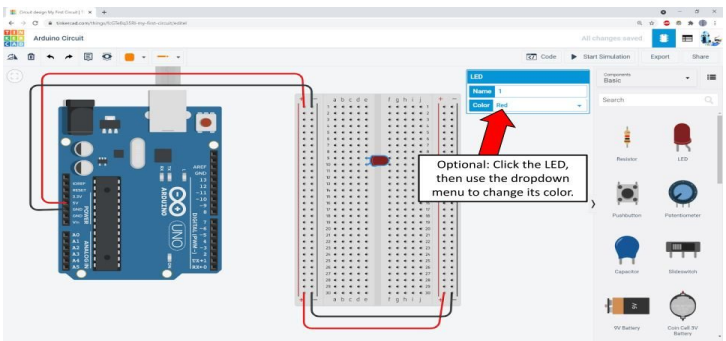




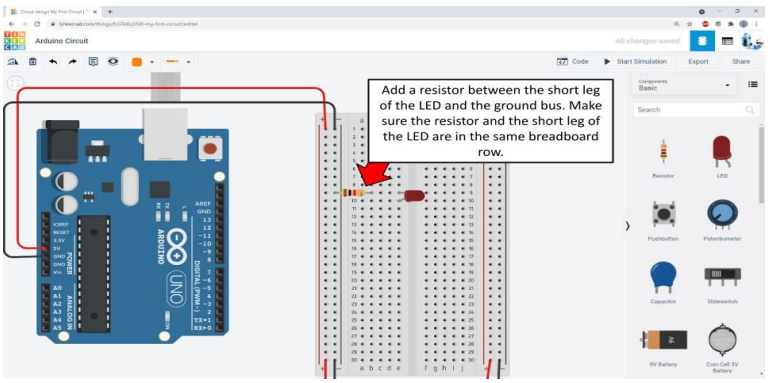


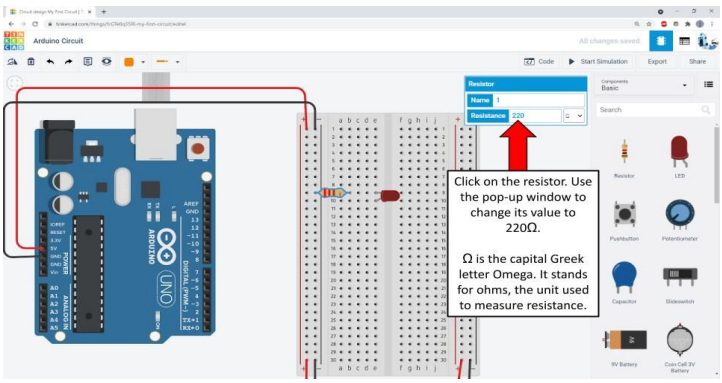
Step 5: Add an LED.



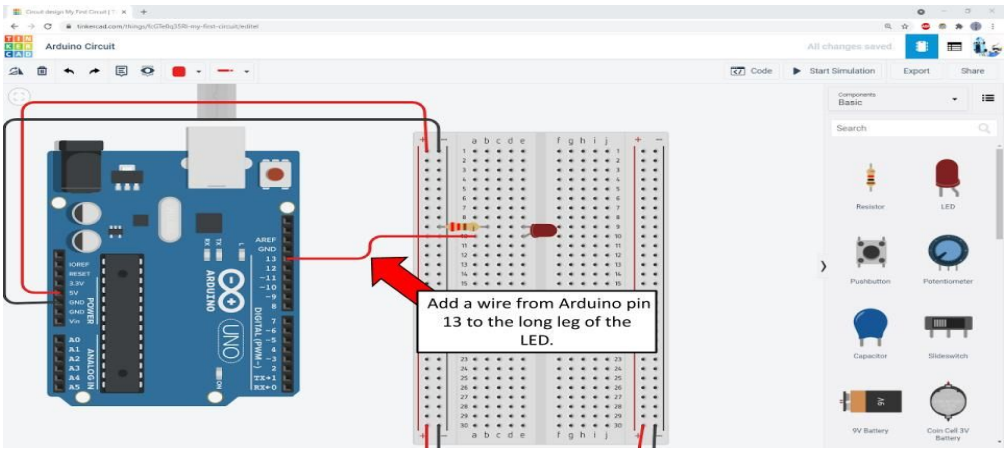


Step 6: Add a Resistor.

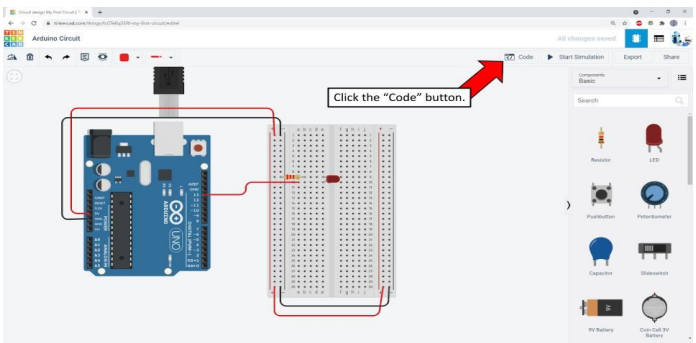


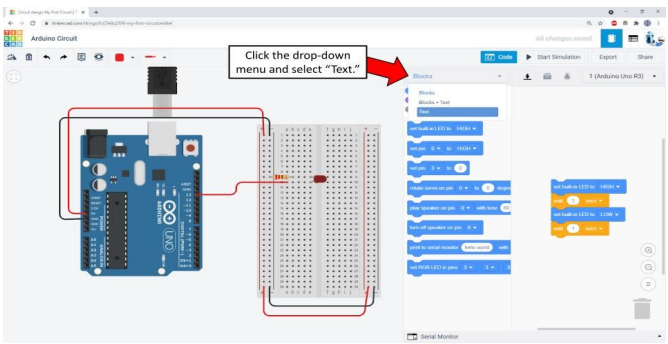


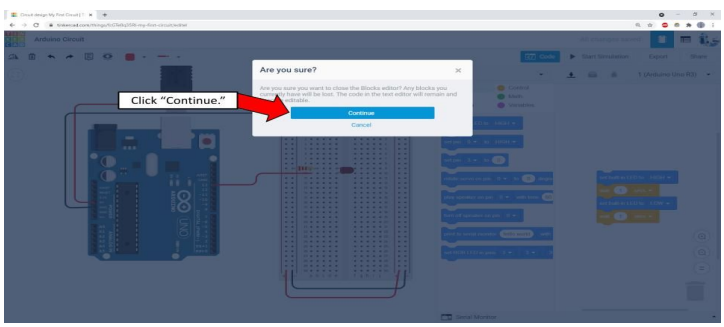
Step 7: Add a wire from Arduino Pin 13 to the Anode of LED.



Step 8: Open the Coding Window.

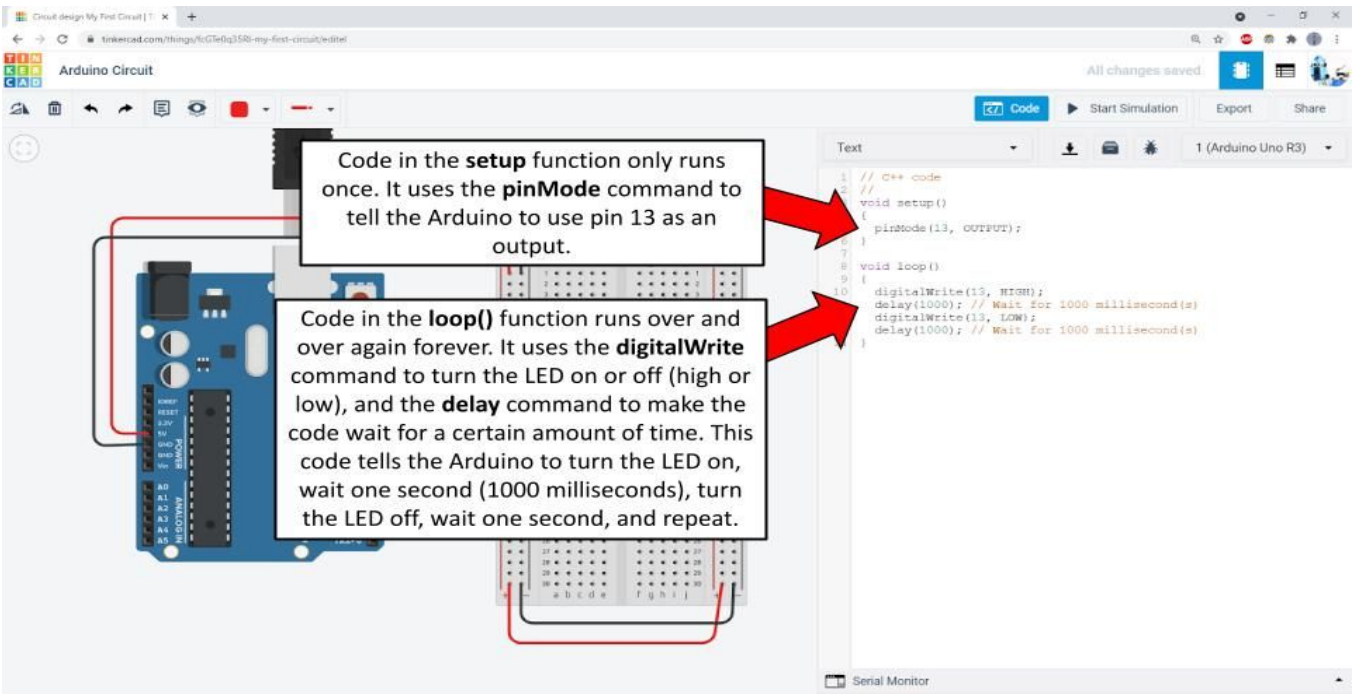






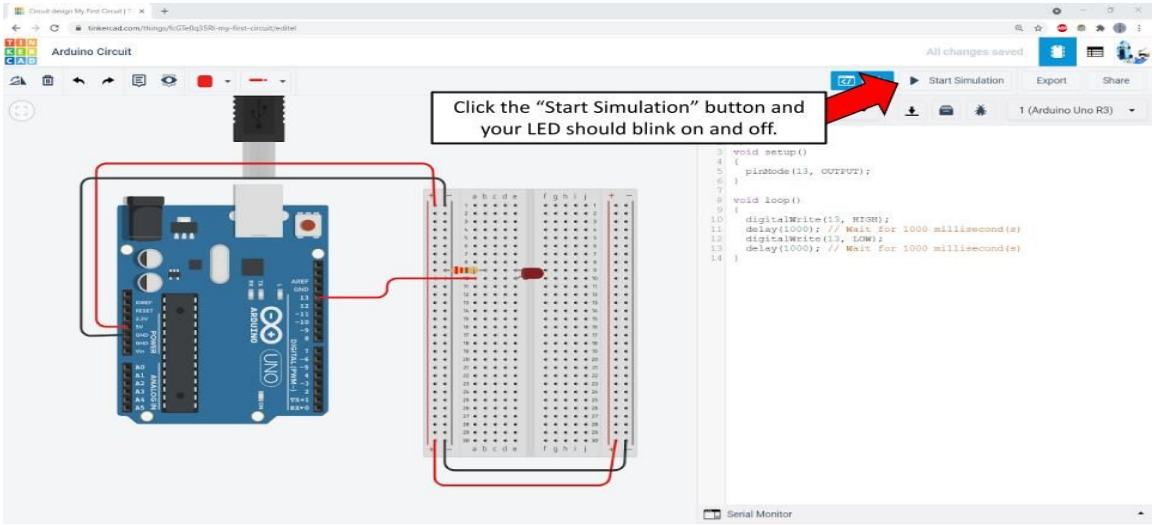
Step 9 : Write the Code.

```
void setup()
{
 pinMode(13, OUTPUT);
}

void loop()
{
 digitalWrite(13, HIGH);
 delay(1000); // Wait for 1000 millisecond(s)
 digitalWrite(13, LOW);
 delay(1000); // Wait for 1000 millisecond(s)
}
```

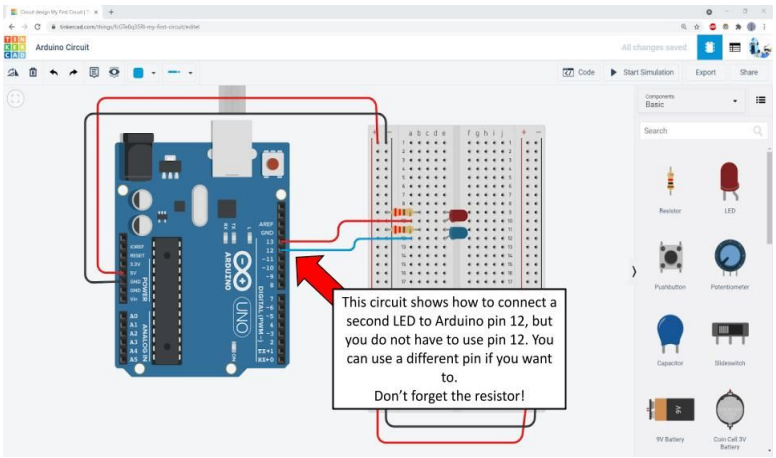


Step 10: Start the Simulation

Your LED should blink on and off, If your LED does not blink, carefully double-check your breadboard wiring.

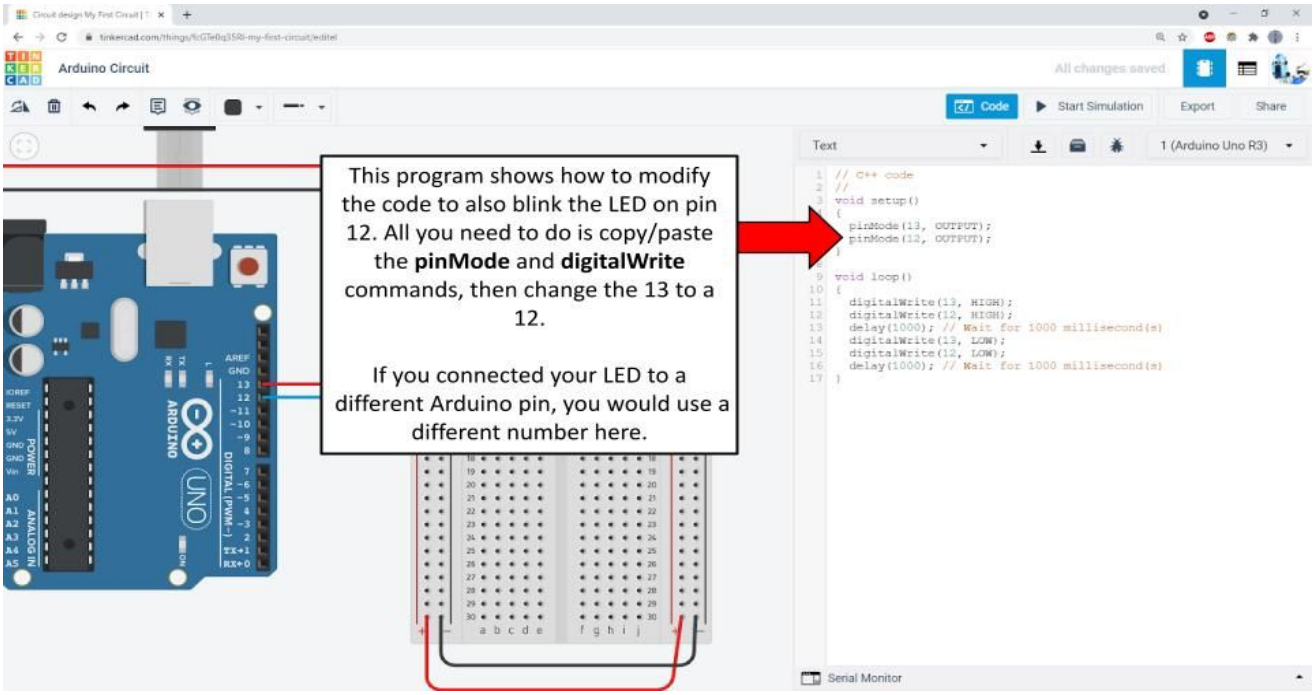


Step 11: Add the second LED.



Step 12: Write the code for 2 LED circuit (you can modify your existing program)

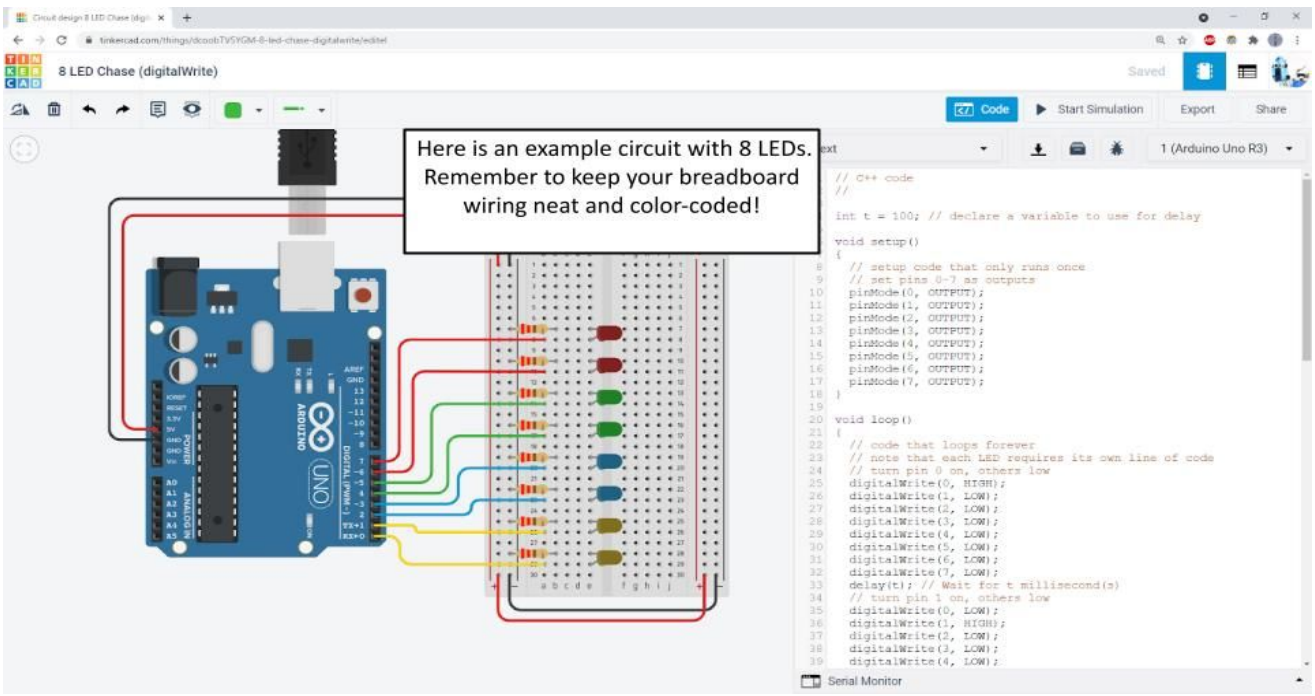
```
void setup()
{
 pinMode(13, OUTPUT);
 pinMode(12,OUTPUT);
}

void loop()
{
 digitalWrite(13, HIGH);
 digitalWrite(12, HIGH);
 delay(1000); // Wait for 1000 millisecond(s)
 digitalWrite(13, LOW);
   digitalWrite(12, LOW);
 delay(1000); // Wait for 1000 millisecond(s)
}
```



Congratulations! You have successfully completed the LED Blinking circuit

Challenge: Design your light show

- Use what you have learned to program your own LED light show!
- You can connect up to 14 LEDs to your Arduino
- Remember:
  -Use the pinMode command to set pins as outputs.
  -Use the digitalWrite command to turn pins on and off.
  -Use the delay command to make the program wait. You can use variables to make it easier to adjust your delay times.



Code :

```
int t = 100; // declare a variable to USE FOR DELAY

void setup()
{
 // setup code that only runs once
 // set pins 0-7 as outputs
 pinMode(0, OUTPUT);
 pinMode(1, OUTPUT);
 pinMode(2, OUTPUT);
 pinMode(3, OUTPUT);
 pinMode(4, OUTPUT);
 pinMode(5, OUTPUT);
 pinMode(6, OUTPUT);
 pinMode(7, OUTPUT);
}
void loop()
{
 // code that loops forever
 // note that each LED requires its own line of code
 // turn first LED on, others low
 digitalWrite(0, HIGH);
 digitalWrite(1, LOW);
 digitalWrite(2, LOW);
 digitalWrite(3, LOW);
 digitalWrite(4, LOW);
 digitalWrite(5, LOW);
 digitalWrite(6, LOW);
 digitalWrite(7, LOW);
 delay(t); // wait fot t millisecond(s)
 // turn pin 1st and 2nd LED on, others low
  digitalWrite(0, HIGH);
  digitalWrite(1, HIGH);
  digitalWrite(2, LOW);
  digitalWrite(3, LOW);
  digitalWrite(4, LOW);
  digitalWrite(5, LOW);
  digitalWrite(6, LOW);
  digitalWrite(7, LOW);
  delay(t); // wait fot t millisecond(s)
```

```
// turn 1st,2nd,3rd and 4th LED on, others low
  digitalWrite(0, HIGH);
  digitalWrite(1, HIGH);
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, LOW);
  digitalWrite(5, LOW);
  digitalWrite(6, LOW);
  digitalWrite(7, LOW);
  delay(t); // wait fot t millisecond(s)
 //turn 1st,2nd,3rd,4th and 5th LED on, others low
  digitalWrite(0, HIGH);
  digitalWrite(1, HIGH);
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, LOW);
  digitalWrite(6, LOW);
  digitalWrite(7, LOW);
  delay(t); // wait fot t millisecond(s)
 // turn 1st,2nd,3rd,4th,5th and 6th LED on, others low
  digitalWrite(0, HIGH);
  digitalWrite(1, HIGH);
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, HIGH);
  digitalWrite(6, LOW);
  digitalWrite(7, LOW);
  delay(t); // wait fot t millisecond(s)
 // turn 1st,2nd,3rd,4th,5th,6th and 7th LED on, others low
 digitalWrite(0, HIGH);
  digitalWrite(1, HIGH);
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, HIGH);
  digitalWrite(6, HIGH);
  digitalWrite(7, LOW);
  delay(t); // wait fot t millisecond(s)
```

```
// All LEDs ON
  digitalWrite(0, HIGH);
  digitalWrite(1, HIGH);
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, HIGH);
  digitalWrite(6, HIGH);
  digitalWrite(7, HIGH);
  delay(t); // wait fot t millisecond(s)
 // OFF all LEDs
 digitalWrite(0, LOW);
  digitalWrite(1, LOW);
  digitalWrite(2, LOW);
  digitalWrite(3, LOW);
  digitalWrite(4, LOW);
  digitalWrite(5, LOW);
  digitalWrite(6, LOW);
  digitalWrite(7, LOW);
  digitalWrite(8, LOW);
 delay(t); // wait fot t millisecond(s)
}
```

Reflection and Learnings (9 mins):

1. Share at least 3 skills or lessons that you learned today.
2. Why do you think we use resistors while connecting the LED? What will happen if we don't use resistors.
3. What did you or your team struggle with while doing this activity and why? How can you improve next time?
4. How did you contribute to the team and how do you think it helped? How else could you have contributed?
5. Research and find out the differences between an Integrated Circuit (IC) and a Microcontroller.

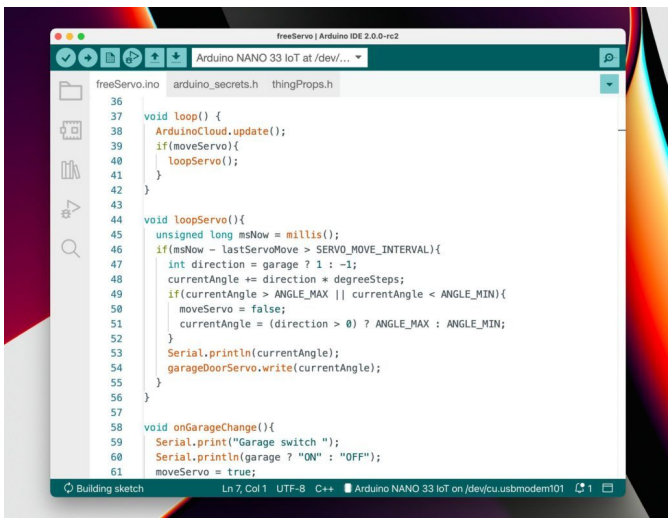
Use the space to draw or write your reflections and learnings

Introduction to Arduino (10 mins):

Arduino IDE is an open source software for programming Arduino boards, We already tried arduino simulation in Tinkercad now we are going to do the same activities using physical arduino board, we need to download and install Arduino IDE 2,0 software for programming arduino .

The Arduino IDE 2.0

The Arduino IDE 2.0 is an open-source project. It is a big step from its sturdy predecessor, Arduino IDE 1.x, and comes with revamped UI, improved board & library manager, debugger, autocompletes feature, and much more.



Materials Required:

1. Arduino IDE (Online Software)
2. Arduino Uno Board
3. LEDs
4. 220 OHM Resistor
5. Breadboard
6. Jumper Wires (Male-Male) - 12 Nos

: 60 minutes

Module: Basic Electronics

Grade: 6th to 9th

Importance/ Value:
It is important to learn the basics of programing to initiate curiosity and learning design. While working with Arduino in the ATL Lab.

Learning Goals:

1. Learners will be able to understand the basics of Arduino programming using Arduino IDE software.
2. Learners will be able to work with a Hardware Arduino Board & explore the working of it.

Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker- Focus Activity
10 Min	Introduction to arduino IDE
15 Min	Downloading & Installation of Arduino IDE
20 Mln	Activity- Basics of programming
09 Min	Reflection and Learnings

Icebreaker (5 mins):

Split the group into teams of 5-7 people and have them select one group member to be the “caller.” The caller will say, “everyone, please line up _____” at the beginning of each round. They can finish the phrase with “everyone, please line up from youngest to oldest” or “from shortest to tallest” or “in alphabetical order by your middle name.”

Then, begin a countdown of 10 seconds to see which group can get lined up first. This game requires you to communicate with the group about their place in line. There is also a friendly competition between groups. The fastest groups to line up is the winner!

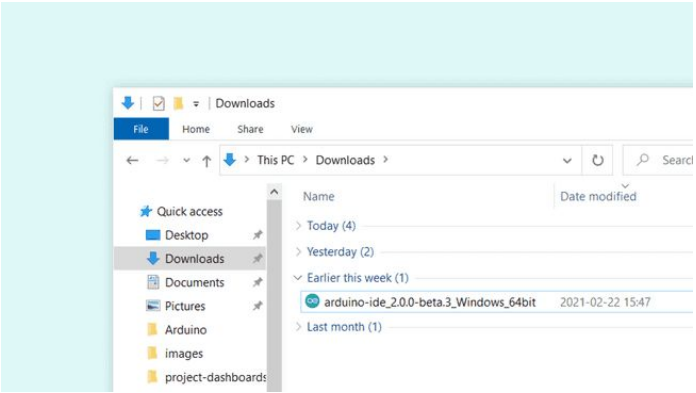
Steps to build an Arduino LED blinking activity using Arduino IDE:

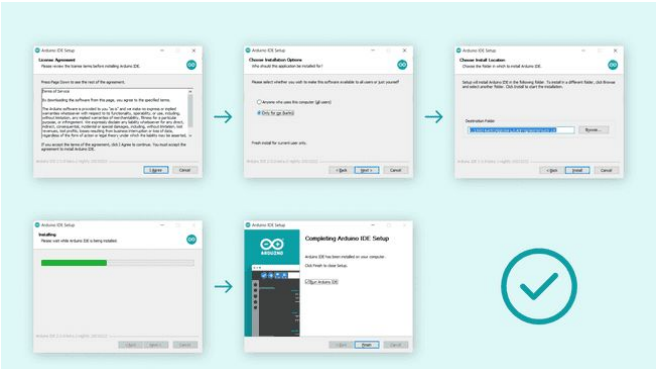
We have already learnt how to Blink an LED and have also explored designing an LED light show using Tinkercad in the previous class, today we are going to do the same with a real Arduino Uno board and the hardware components.

Step 1: Download & Install Arduino IDE 2.0 on your computer(If you already have Arduino software on your PC skip this step)

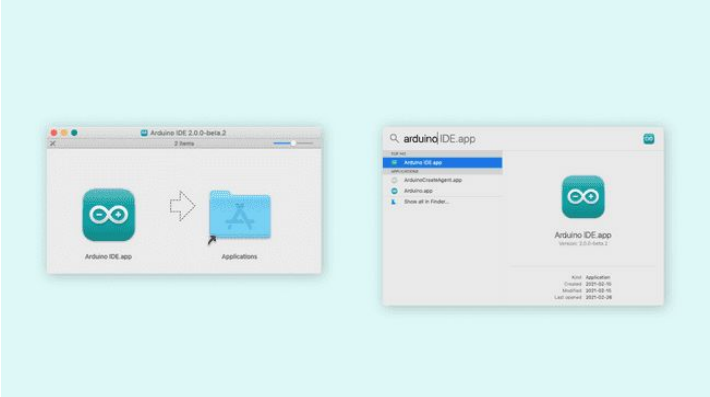
Goto https://www.arduino.cc/en/software and Download the appropriate version.

Windows Installation : To install the Arduino IDE 2.0 on a Windows computer, simply run the file downloaded from the software page.



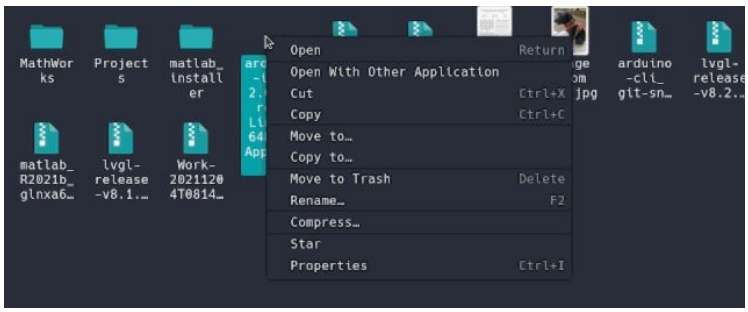


macOS Installation : To install the Arduino IDE 2.0 on a macOS computer, simply copy the downloaded file into your application folder.



Linux Installation : To install the Arduino IDE 2.0 on Linux, first download the AppImage 64 bits (X86-64) Before we launch the editor, we need to first make it an executable file.

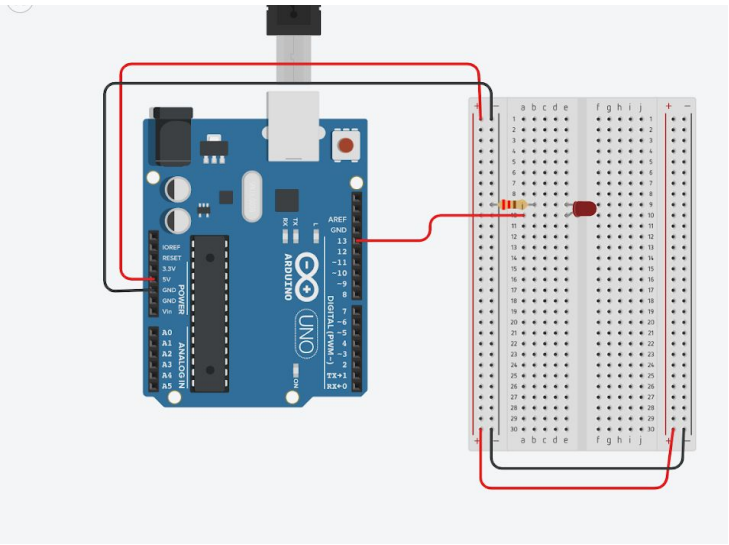
right-click the file -> choose Properties -> select Permissions tab -> click the Allow executing file as program box.



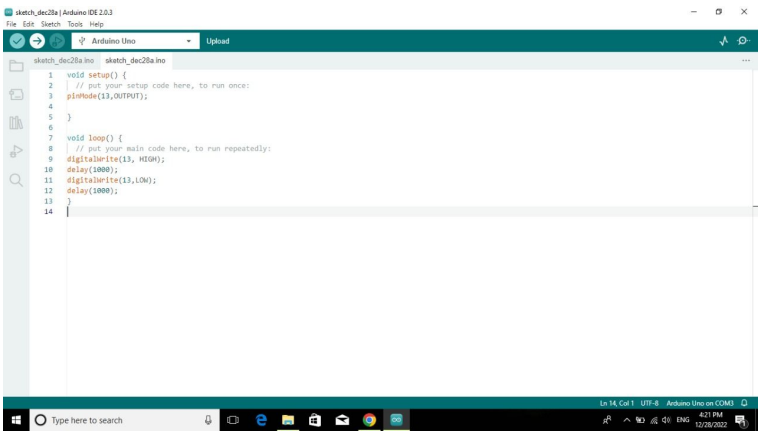
You can now double click the file to launch the Arduino IDE 2 on your Linux machine.

Step 2: Connect circuit for a single LED blinking as per the circuit diagram.

- Positive(Long Leg) of LED Connected to Pin no 13 of arduino.
- Negative (Short Leg) of LED to GND via resistor.



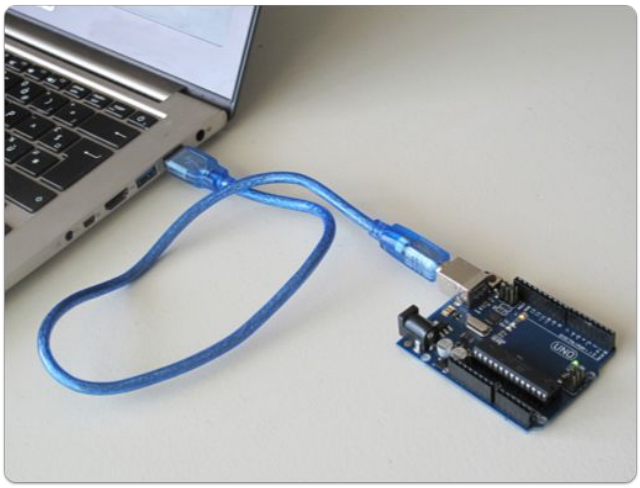
Step 3: Open Arduino software and write the code for LED Blinking.



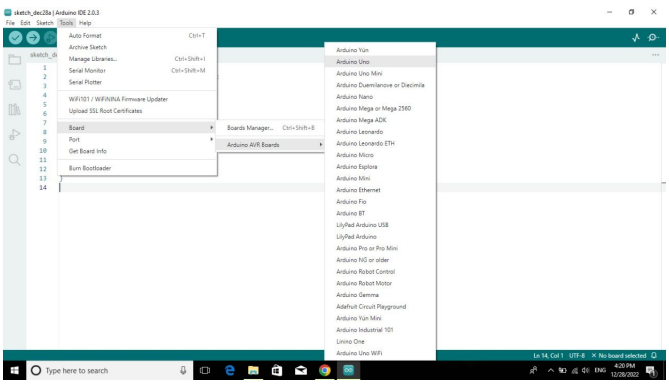
Code:

```
void setup()
{
 pinMode(13, OUTPUT);
}

void loop()
{
 digitalWrite(13, HIGH);
 delay(1000); // Wait for 1000 millisecond(s)
 digitalWrite(13, LOW);
 delay(1000); // Wait for 1000 millisecond(s)
}
```

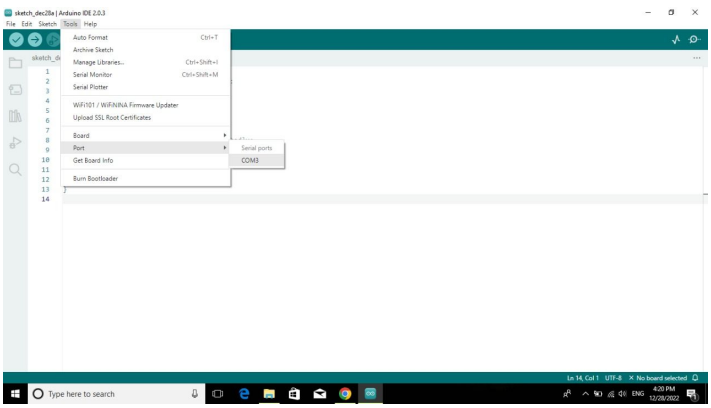
Step 4: Connect Arduino board to the computer USB via Arduino USB cable.



Step 5: Select Board, Go to Tools>Boards>Arduino AVR Boards>Arduino Uno.

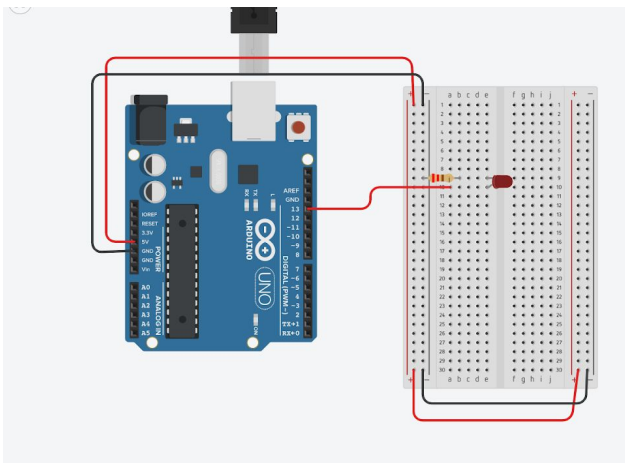


Step 6: Select Port, Go to Tools and select the COM Port (COM Port number will vary in my case it is COM3).

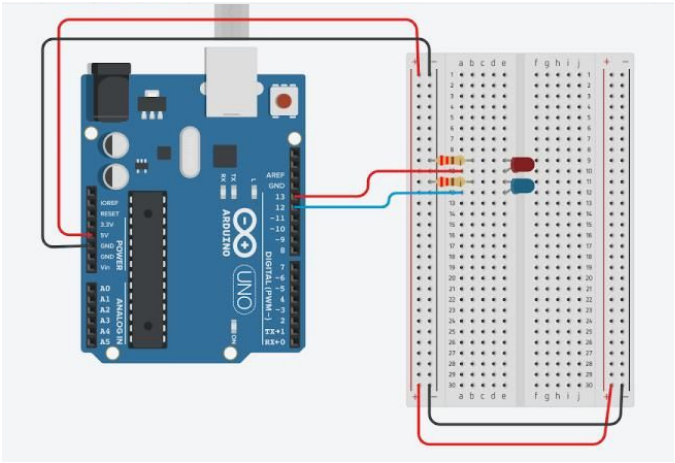


Step 7: Upload the code by clicking the Upload button in Arduino and wait for a minute, you will get a notification when the upload is completed.

Step 8: Check the Working, LED should blink in a 1 second interval.



Step 9 : Add the second LED to the circuit as per the circuit diagram



Step 10 : Write the code in arduino IDE and upload the code.

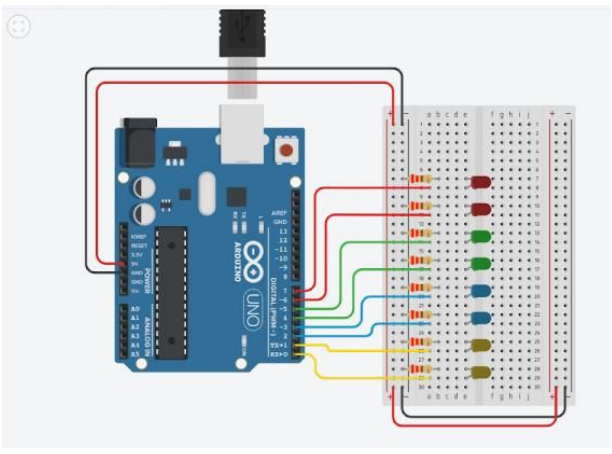
Code :

```
void setup()
{
 pinMode(13, OUTPUT);
 pinMode(12,OUTPUT);
}

void loop()
{
 digitalWrite(13, HIGH);
 digitalWrite(12, HIGH);
 delay(1000); // Wait for 1000 millisecond(s)
 digitalWrite(13, LOW);
   digitalWrite(12, LOW);
 delay(1000); // Wait for 1000 millisecond(s)
}
```

Try it yourself : Add more LEDs and Design a light show

- Use what you have learned to program your own LED light show!
- You can connect up to 14 LEDs to your Arduino
- Remember:
  Use the pinMode command to set pins as outputs.
  Use the digitalWrite command to turn pins on and off
  Use the delay command to make the program wait. You can use variables to make it easier to adjust your delay times.

Example : Light show with 8 LEDs



Code :

```
int t = 100; // declare a variable to USE FOR DELAY

void setup()
{
 // setup code that only runs once
 // set pins 0-7 as outputs
 pinMode(0, OUTPUT);
 pinMode(1, OUTPUT);
 pinMode(2, OUTPUT);
 pinMode(3, OUTPUT);
 pinMode(4, OUTPUT);
 pinMode(5, OUTPUT);
 pinMode(6, OUTPUT);
 pinMode(7, OUTPUT);
}
void loop()
{
 // code that loops forever
 // note that each LED requires its own line of code
 // turn first LED on, others low
 digitalWrite(0, HIGH);
 digitalWrite(1, LOW);
 digitalWrite(2, LOW);
 digitalWrite(3, LOW);
 digitalWrite(4, LOW);
 digitalWrite(5, LOW);
 digitalWrite(6, LOW);
 digitalWrite(7, LOW);
 delay(t); // wait fot t millisecond(s)
 // turn pin 1st and 2nd LED on, others low
  digitalWrite(0, HIGH);
  digitalWrite(1, HIGH);
  digitalWrite(2, LOW);
  digitalWrite(3, LOW);
  digitalWrite(4, LOW);
  digitalWrite(5, LOW);
  digitalWrite(6, LOW);
  digitalWrite(7, LOW);
  delay(t); // wait fot t millisecond(s)
```

```
// turn 1st,2nd,3rd and 4th LED on, others low
  digitalWrite(0, HIGH);
  digitalWrite(1, HIGH);
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, LOW);
  digitalWrite(5, LOW);
  digitalWrite(6, LOW);
  digitalWrite(7, LOW);
  delay(t); // wait fot t millisecond(s)
 //turn 1st,2nd,3rd,4th and 5th LED on, others low
  digitalWrite(0, HIGH);
  digitalWrite(1, HIGH);
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, LOW);
  digitalWrite(6, LOW);
  digitalWrite(7, LOW);
  delay(t); // wait fot t millisecond(s)
 // turn 1st,2nd,3rd,4th,5th and 6th LED on, others low
  digitalWrite(0, HIGH);
  digitalWrite(1, HIGH);
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, HIGH);
  digitalWrite(6, LOW);
  digitalWrite(7, LOW);
  delay(t); // wait fot t millisecond(s)
 // turn 1st,2nd,3rd,4th,5th,6th and 7th LED on, others low
 digitalWrite(0, HIGH);
  digitalWrite(1, HIGH);
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, HIGH);
  digitalWrite(6, HIGH);
  digitalWrite(7, LOW);
  delay(t); // wait fot t millisecond(s)
```

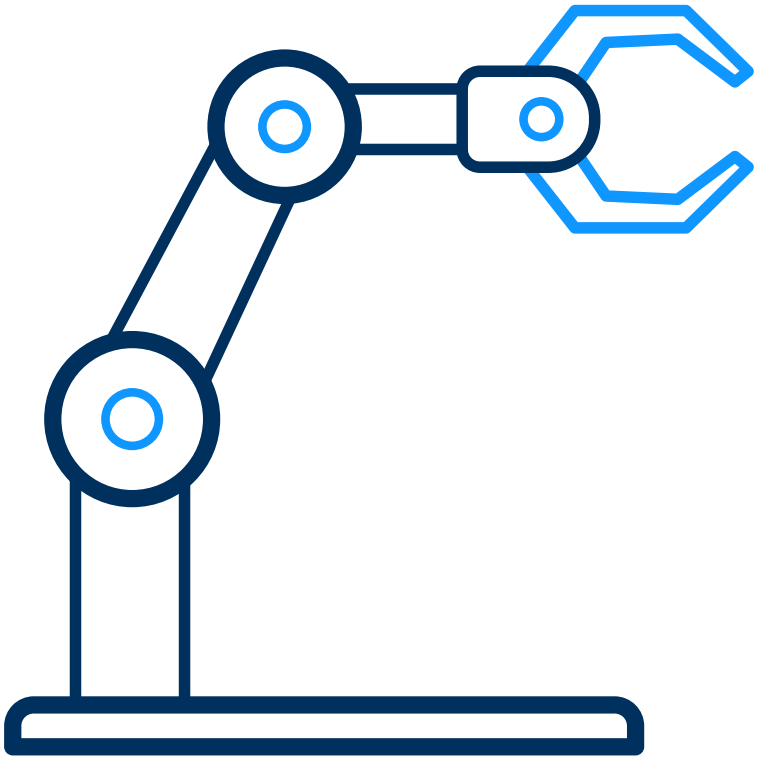
```
// All LEDs ON
  digitalWrite(0, HIGH);
  digitalWrite(1, HIGH);
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, HIGH);
  digitalWrite(6, HIGH);
  digitalWrite(7, HIGH);
  delay(t); // wait fot t millisecond(s)
 // OFF all LEDs
 digitalWrite(0, LOW);
  digitalWrite(1, LOW);
  digitalWrite(2, LOW);
  digitalWrite(3, LOW);
  digitalWrite(4, LOW);
  digitalWrite(5, LOW);
  digitalWrite(6, LOW);
  digitalWrite(7, LOW);
  digitalWrite(8, LOW);
 delay(t); // wait fot t millisecond(s)
}
```

Reflection and Learnings (9 mins):

1. What do you think is the purpose of a code? Can a controller work without a code?
2. How will you apply these skills outside class?
3. What did you or your team struggle with while doing this activity and why? How can you improve next time?
4. How did you contribute to the team and how do you think it helped? How else could you have contributed?
5. What communication challenges did you and your team face? How can your team communicate better next time?

Use the space to draw or write your reflections and learnings

MECHANICS



Introduction to Hydraulics (10mins)

Have you ever wondered how we lift cars from the bottom side? How do humans possibly life an object so heavy? Let's learn the science behind this!

A hydraulic system works by applying force at one point to an incompressible liquid, which sends a force to a second point. The process involves two pistons that are connected by an oil-filled pipe.

Hydraulic lifts are used mainly for lifting cars and heavyweights on construction sites, today we are going to make a model of a hydraulic lift using syringes, ice cream sticks, flexi tube etc.

We use a hydraulic lift because we need to apply only a small force for lifting a heavy weight (For Example you can lift a 3000 KG car using just your hands)

Source: almaslift.com

Materials Required:

1. Pencils
2. Ice cream sticks/ popsicle sticks
3. Cardboard sheets
4. Glue
5. Scissors
6. Cardboard Piece
7. Flexi Tube
8. Icecream Stick
9. Copper Wire(Single Strand Wire or a Straightened Paper Clip also Works)
10. Syringe - 2 Nos
11. Needle

: 60 minutes

Module: Mechanics

Grade: 6th to 9th

Importance/ Value:
Working with cardboard helps learners explore different materials and test out mechanical models encouraging them to to experience the power of hydraulics through hands-on learning.

Learning Goals:

1. Learners will be able to understand how power is transmitted through fluids.
2. Learners will be able to understand the working of hydraulic lift.

Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker- Focus Activity
10 Min	Introduction to module
15 Min	Understanding Robotics and the Types of Robots
20 Mln	Activity- Making a functional Robotic Arm
09 Min	Reflection and Learnings

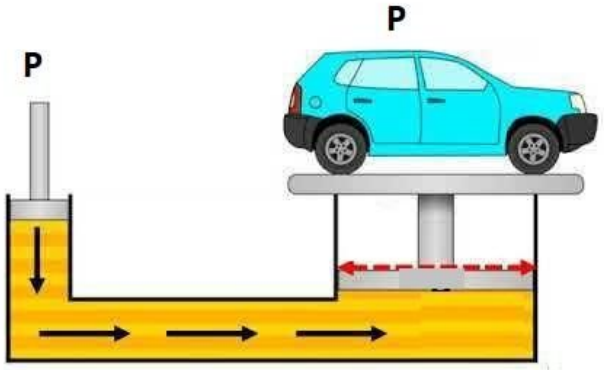
Icebreaker (5 mins):

Scatter yourselves around the ATL Lab and close your eyes once you have found your spot. The teacher will go around and tap one person on their shoulder and that student must make a noise (animal noises for example). The rest of the student must now find out who made the noise.

Principle of Hydraulic lift

This project is based on the famous law known as **Pascal's law.** Pascal's law can be stated when we apply pressure on the fluid inside a closed container. This force is transmitted to the liquid and wall of the container.

The concept of Pascal's law and its application to hydraulics can be seen in the example below, where a small amount of force is applied to an incompressible liquid on the left to create a large amount of force on the right.



Source: vedantu.com

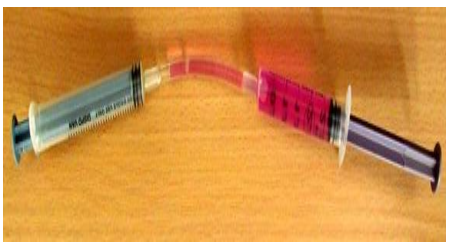
Activity: Hydraulic Lift (20 mins)

In this activity, you will learn how to build an hydraulic lift using using syringes,flexi tube, icecream stick, etc. This activity can be done in groups or individually.

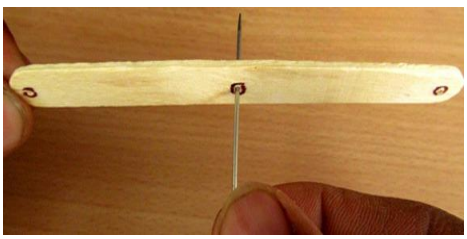
Now, let's learn to build an hydraulic lift!

Steps

Step 1: Fill the syringe & tube with colored water or regular water and connect the 2nd syringe to the other end of the tube.



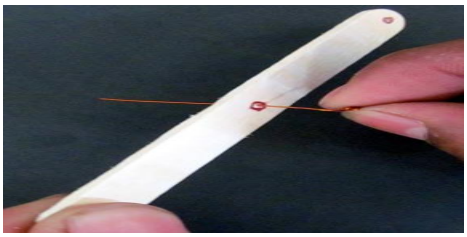
Step 2: Mark 3 holes in the icecream stick and make holes with a needle.



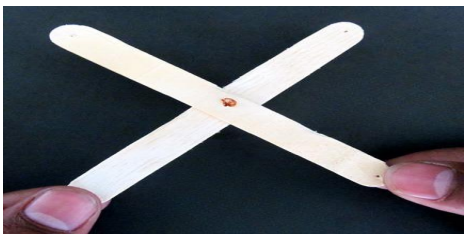
Step 3: Make holes in all icecream sticks.

Source: Arvindguptatoys.com

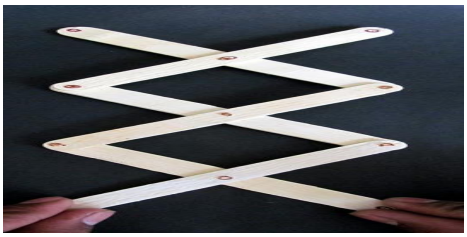
Step 4: Weave the wire into the holes.



Step 5: Join two ice cream sticks with copper wire and bend wire in both sides.

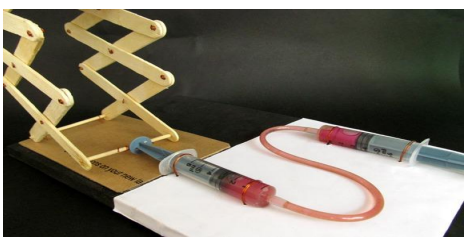


Step 6: Make a lazy-tongs structure with icecream sticks and wires.

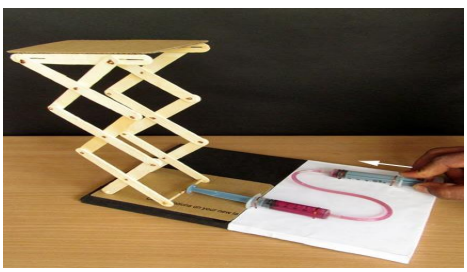


Step 7 : Connect two lazy tongs structures with a toothpick and tie the syringe with a wire.

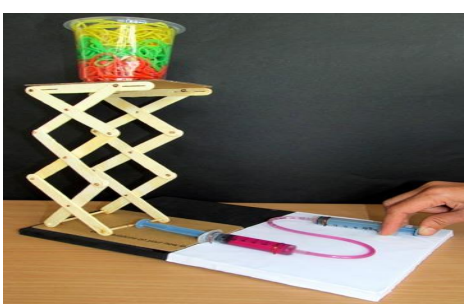
Step 8 : Your assemble should look like the image shown.



Step 9 : Fix a cardboard piece on the top using glue.



Step 10 : Hydraulic lift is ready!

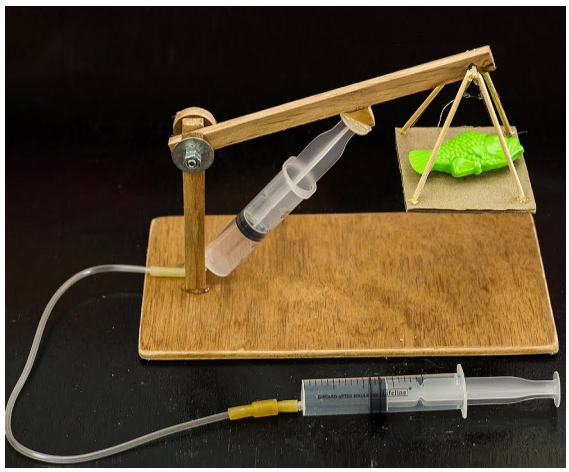


Reflection and Learnings (9 mins):

1. Can you describe Pascal's Law in your own words?
2. Have you ever seen a real-life example of Hydraulics? If yes, where?
3. What did you or your team struggle with while doing this activity and why? How can you improve next time?
4. How did you contribute to the team and how do you think it helped? How else could you have contributed?
5. What communication challenges did you and your team face? How can your team communicate better next time?

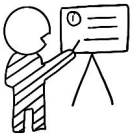
Try it yourself!

Using the concepts you have learnt so far, Try creating a Hydraulic crane as shown in the image.



Use the space to draw or write your reflections and learnings.

Introduction to Biomimicry



What Is Biomimicry?

Biomimicry is when people use ideas from nature to solve problems. Plants and animals have different ways to solve problems that have inspired inventions.

By copying the world around us, scientists believe they can find innovative solutions to almost any problem imaginable. Biomimetics (or biomimicry) has already led to the development of technology as diverse as airplanes, Velcro, windshield wipers, and sharkskin swimsuits.

Learn more about Biomimicry by watching this video.

Reflection (5 Min.)

1. After seeing this video, can you think of a few examples you have seen around you?
2. Now, in your own words, what do you understand by biomimicry?

: 60 minutes

Module: Mechanics

Grade: 6th to 9th

Importance/ Value

Biomimicry is a fascinating and novel topic of study for younger students. It helps in observing "what works" in nature and mimicking it to solve problems, create, and innovate.

Learning Goals

1. Learners will understand the working of vibrating motors.

2. Learners will know how we can make simple biomimetic robots from household objects.

Materials Required :

1. Wooden Clothes Pin - 1
2. Paper Clip - 3
3. Mobile Phone Flat Vibrating Motor - 1
4. 3V Button Battery (CR 2032) - 1
5. 3MM LED (Red in Red) - 2
6. Multi Strand Wire (5 CM Length) - 2
7. Tape
8. Glue Gun
9. Soldering Iron(Optional)
10. Wire Stripper or Scissors

Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Recap/Icebreaker
10 Min	Introduction: What Is Biomimicry? Examples and use cases of Biomimicry
05 Min	Introduction to Vibrating Motor
10 min	Pre-Activity Task
20 Mln	Activity: Making a Bug Bot
09 Min	Reflection and Learnings

Ice Breaker Activity (5 min) :

Think about all the electronic gadgets you see around, observe them in as much detail as possible. Draw what you see on a paper, mark the materials you have used in previous workshops

Recap

1. Give one word to describe the electronics act
2. What do you mean by sensors? Give examples of different types of sensors
3. What do you mean by transistor?
4. Expand on LDR
5. Which part of the electronics activity did you find difficult? And if so, why?

Introduction to Vibrating Motor (10 Min.)

Vibration motor is a compact size coreless DC motor used to informs the users of receiving the signal by vibrating, no sound. Vibration motors are widely used in a variety of applications including cell phones, handsets, pagers, and so on.

The main features of vibration motor is the magnet coreless DC motor are permanent, which means it will always have its magnetic properties (unlike an electromagnet, which only behaves like a magnet when an electric current runs through it); another main feature is the size of the motor itself is small, and thus light weight. Moreover, the noise and the power consumption that the motor produce while using are low. Based on those features, the performance of the motor is highly reliable.

The vibration motors are configured in two basic varieties: coin (or flat) and cylinder (or bar).

1. Cylindrical Vibrating motor:

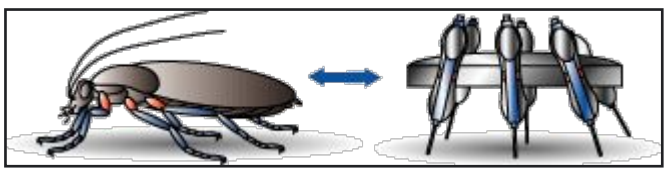
Question: Any guesses which vibrating kind of motor we will use in today's activity?

Today, we will use a flat vibrator motor for our Activity.

2. Flat Vibrating Motor:

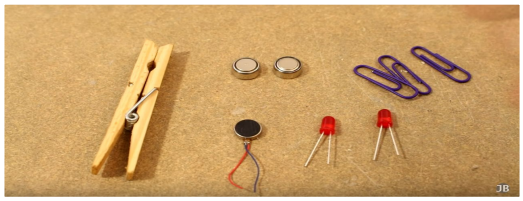
Pre Activity Task (10 Min):

Pick up the A4 cardboard sheets, Try and design a small biomimicry model of a bug and label them.

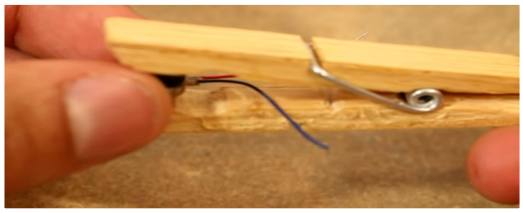


Activity : BugBot (20 Min.)

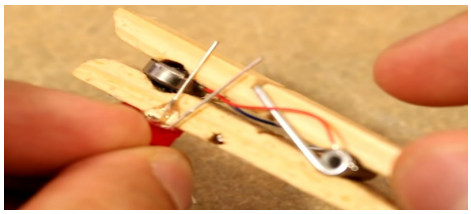
1. Arrange all the components on the top of your table.

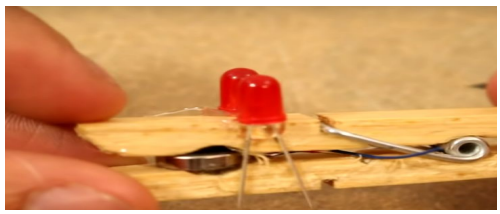


2. Place vibrating motor on the front side gap of the wooden clip.

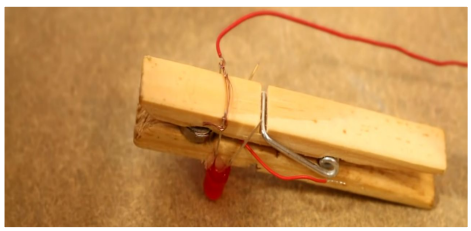


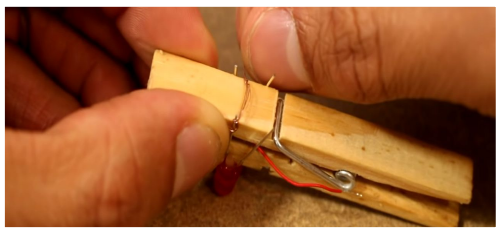
3. Glue the LED of either side of the wooden clip with a glue gun.



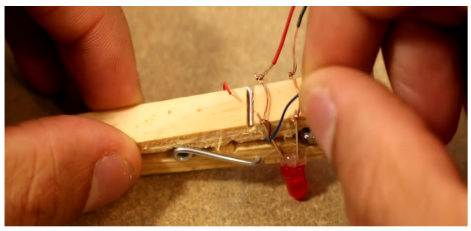


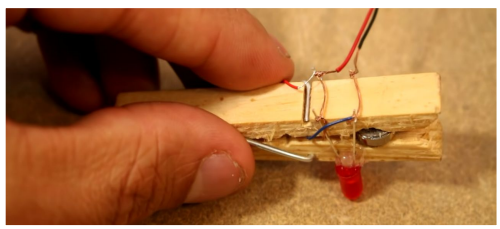
4. Connect Positive (+ve) of both LEDs with a Red wire.





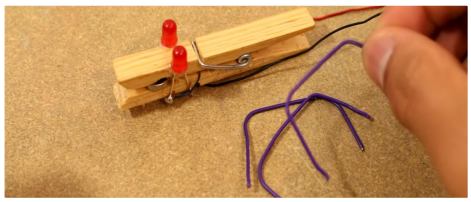
5. Connect one wire of vibrating motor (blue or red) to the common point of two LED Negatives. Connect another side of vibrating motor to a common point of two LED Positives.

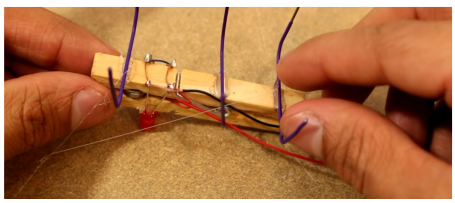


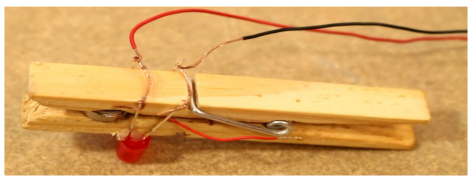


6. Straighten out paper clips and then fold into the following shape.

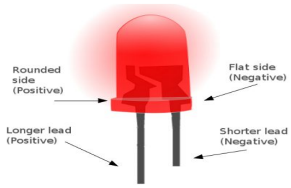
7. Cut excess parts using a wire stripper or scissors. Do the same for all three paper clips and glue them together.





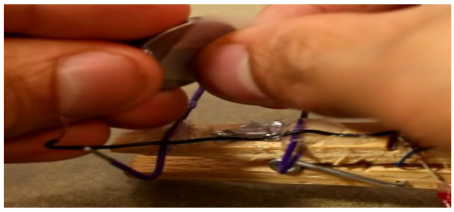


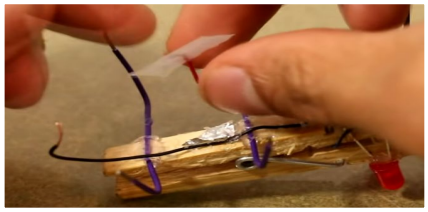
Connect Negative (-ve) of both LEDs with a Black wire



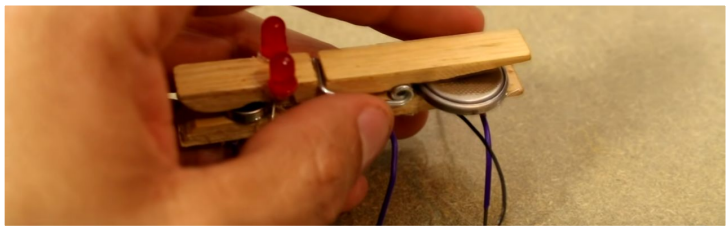
Students can identify +ve and -ve of LED

7. Connect red wire to positive terminal of battery using a tape.

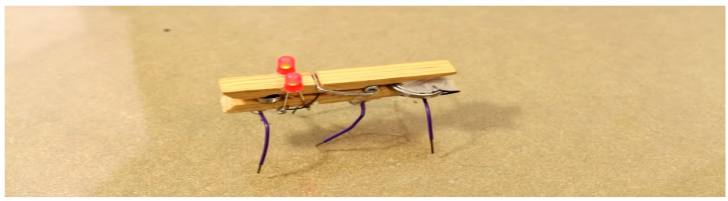




8. Place the battery into the gap of the wooden clip using a glue gun.



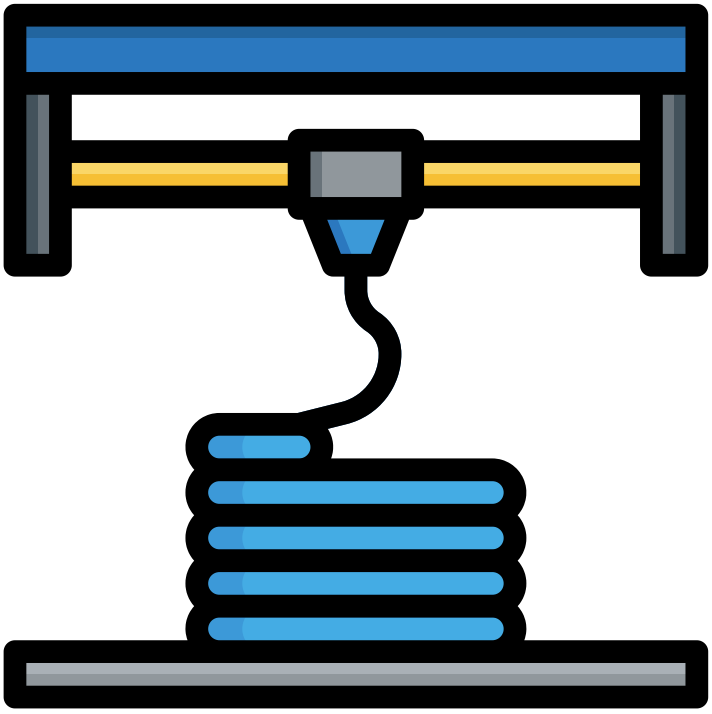
9. This is the final step, Connect black wire to the negative of the battery using a tape.



This bug bot will move around your desk!

We use CR2032 battery for this activity. Can you Identify the Positive and Negative in this battery?

3D DESIGNING & PRINTING



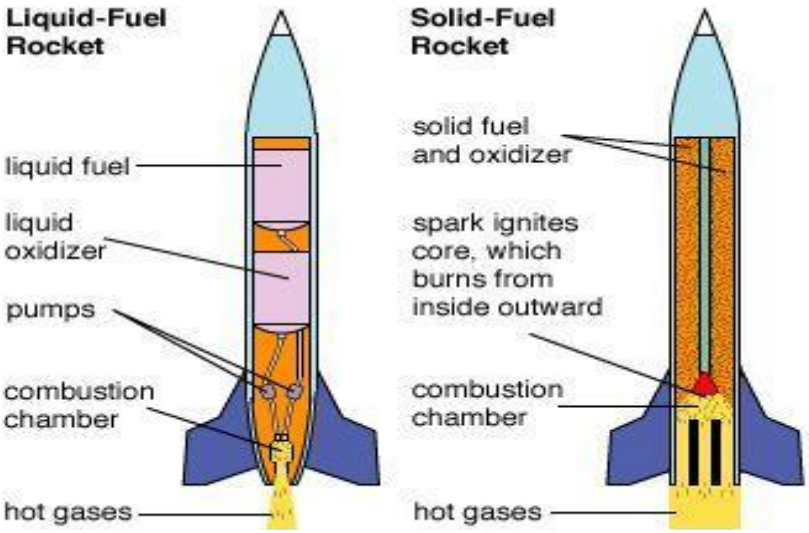
Introduction to Rockets

Rockets are devices that produce the force, or push, needed to move an object forward. Rockets are used to launch **spacecraft**. They are also used to shoot missiles and fireworks.

How Rockets Work?
Rockets carry fuel that is burned inside a chamber. The fuel burns when it is mixed with oxygen gas and ignited, or set on fire. As the fuel burns, it gives off hot gas that shoots out from an opening at the back of the chamber. The force of the gas moving backward pushes the rocket forward. This action is called jet propulsion.

The engines of a jet airplane also use jet propulsion. But unlike a jet engine, rockets carry their own oxygen supply. This makes rockets valuable in outer space, where there is no oxygen.

Rocket fuel can be liquid or solid. Two solid-fuel booster rockets launched the shuttle into space. Three liquid-fuel rocket engines allowed the shuttle to move in and out of orbit.



Source:kids.britannica.com

Materials Required :

1. Laptop with Internet Connection
2. 3D Printer

: 60 minutes

Module: 3D Design and Printing

Grade: 6th to 9th

Importance/ Value:
3D Printing and Design allows children to think, visualize their imaginative concepts and create prototypes on their own. It also enables the children to understand the basic design concepts while differentiating between 2D and 3D images.

Learning Goals:

1. Learners will be able to understand the basic concepts of 3D design.
2. Learners will explore and learn to use a simple 3D design software called Tinkercad.
3. Learners will design and 3D print a Rocket exploring the possibilities of 3D Printing.

Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker
10 Min	Introduction to module
20 Min	Activity
15 Min	Challenge
09 Min	Reflection and Learnings

Icebreaker (5 mins):

I went to market and bought a___

To play, Form a circle, one person starts off by saying, 'I went to market and bought a _____', adding a grocery item he or she would buy. The next player continues by saying, 'I went to market and bought a <first player's item> and a _____'. Each player continues, adding items to the list as they go along. When a player makes a mistake, they are eliminated and the game continues until there is only one person left.

Safety Measures:

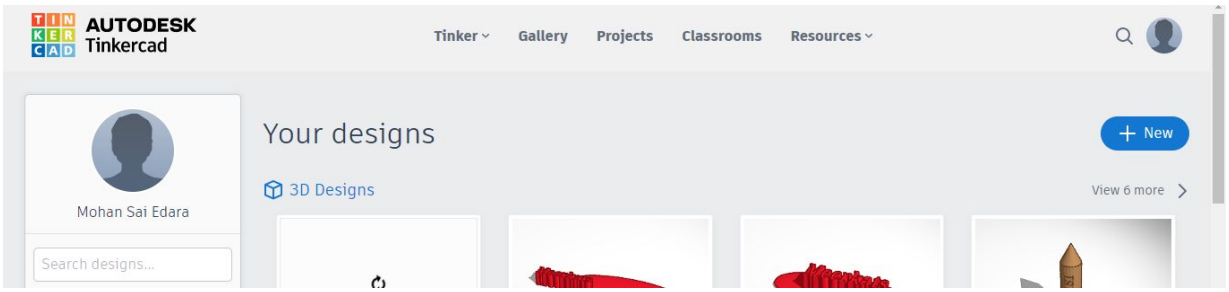
1. Put your 3D printer in an area which isn't easily accessible
2. Wear gloves when handling your 3D printer.
3. Keep a mental note in your head that your 3D printer gets very hot.
4. Only reach for your printer when you are certain it's off

Activity: Design & 3D Print a Rocket

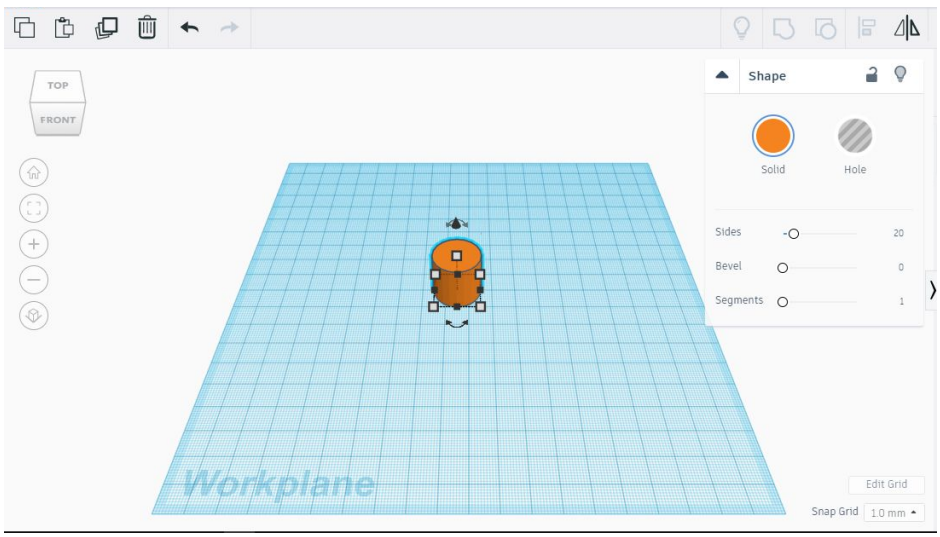
In this activity you will learn how to use a 3D design software called TinkerCad and Design a simple 3D Rocket and 3D print it.

Step 1: Open a browser and type tinkercad in the url and press enter. Click on the first result www.tinkercad.com and you will be redirected to a tinkercad website. Click on sign in and use your google account or autodesk account to sign in to the tinkercad website.

Step 2: After logging in, click on "+ New" to start a new design.

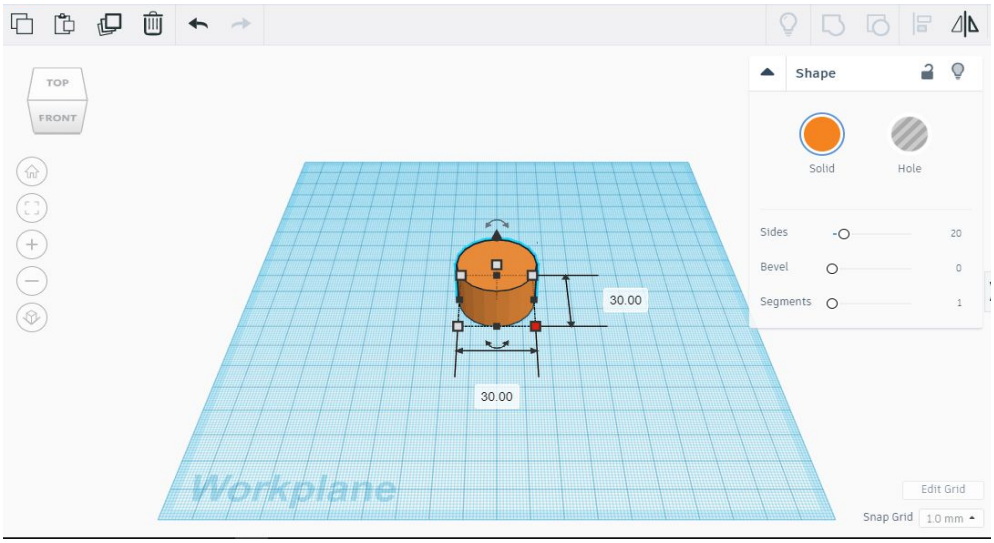


Step 3: Drag and drop a Cylinder from the basic shapes menu on to the work plane.

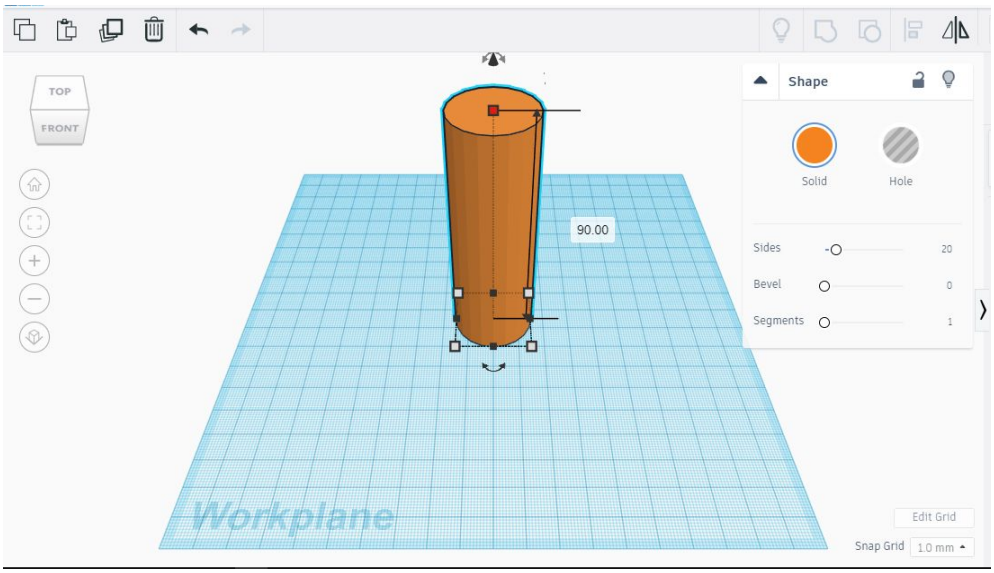


Source: tinkercad.com

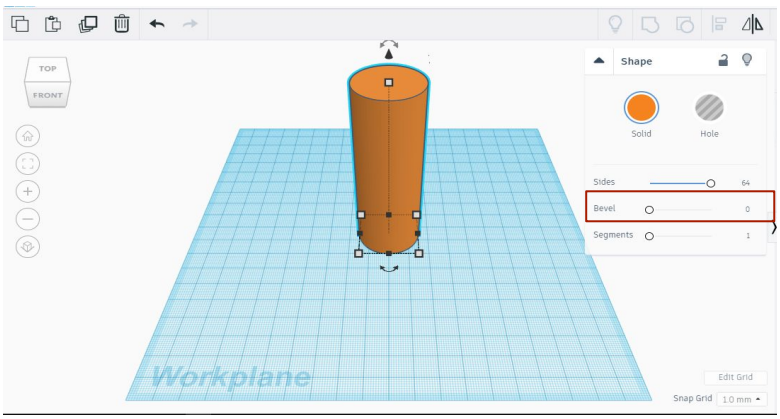
Step 4: Now let's increase the size of the cylinder to 30 mm. Hold the shift key and drag the corner of the cylinder to 30 mm.



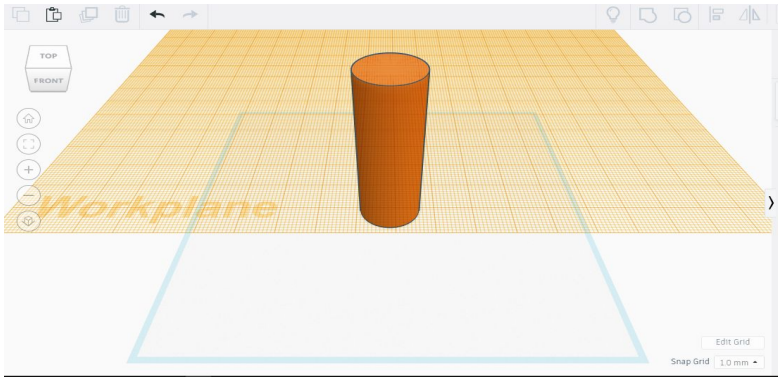
Step 5: Let's increase the height of the Cylinder to 90mm. Click on the middle dot on the top and enter 90.



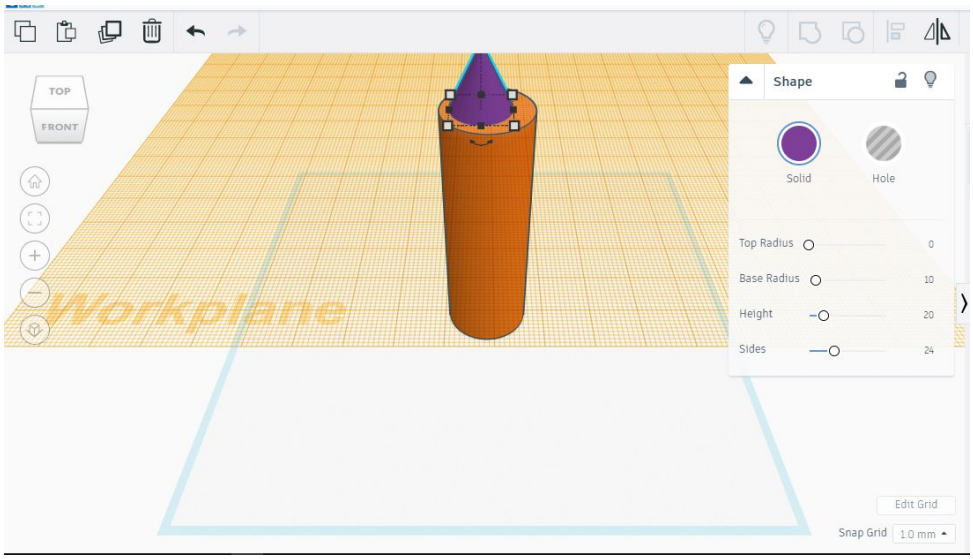
Step 6: Now let's make the surface of the rocket body smooth. In the shape toolbar increase the sides slide bar to 64.



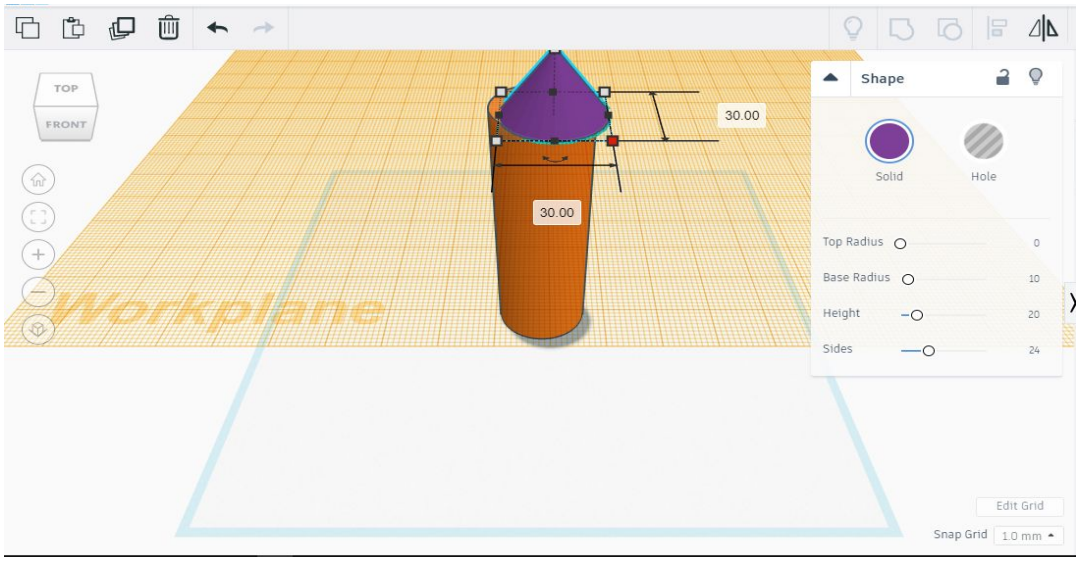
Step 7: Drag and drop a work plane and place it on the cylinder as shown in the image.



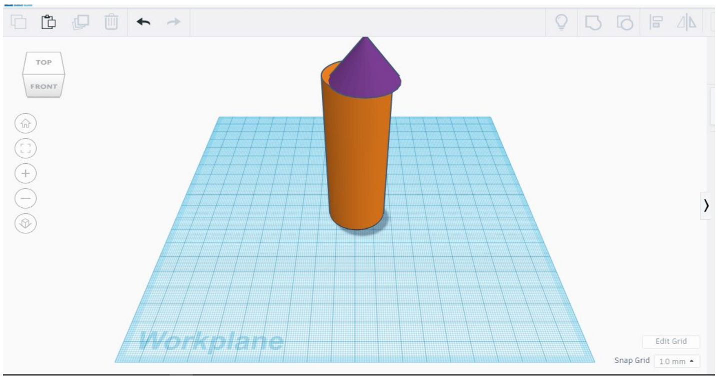
Step 8: Now let's make the rocket head. Drag and drop a cone from the basic shapes toolbar on to the cylinder top.



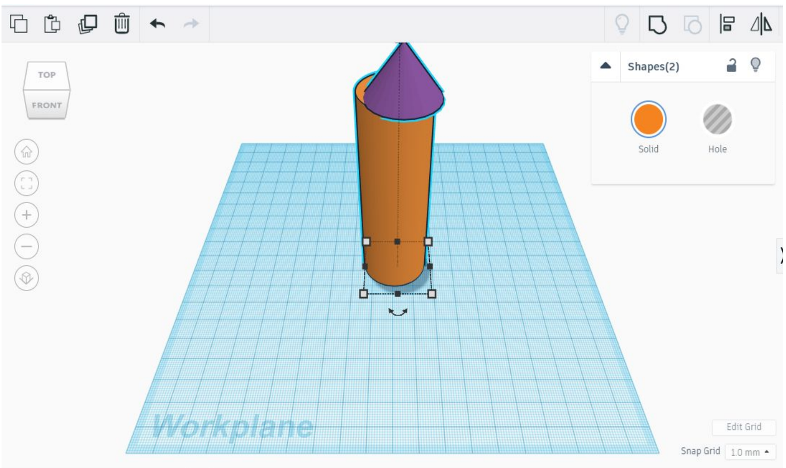
Step 9: Click on the corner of the shape and enter 30 on both sides to change the dimensions to 30 mm.

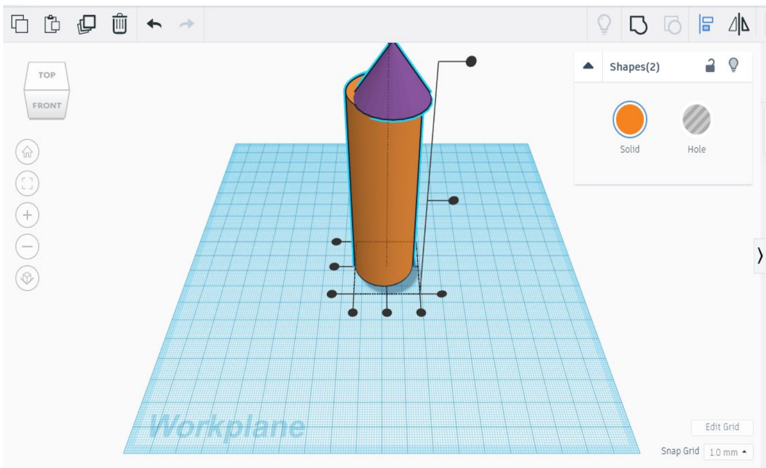


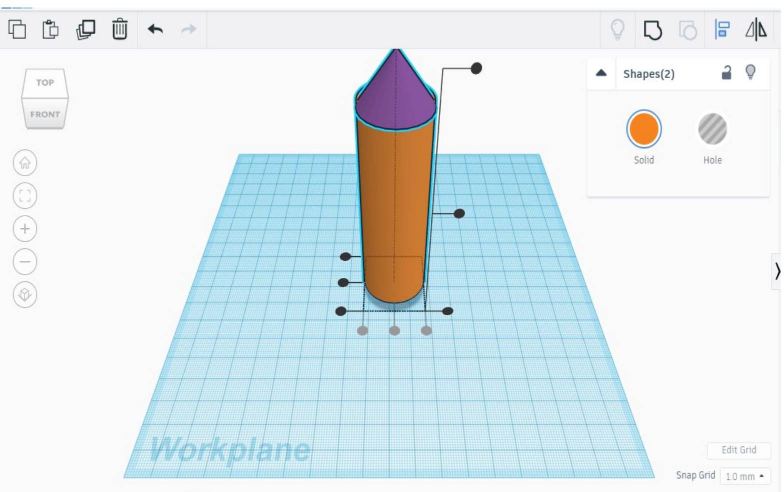
Step 10: Drag and drop a work plane on the basic work plane. This will remove the existing workplane we have added earlier.

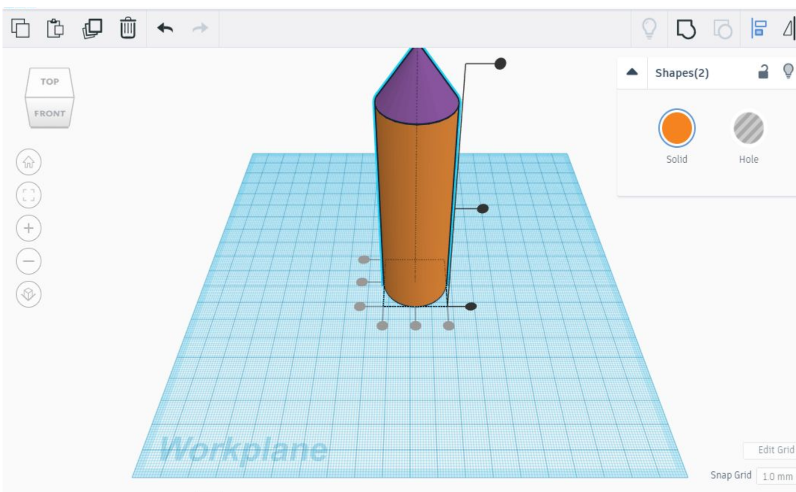


Step 11: Now let's Align the shapes. Select all the shapes and click on Align icon or Press L. Then center align the shapes as shown in the images.

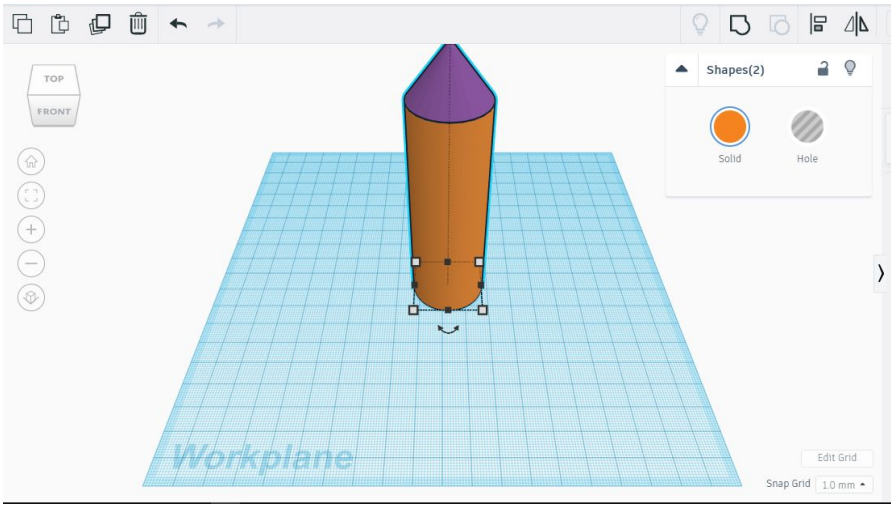




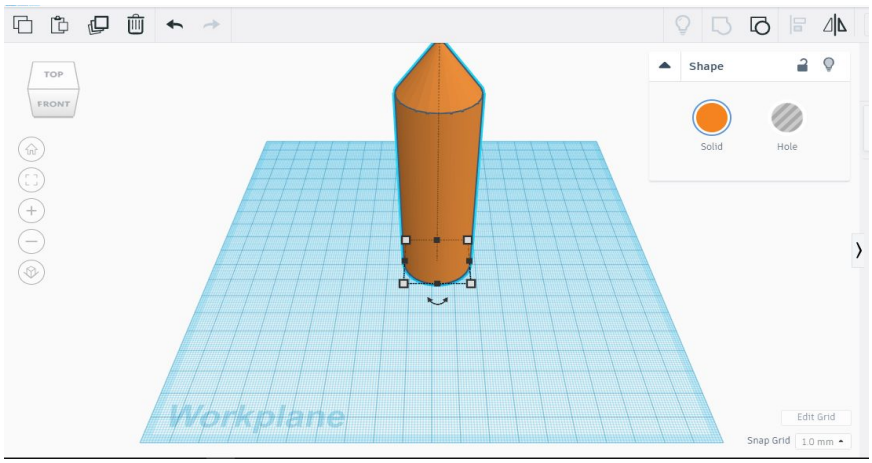




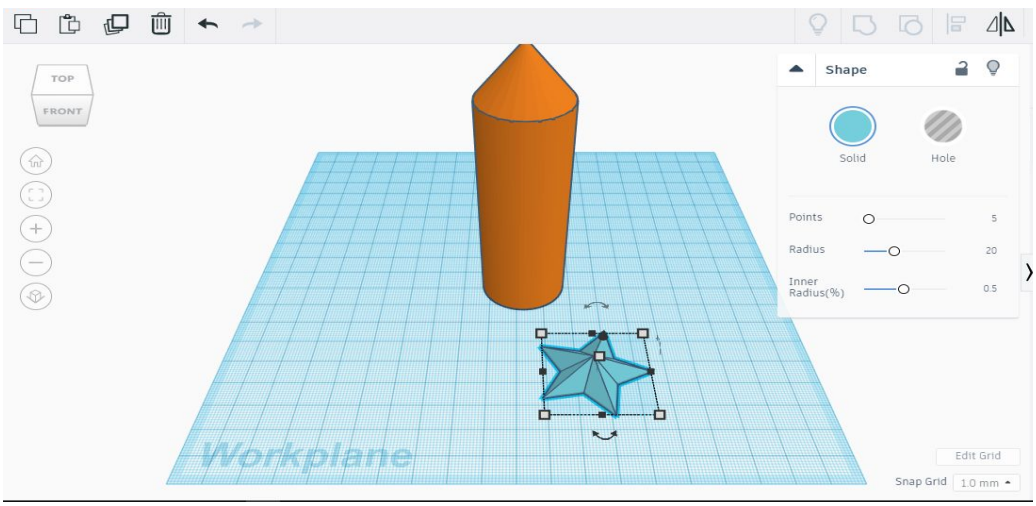
Step 12: Now click on the align icon again to deactivate the command.



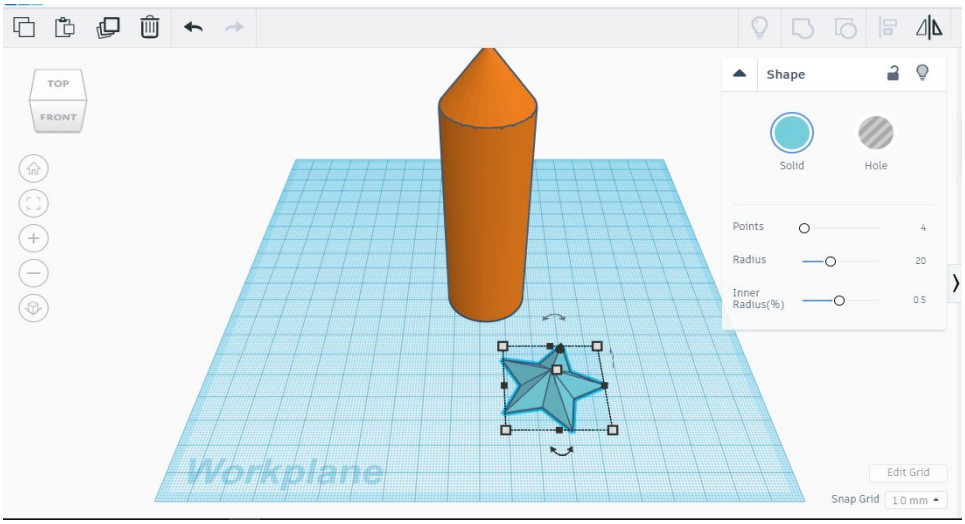
Step 13: Click on the Group icon or press Ctrl+G to group the shapes.

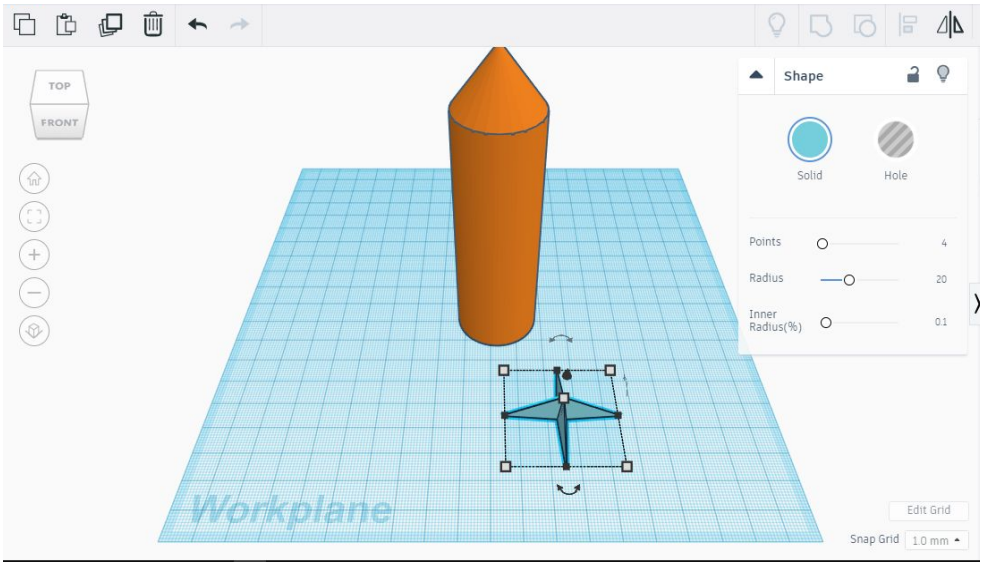


Step 14: Drag and drop a star from the shapes menu as shown in the image.

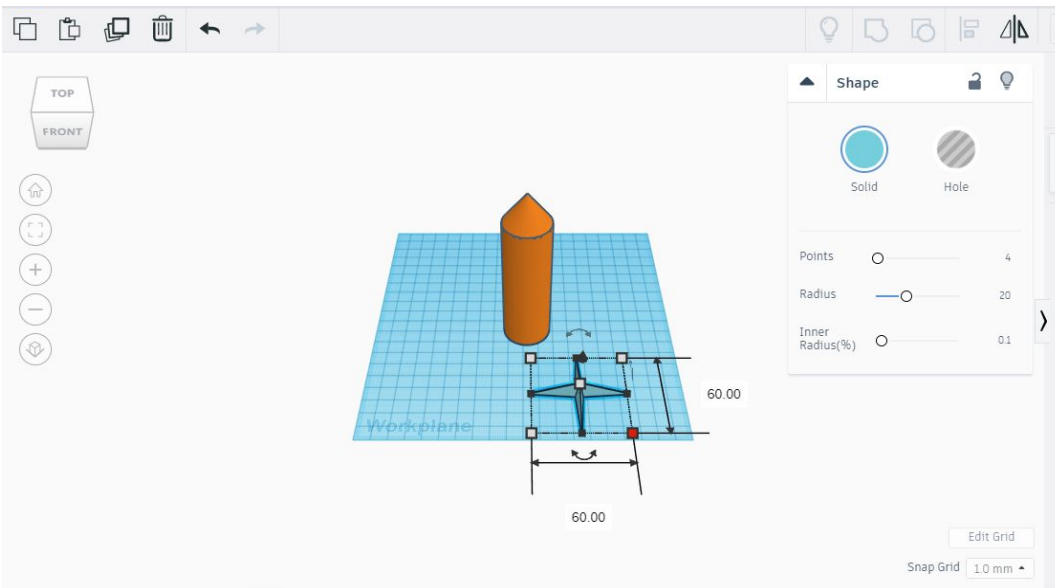


Step 15: Let's add 4 fins to the rocket. We need only 4 sides. Click on the points and enter 4 in place of 5 and then decrease the inner radius. Enter 0.1 in place of inner Radius%

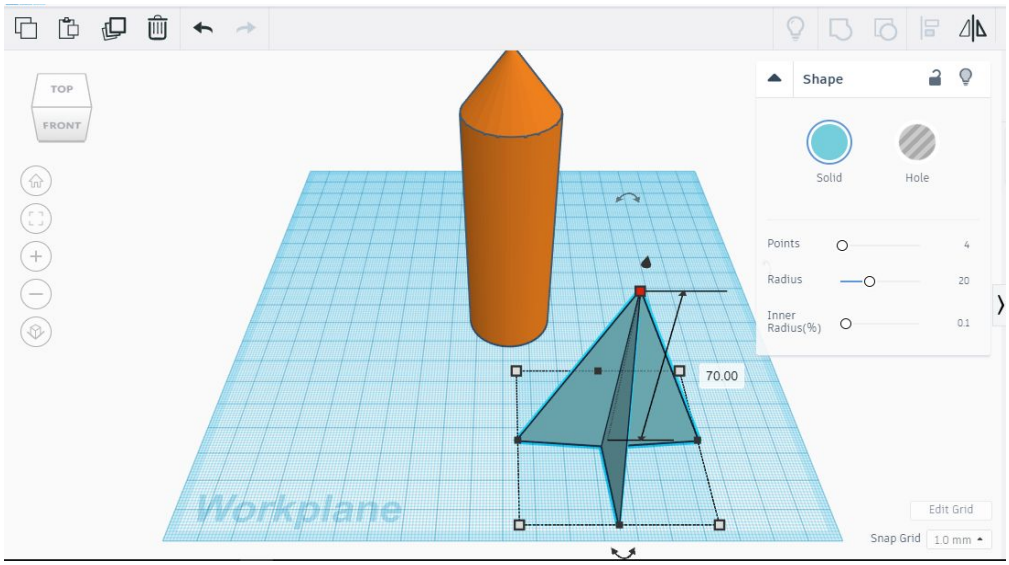




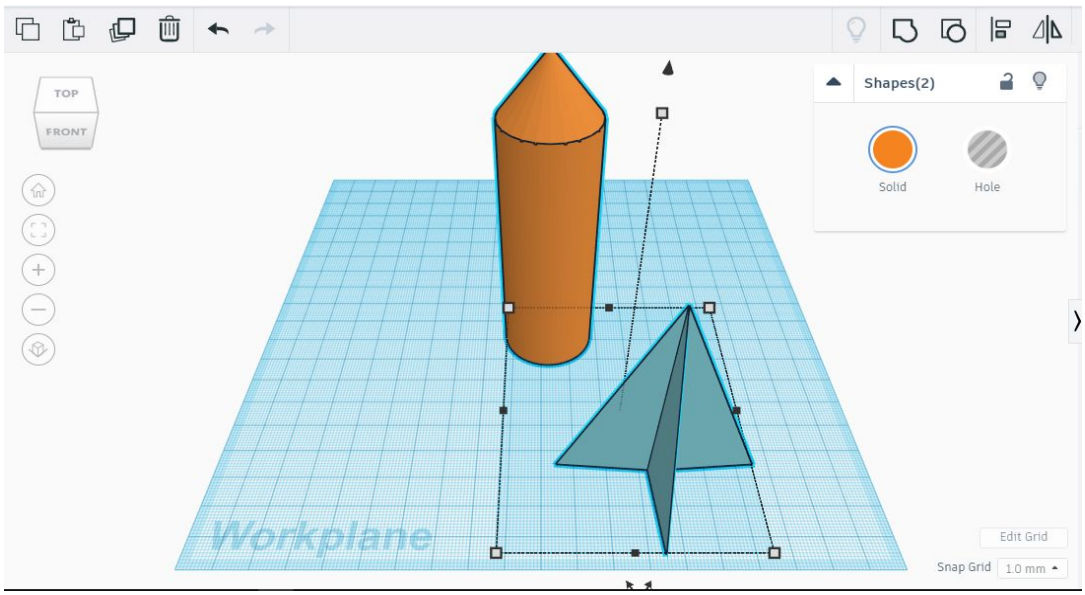
Step 16: .Click on the corner and change the dimensions to 60mm on both sides as shown in the image.

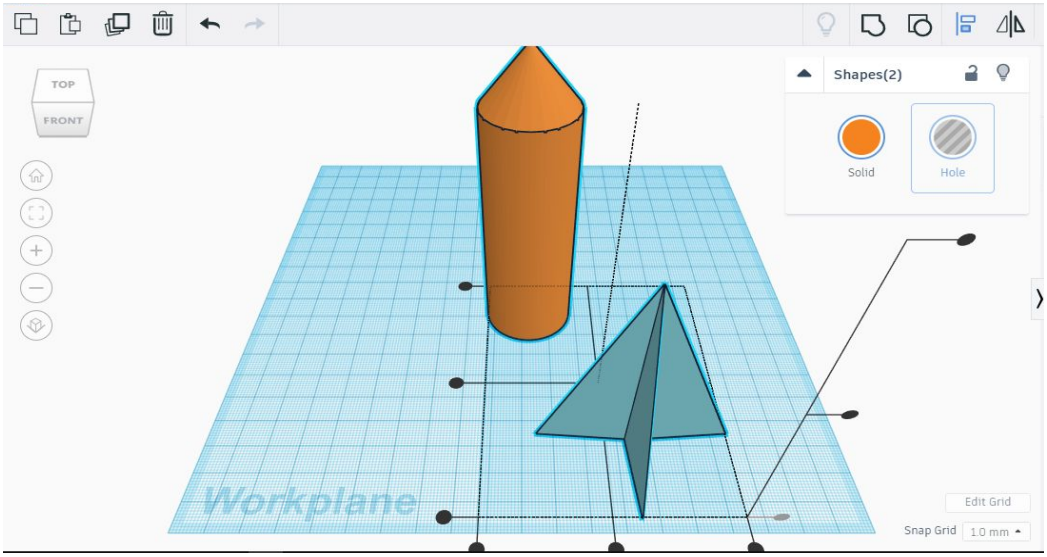


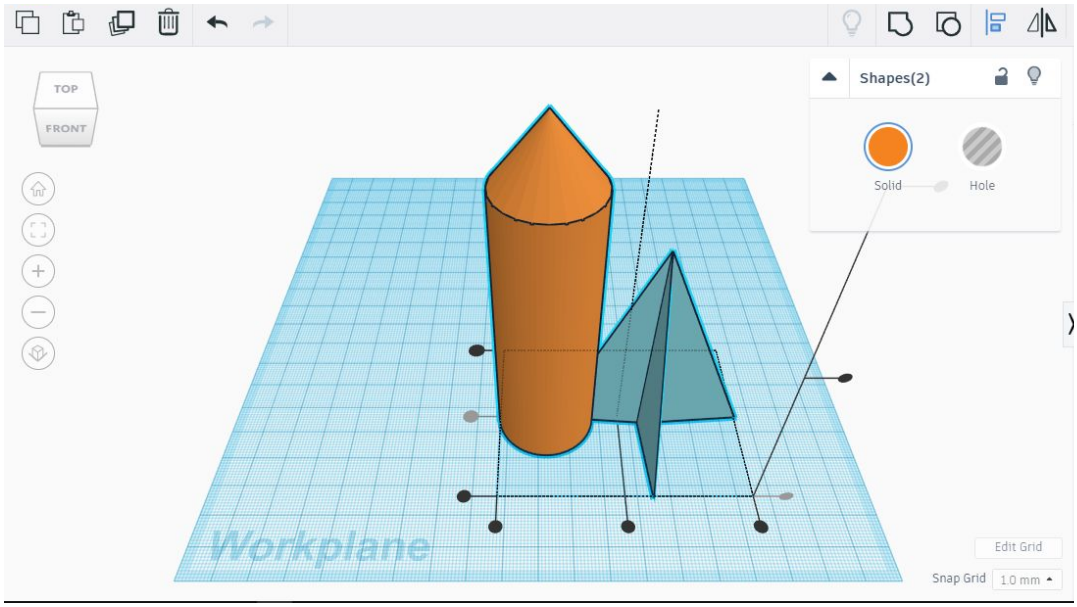
Step 17: Change the height of the fins to 70mm.

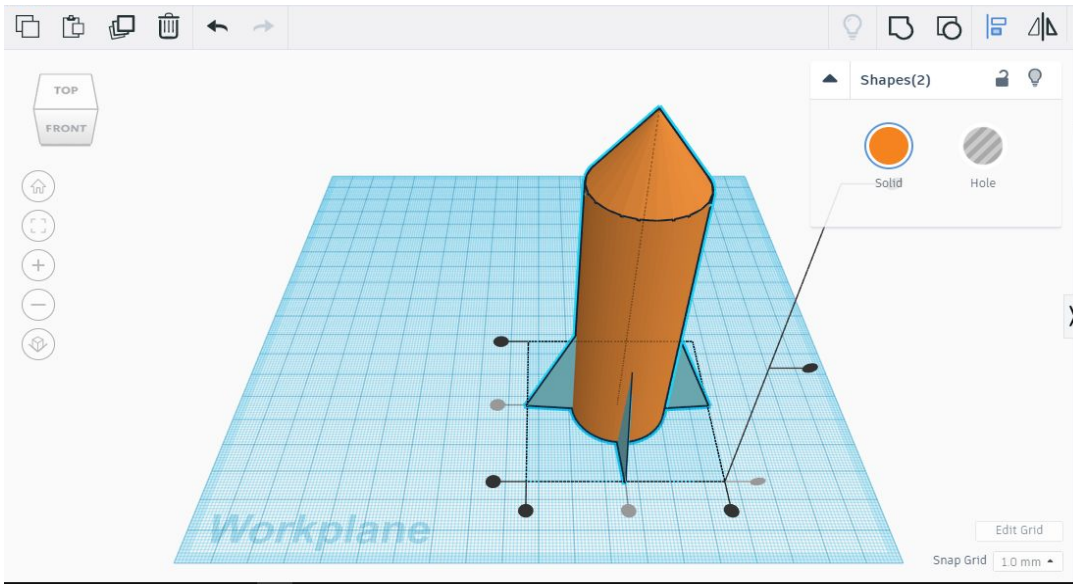


Step 18: Now, select the shapes and center align the rocket fins with the rocket body as shown in the images given below.

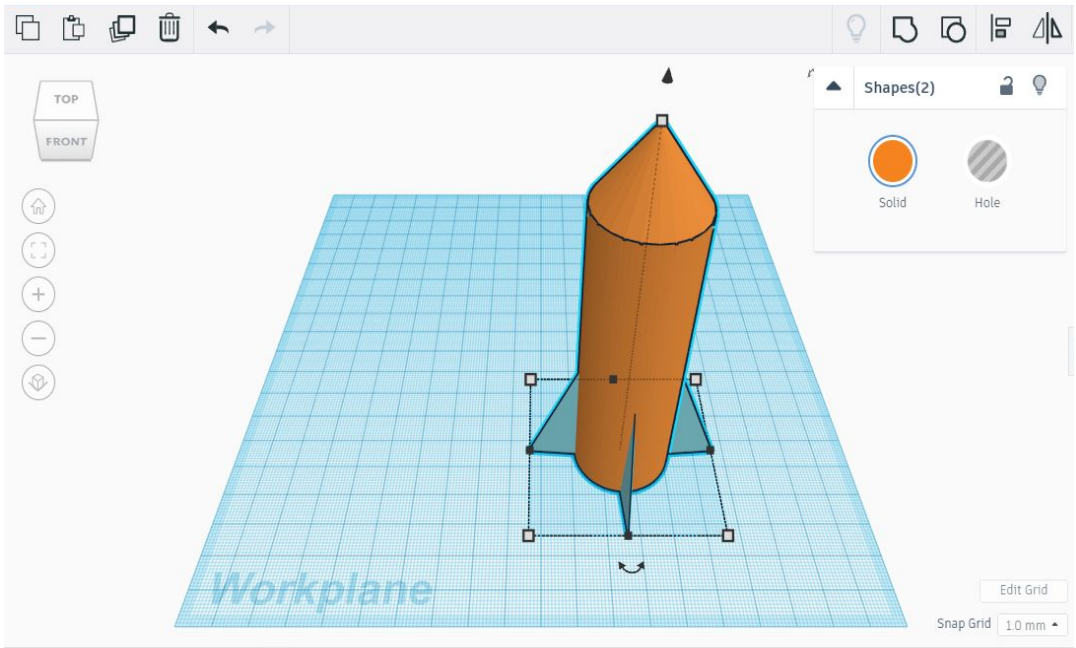


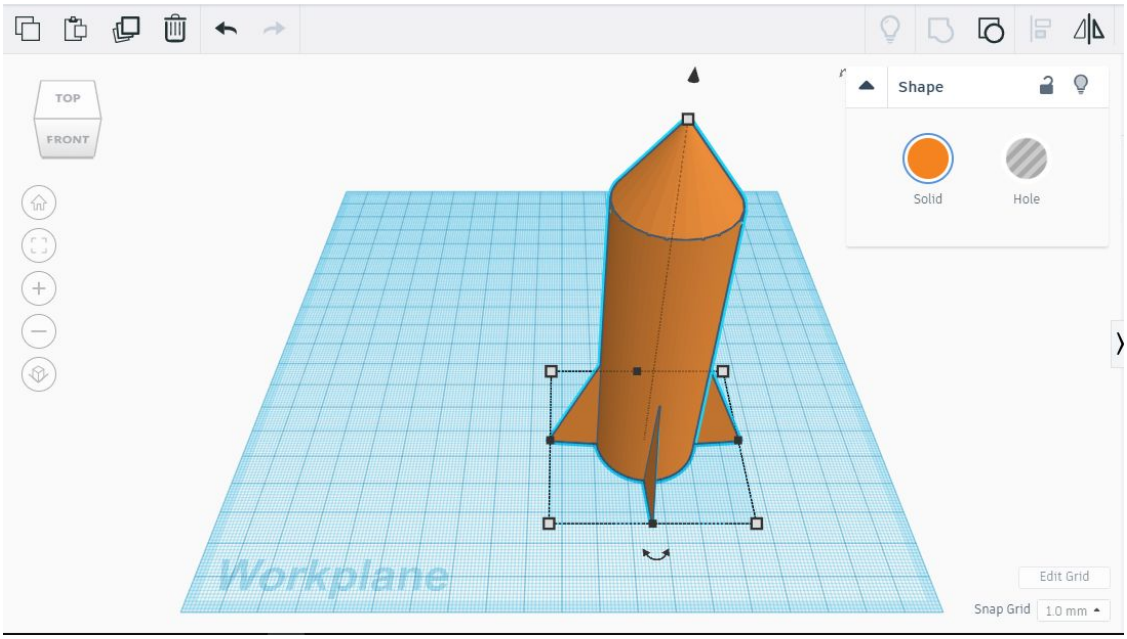






Step 19: .Select both the shapes and group them.





Challenge

<u>Try it yourself:</u> *Now that you have built the rocket, think of a creative name for your rocket and add it on the cylinder using the concepts you have learnt so far. An image has been added for your reference.*

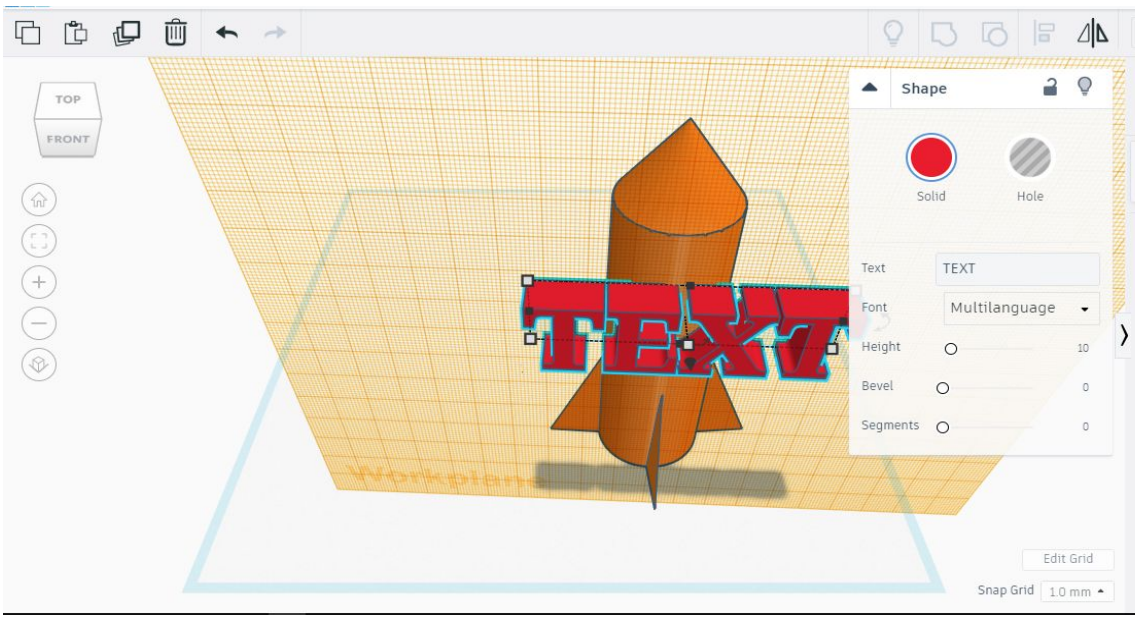


Image Source: tinkercad.com

Congratulations! You have successfully completed your activity.

Reflection and Learnings (9 mins):

1. What do you think is the difference between a Rocket and a Satellite?
2. What will happen when you use the “Workplane” option in TinkerCad?
3. Imagine yourself to be a rocket scientist, you along with your team got a chance to resign the shape of the rocket. Think creatively and draw your redesigned shape in the space given below.
4. What did you or your team struggle with while doing this activity and why? How can you improve next time?

Use the space to draw or write your reflections and learnings

Wonders of 3D Printing: 3D Printed House (10 mins):

What is a 3D printed house?

Houses that are designed and built using construction technologies that use the 3D printing method are known as 3D printed homes. 3D printed homes are faster to build and are superior to the traditionally constructed structures in many ways.

Created by Tvasta Manufacturing Solutions, a start-up founded by the alumni of IIT-Madras, this 3D-printed house overcomes the pitfalls of conventional construction.

The process of building a 3D-printed Tvasta house is not just different but a lot quicker than conventional construction. It is built with focus on reduced build-time, zero-waste construction and optimised production. To start with, the structure was printed using a special concrete mix through which large-scale 3D structures were made. The concrete mix is a base of ordinary cement which has a lower water-cement ratio. While concrete is the primary material for typical construction projects as well, the energy consumed to mix and transport it is way more than in 3D printing.

Source: housing.com

Materials Required :

1. Laptop with Internet Connection
2. 3D Printer

: 60 minutes

Module: 3D Design and Printing

Grade: 6th to 9th

Importance/ Value:
3D design offers students the ability to sketch out their concepts and even their ideas and model them in the real world. The excitement and enthusiasm come naturally to students when they can touch and see things in real life rather than trying hard to imagine a picture in their minds.

Learning Goals:
1. Learners will be able to understand the basic concepts of 3D design.
2. Learners will explore and learn to use a simple 3D design software called Tinkercad.
3. Learners will design and 3D print a mobile holder exploring the possibilities of 3D Printing.

Time	Description
01 Min	Check-in-Experience (CIE
05 Min	Icebreaker- Six word story
10 Min	Introduction to 3D Printed House
35 Min	Activity: Design and 3D Print a mobile holder.
09 Min	Reflection and Learnings

Icebreaker (5 mins): Six word story

Make students describe their summers in a complete sentence using only six words. Have them switch papers with a classmate that has to add a comment comprised of only six words. It may appear easy but it's a lot more difficult than it seems.

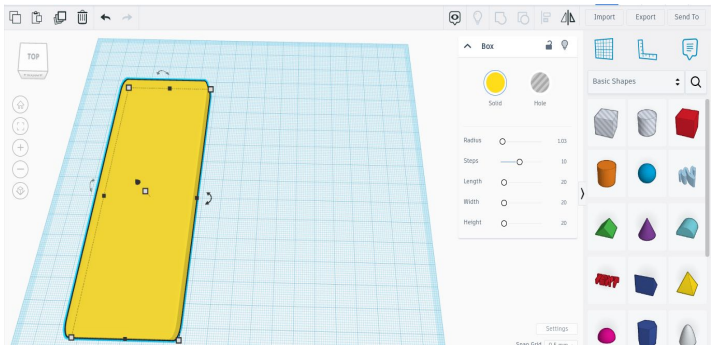
Safety Measures:

1. Put your 3D printer in an area which isn't easily accessible
2. Wear gloves when handling your 3D printer.
3. Keep a mental note in your head that your 3D printer gets very hot.
4. Only reach for your printer when you are certain it's off

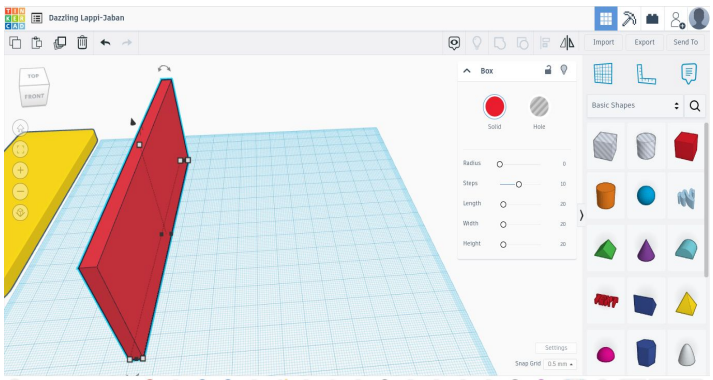
Activity: Design & 3D Print the Mobile holder

In this activity you will learn how to use a 3D design software called TinkerCad and Design a simple 3D Mobile Holder and 3D print it.

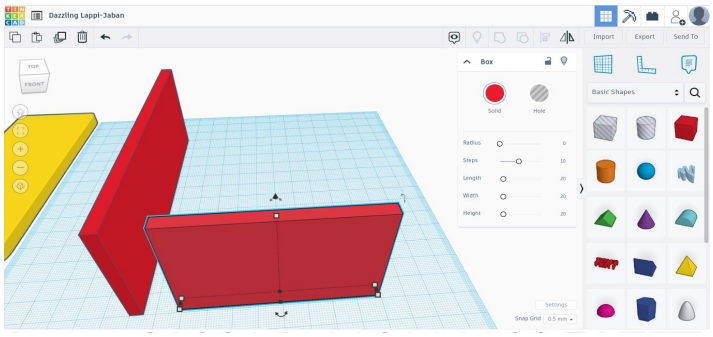
Step 1: Login in to TinkerCad Website.
First Let's create the mobile phone's shape by inserting a box shape from the basic shapes menu and change the dimensions to approximate the size of a mobile phone (130MMX50MMX8MM).



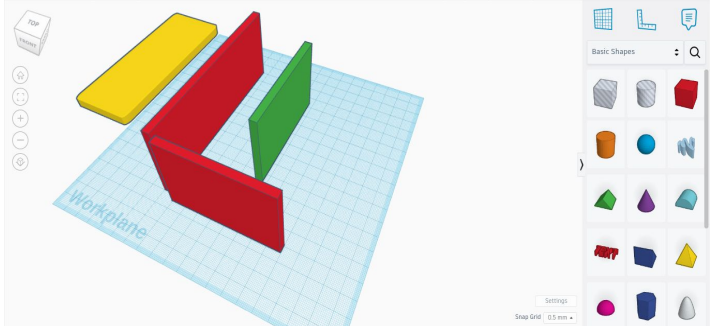
Step 2: Drag and drop the Box Shape from the basic shapes menu and change its dimensions to (130MMX50MMX5MM).



Step 3: Insert one more Box Shape and change its dimensions to (80MMX50MMX5MM) and rotate it to 90 Degrees as shown in the image.

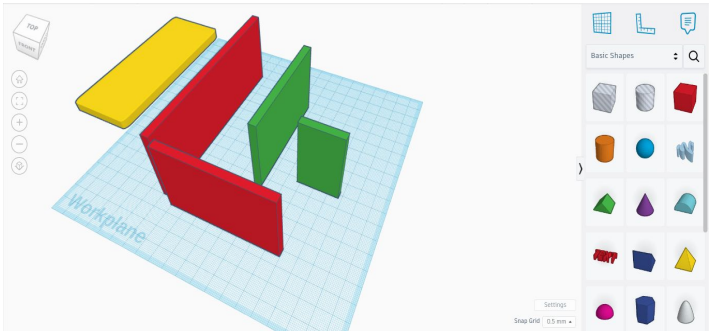


Step 4: Insert one more Box Shape and change its dimensions to (80MMX50MMX5MM) - *Marked in Green Color for better understanding*

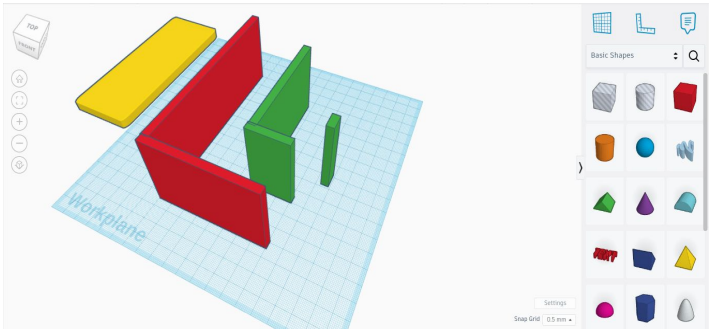


Source: tinkercad.com

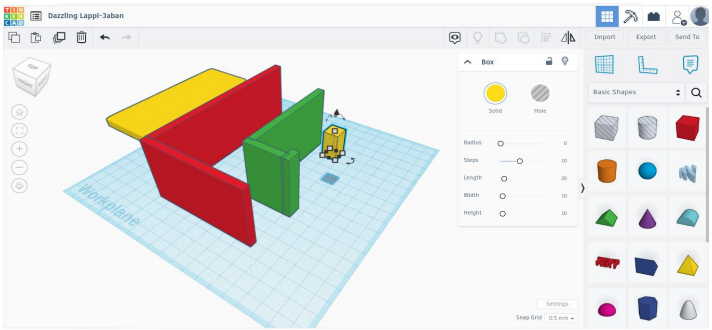
Step 5: Insert one more Box Shape and change its dimensions to (30MMX50MMX5MM.)



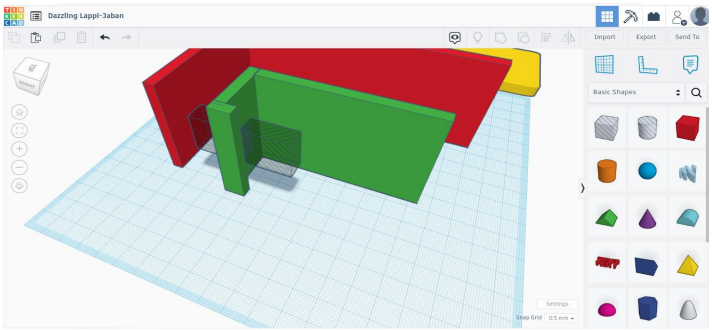
Step 6: Insert another Box Shape and change its dimensions to (10MMX50MMX5MM)



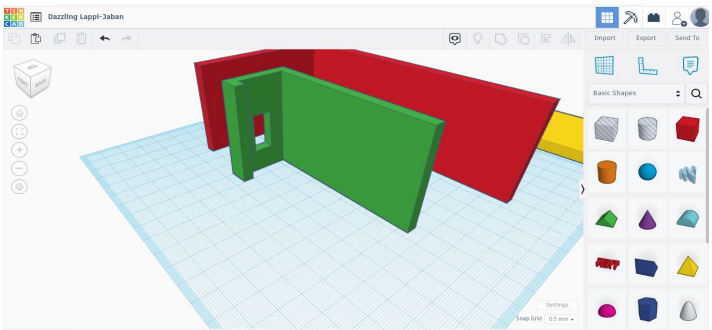
Step 7: Need to create a hole in the mobile holder for the charging cable, insert a small box shape (20MMX10MMX10MM). We need to subtract that from the green part.



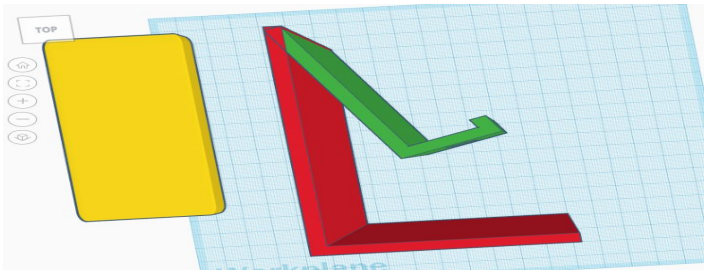
For creating holes we need to change the box property from Solid to Hole



Step 8: Align and select all 3 parts of green part by pressing Ctrl + G (Shortcut for grouping)

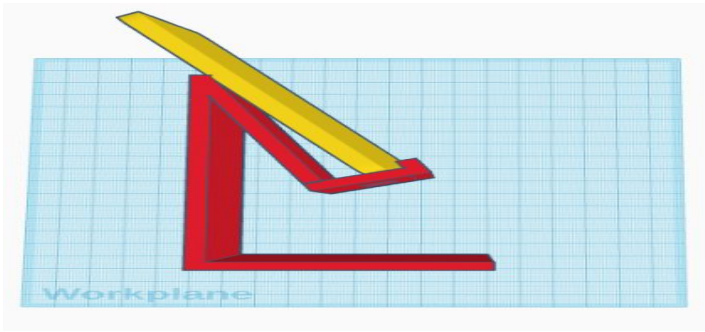


Step 9: Rotate the green part and join with the mobile holder red part



Step 10: Select both Red and Green Parts and Group them (Ctrl+G)

Now the mobile holder is ready we can test with a dummy mobile 3D file (yellow color)



Step 11: Export the STL file and prepare Gcode using slicer software and 3D print it.

Source: tinkercad.com

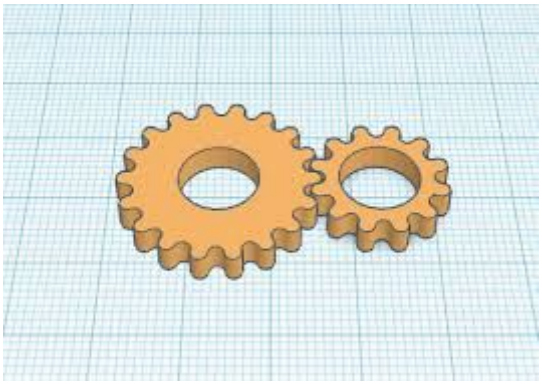
YOU HAVE SUCCESSFULLY COMPLETED THE ACTIVITY

Reflection and Learnings (9 mins):

1. Do you think we can 3D Print an Aeroplane? Analyse and write your thoughts on Pros and Cons of 3D Printing an Aeroplane.
2. How will you apply these skills outside class?
3. What did you or your team struggle with while doing this activity and why? How can you improve next time?
4. How did you contribute to the team and how do you think it helped? How else could you have contributed?
5. Have you heard of the word sculpting? What do you think are the differences between sculpting and 3D Printing?

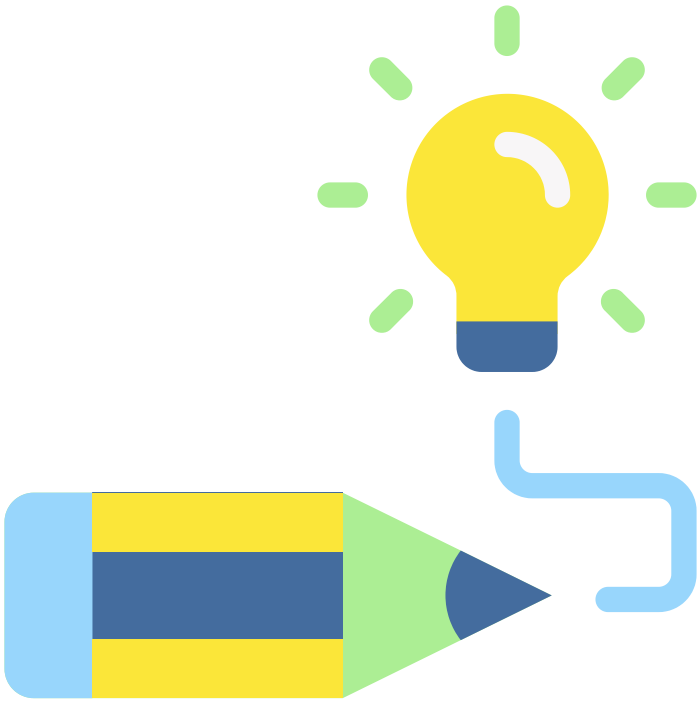
Try it yourself!

Using the concepts you have learnt so far, Try creating a simple gears as shown in the image.



Use the space to draw or write your reflections and learnings.

DESIGN & ENTREPRENEURIAL THINKING



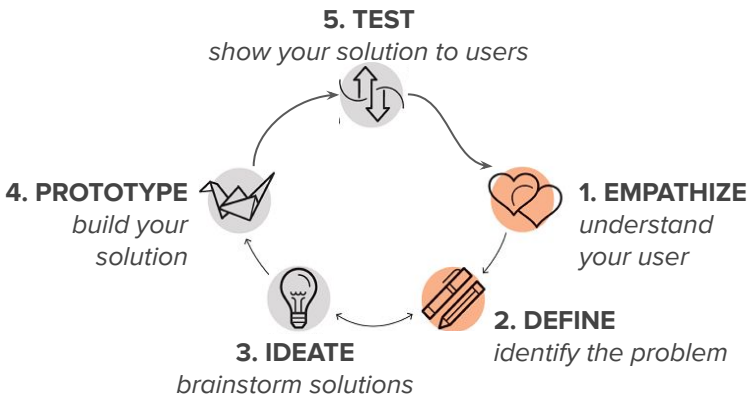
Design and Entrepreneurial Thinking
Session 1
Design a room for Elderly

Introduction to Design Thinking (10 mins):

Have you ever paid attention to the objects in your environment and thought about who designed it and why? Why did someone create the TV remote? So that, you can change the channel from a distance instead of walking to the TV. Someone designed the TV remote to solve a problem.

Design is part of our everyday life and shapes the way we interact with the world, but we frequently don't realize it. Everything from the tables and chairs you are sitting on, to the pen in your hand, your water bottle and lunchbox was designed by someone. Today, we will learn about the design process! There are 5 steps to this process: **Empathize, Define, Ideate, Prototype, and Test.**

In this chapter, we will learn about these steps and practise them. But in real life, the design process can take months. Designing is a time-taking process, but it is definitely worth the wait because that is how a good product is created.



Materials Required :

1. Colourful Pens
2. Post-it notes
3. Chart Paper
4. Wall space if available to stick post-it notes
5. Any other materials in your environment!

: 90 minutes

Module: Design and Entrepreneurial Thinking

Grade: 6th to 9th

Learning Goals:
1. Learners will understand the process of identifying problems and creating solutions.
2. Learners will have the necessary skills to rapidly design and sketch.

Time	Description
01 Min	Check-in-Experience (CIE)
05 Min	Icebreaker- Build a story
10 Min	Introduction to the module
15 Min	Understanding Design Thinking and the 5-step process
60 Mln	Activity- Designing for the elderly
09 Min	Reflection and Learnings

Icebreaker (5 mins):

Let's create a story! Form a circle and sit down. The teacher will give the first word of the story. Then, one by one, each student will add one word and create a sentence and eventually create a story.

For example, if the teacher gives the first word as, "Once", the first student can add to it by saying, "upon". The second student can say, "a" and the third student can say, "time."

Try to make sure that your story has at least one character, one problem that the character faces and a solution to that problem.

Activity: Design thinking for elderly (60 mins)

Our Activity for today is going to be designing a system to help your grandparent or elders do some tasks at home more easily.

Do not hesitate to be creative and come up with solutions that you think will work best! For this activity, you will interview your classmates in groups. You can do this activity in groups of 4-5. Make sure to follow the instructions from your teacher. Get your notepads and pens ready!

Steps to design a room for the elderly:

Step 1: EMPATHISE: To understand the users and see things from their perspectives

Source: bootcamp.uxdesign.cc

The word empathise means to understand someone's feeling and thoughts from their perspective and not your own. This step is the foundation of all design. It means that you need to think about who you want to design for and really understand their behavior. There are many ways to do this: observing people, talking to them, or doing some kind of activity with them. The aim of this step is making sure that the you see the other person's point of view. By the end of this step, you need to have a clear idea of what problems the elderly face in day-to-day life. To do so, you can ask a series of questions and write down the answers.

Now, let us do the interviews! For this step you will need to get into pairs to conduct the interviews.

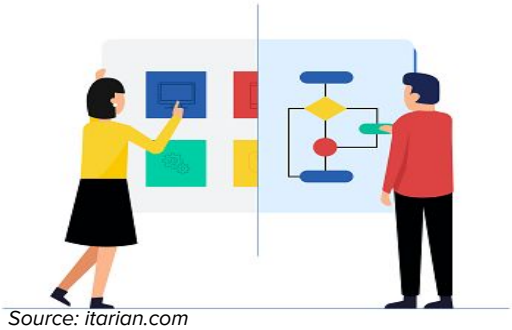
Take turns to ask each other the following questions about elderly persons. Fill out what you learned below. You get 3 minutes each.

1. What are some problems elderly people face?
2. What are the activities elders do daily? In which activities, they need someone's help/support?
3. Are they comfortable using the technologies?
4. What are the common problems they all face while doing any routine work?

You can ask them your own questions!

Person 1:
Person 2:
Person 3:
Person 4:

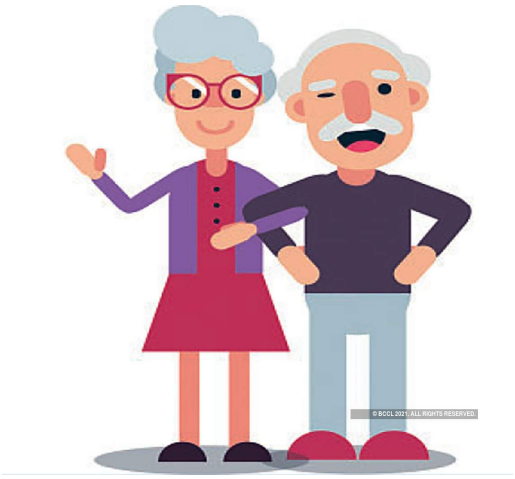
Step 2: DEFINE: The goal for the next step is to come up with a problem statement



Source: itarian.com

How can you contribute to helping elderly? You will now *synthesize* what you learned from the interviews. (Synthesize means to combine different parts into one unified whole). You can use this template to define your problem statement.

Make sure to include the problem, whom it affects and how it affects them in your problem statement.



There are many different problem statements that you can come up with depending on what your experience with elders are. You will have a different point-of-view depending on what you have encountered. E.g. Due to muscle weakness, seniors may no longer be able to stand over the stove to cook. Consuming inadequate nutrients may be the outcome of forgetfulness or depression in the senior. A limited income also prevents some seniors from enjoying nutrient-rich meals on a daily basis.
Think about the *values* that you care about as a team such as how this impacts you or other family members, community and how you can make the situation better for them
The problem statement that you choose to write down depends on what matters to you. In the real world, different people will have different opinions so it is really important to have a problem statement that reflects values that are important and relevant to multiple people.

Write down your problem statement below in 1-2 sentences.

Problem Statement:

Step 3: DESIGN: Come up with design alternatives

Source: architecturaldigest.com

Now comes the fun part! Thinking of your problem statement, come up with as many solutions as possible. Do not limit yourself! Your solutions could involve technology, humans, policy/rule/law, or something else. Write down your ideas on post-it notes and find a wall or chart paper to stick it on.

Now as a team, discuss the ideas that you came up with. Which ideas did everyone like? What were common themes? What was unexpected?

Write down three ideas that you liked as a team below. Make sure that everyone's ideas were considered fairly. You can even combine ideas that are similar or that you think go well together. Pick one idea to proceed with for the rest of the class (you can circle the number 1, 2, or 3). If you are struggling to decide what ideas to pick, you can vote on each one.

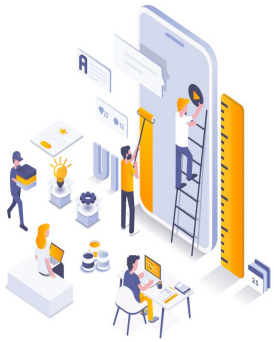
Idea 1:
Idea 2:
Idea 3:

Finally, reflect on your decision-making process? Why did you pick these ideas over others?

Reflection:

The teacher can organise a presentation for each group. Each group can pitch their ideas to the class in 5 minutes.

Step 4: PROTOTYPE: Build your own design solution



Source: uptophealth.com

Prototyping is the process of experimenting with ideas, and trying to bring it to life. You work on implementing your idea using various materials---paper, cardboard, wood, digital, clay, electronics. The purpose of prototyping is not necessarily to create a perfect product, but to quickly test out what the product should look like, feel like, and how it will function.
For example, These could involve some type of exercises, activities, or tiny mechanical changes to your chair to a new and improved design. It could also include inventing/designing back support for your spine, or arms which will help the elderly

As a team, sketch a prototype of your favorite solution from the previous step.

Step 5: TEST: Get feedback on your design

Source: dreamstime.com

For this next step, you will share your prototype with another team. In real life, you would show your idea to real consumers and get their feedback. Each team will 2 minutes to present their idea, and 3 minutes to hear feedback. Note down the feedback that you received.

Remember to give feedback in the format below. Record the feedback that you got from the other team.

I like:
I wish:
What if:

Once you are done, go back to the drawing board! Improve your solution based on the feedback you received. Record the improved design below. (5 minutes)

Now that you have gone through the entire exercise, share your final design with the class! You have exactly 5 minutes to present your final prototype. In real life, the next step would be for you to repeat this process multiple times to improve the design until users are satisfied!

Conclusion:

Design is a skill that takes time to cultivate. The best designers are those that practise their skill and have learned to see the world as full of opportunities for better design. But even without being a professional designer, you can benefit from applying design tools to your everyday life. It forces you to think about your environment, and identify ways that things can be done better. It can even help you find opportunities to build a product that others may want to buy!

In your everyday life, be more conscious about the items and services you use. Observe your environment carefully and engage with people different from you to understand their point-of-view and values. Keep a diary to record interesting observations or ideas that come to your mind and share it with others for feedback!

Source: blog.bit.ai

Reflection and Learnings (9 min):

1) Share at least 3 skills or lessons that you learned today.
2) How will you apply these skills outside class?
3) What did you or your team struggle with while doing this activity and why? How can you improve next time?
4) How did you contribute to the team and how do you think it helped? How else could you have contributed?
5) What communication challenges did you and your team face? How can your team communicate better next time

Use the space below to draw or write your reflections and learnings

Design Thinking and Rapid Prototyping

In our previous sessions, we learned the **5-step process: Empathize, Define, Ideate, Prototype, and Test.** Let us do a quick recap of how we applied this step-by-step process to redesign a Rickshaw

The foundation of all design is that you need to think about whom you want to design for and understand their behavior. There are many ways to do this: observing people, talking to them, or doing some kind of activity with them. This is the first step - Empathy! Empathy is when you are able to understand and share the feelings of another person. From the last sessions we were able to some extent understand what the problems a rickshaw had with its design are and empathize with users.
The second stage is “define” which we did in the last session where all of us came up with a problem statement and discussed the problems that need to be solved with the Rickshaw

The next stage was ideation, we discussed ideas to solve the problem and finally, rapid prototyping. Building/sketching a model of your solution and receiving feedback on it.

For this session we will use the 5 step process to design your final project!

Materials Required :

1. Colourful Pens
2. Post-it notes
3. Chart Paper
4. Wall space if available to stick post-it notes
5. Any other materials in your environment!

: 60 minutes

Module: Design and Entrepreneurial Thinking

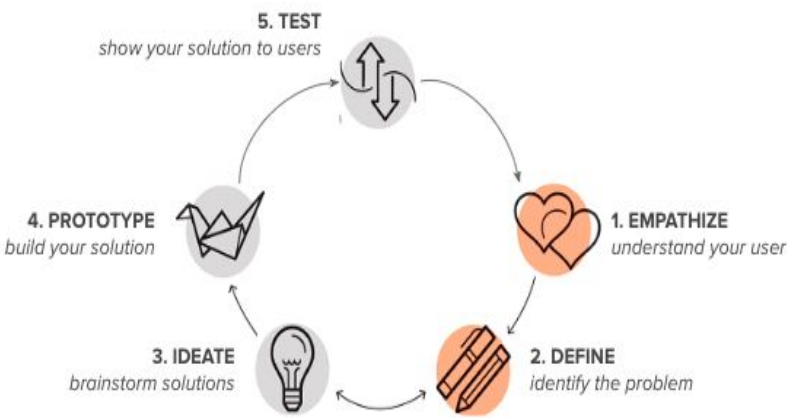
Grade: 6th to 9th

Learning Goals:

1. Learn to independently come up with solution to problems using the design thinking approach
2. Learn to rapidly design and sketch

The final project is an opportunity to use these 5 steps and create your own solutions for a problem in your community! You will get to put in practice the problem discovery process and rapid prototyping.

Remember, there is no right or wrong. Each design solution is unique to their own and it is more important to enjoy the process!



Step 1: EMPATHISE: To understand the users and see things from their perspectives

As we learned in the previous session, this is the foundation of all design. It means that you need to think about who you want to design for and really understand their behavior. There are many ways to do this: observing people, talking to them, or doing some kind of activity with them.

For the final project, here are a few problems you can find solutions for water conservation and efficiency Remember, it is not necessary that you choose these specific problems for your project but these **examples** will help guide your approach to find solutions.

a. As we know, water bodies are reducing all over the world as the population increases. Water is essential for our survival and we need clean contamination free water for our daily needs. Try to think of ways we can filter water to use for our daily purposes. This is not necessarily only drinking water but for other activities as well

b. India is known for the agricultural sector. Even in dry regions of the country, farmers have found creative irrigation techniques to provide us with essential food materials. Pertaining to this, how can we think of innovative solutions to provide water for crops to nourish our plants.

c. Electricity is an essential part of our lives. It helps us in everyday functions and to carry out our daily activities efficiently and effectively and is integral for our survival. How can we use water to produce power? Can you think of solutions to use water effectively for energy production.

Use the space below to write which problem you have chosen to solve and why it is important. You have 5 minutes for this.

Once you have chose which problem to solve, it is time go a bit deeper on what the problem is. For this step you will need to get into pairs to conduct the interviews.

You can come up with your own interview questions by using these guiding questions:

1) What *should be* happening (ideal condition) and what *is currently* happening (reality)
2) Ask “Why?, Why?, Why?”
3) Try to define who all are affected by the problem
4) How are they currently trying to solve the problem?
5) What will happen in the future if the problem is solved/ not solved?
6) Try and see the problem from different perspectives

Use the space below to write your interview questions along with the responses. You get 5 minutes each.

Step 2: DEFINE: The goal for the next step is to come up with a problem statement

You will now *synthesize* what you learned from the interviews. (Synthesize means to combine different parts into one unified whole).

Write down the common problems you saw people having that you interviewed.

There are many different **problem statements** that you can come up with depending on what you care about. You will have a different *point-of-view* depending on the *stakeholder* that you care about: e.g. a young child, teenager, parent, woman, a shopkeeper, government, traffic police etc.

Think about the **values** that you care about as a team---affordability, availability, energy, health efficiency, environmental impact, safety, etc. The problem statement that you choose to write down depends on what matters to you. In the real world, different stakeholders will have conflicting values so it is really important to have a problem statement that reflects values that are important and relevant to multiple people.

Once you identify the problem, record the problem statement in the following format and share it with the class. Write down your problem statement below or in your notebooks in the following format. Here is an example of a problem statement from the choices given:

Here is an **example** of a problem statement:

The problem I have identified is ***there are no clean water bodies in my community*** I wanted to do something about this because ***I want to stay healthy with clean water.***

The problem I have identified is (1)_____ and it affects (2)_____. I wanted to do something about this problem because (3)_____”

Slot 1 - write what is the issue you have identified
Slot 2 - Define the stakeholders (whom all it affects and are involved)
Slot 3 - Put down your “why” to address this problem (personal motivation)

Take Home Activity: Problem Research

Research is a critical step in the problem-solving process. It helps us identify the problem better and get more information on it. Through this, we can understand thoroughly what problem we are dealing with and who all are affected by it.

TASK: Do more research on the problem statement you have identified. If you didn't get enough time to come up with questions in class, you can take the time now to come up with questions.

Once you have finalized your problem statement and have come up with the questions which you want to research more, In teams you have to go and ask as many people as possible to get the research for this. You must ask at least 10 people these questions and note down what they say.

As a team decide when you will meet and where you will go.

After you have the required information from the people you spoke to, you have to see what Information you can use and what you have to remove.
The way you can do this is to see if the answers given by people are related to the problem statement you want to solve.

REMEMBER: Safety is the top priority. You must always be in teams. You should not enter any strangers' houses or go to unsafe locations in the community.

* **Always inform your teacher and parent before you go to any specific area and ask for advice if is safe and which locations you must avoid.**

***Bring your responses to the next session and share a few of them with the class.**

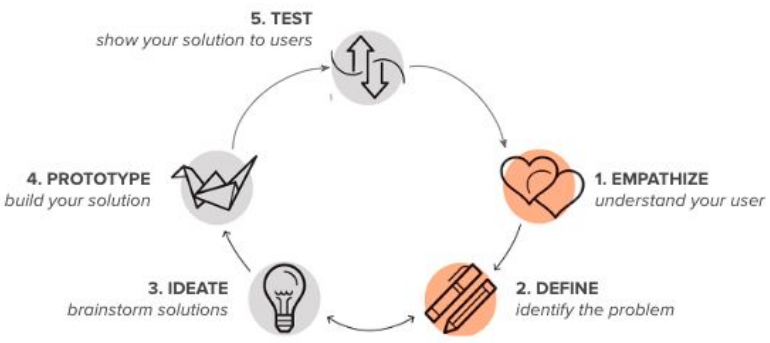
Design Thinking and Prototyping

In our previous sessions, we learned the **5-step process: Empathize, Define, Ideate, Prototype, and Test.**

In the previous session you were asked to choose one problem and explain why you chose the problem and what you want to solve. The first step was empathy which means that you need to think about whom you want to design for and understand their behavior. We saw that there were many ways of doing this and learned some guiding questions to help learn about the problem more and their perspective. We learned what the problems of our community are and empathize with them.The second step was “define” where all of us came up with a problem statement and did research to back it up as a take home activity.

Take **5 minutes** to quickly share with the class some findings from the take home activity.

In our previous sessions, we have completed the first two steps now it is time to look at ideation!



Materials Required :

1. Colourful Pens
2. Post-it notes
3. Chart Paper
4. Wall space if available to stick post-it notes
5. Any other materials in your environment!

: 60 minutes

Module: Design Thinking and Rapid Prototyping

Grade: 6th to 9th

Learning Goals:

1. Learn about ideation and how to solve the problem better
2. Learn to rapidly design and sketch
3. Learn how to build a prototyping

Activity: Impossible objects

Think about any object around you. Now pair up and begin the ideation process—you have to connect the two objects and come up with a hybrid (combination of both of the objects). Try imagine the item that comes out of it and what details it entails

Draw a picture of it on a piece of paper or in your notebook. This is just an ideation process, it need not be a real object. You have to use your imagination to come up with something.

You have **5 minutes** to do this in your pair. You to be honest and not change objects for convenience of this activity. In fact the more creative the idea the better, Go as crazy as possible!

Once the 5 minutes are done, share it with the class.

IDEATION

From the previous activity, keep up the same spirit of coming up with crazy ideas.
We will use the same creativity from the last activity and use it for our projects.
In your project groups (group of 5) think of your problem statement, **come up with AS MANY SOLUTIONS AS POSSIBLE to the problem statement.**

For example: If you interviewed the elderly and they said they need help with remembering what medicines to take and when then you can make them a medicine reminder box.

GO WIDE, GO BIG! Think of crazy ideas, don't limit yourself by physical constraints or common-sense limitations.
This is an ideation process. Each person in the team should come up with as many ideas as possible. You should note it down individually in this guide or paper. You have 5 minutes to come up with as many ideas as they can.
Once you are done, count how many ideas each person on your team came up with below.

Person 1:
Person 2:
Person 3:
Person 4:
Person 5:

Now in your team, share the ideas that everyone came up with. You can take 5 minutes for this.
The next step is to discuss the **following questions-**

1. Which ideas did everyone like?
2. What were common themes?
3. What was unexpected?

Now, you have to decide on the top 3 ideas that you like.
Make sure that everyone's ideas were considered fairly. You can even combine ideas that are similar or that you think go well together. If you are struggling to decide what ideas to pick, you can vote on each one!

Idea 1:
Idea 2:
Idea 3:

PROTOTYPING

The next stage that comes in the design process is prototyping.

Prototyping is the process of experimenting with ideas and trying to bring them to life. You work on implementing your idea using various materials---paper, cardboard, wood, digital, clay, electronics. A prototype is used to test different working aspects of a product before the design is finalized.

A prototype is a working model of a product that is used for testing before it is manufactured. The advantages of prototyping are :-

1. They help the people understand what all is required to make the product. Basically they understand the manufacturing process
2. How users will use the product
3. How the product could fail or break.

For example, a team of engineers designing a new cell phone might produce several cardboard and paper models to illustrate how the final product would look and feel. They may survey the general public to gain feedback about how the cell phone could look. The team might build a sturdier plastic prototype to test how easily the cell phone could break when dropped. If the prototype does not meet the team's design requirements, then they may try again to come up with a better prototype.

For this activity you will stay with your group created before. As a team, sketch/draw a prototype of your favorite idea you had selected from the last session using the space below or on a piece of paper. You can use any material you need, the Idea is to make a prototype of the product you will implement.

While creating the prototype these are few things you can keep in mind:

1. What will be the name of your product?
2. What will it look like ?
3. What materials will you need to make it?
4. What do you want your final product to do?

The teams have 30 minutes to come up with the drawing of the prototype.

Once you are done with the drawing of your prototype, each team has **5 minutes** to come up and present your ideas to the class!

Now, we need to examine and evaluate your final prototype to see what works and what doesn't. Once you have finalized it on paper you have to make a physical prototype of the product. You can use the components that you actually plan to use or use material like cardboard and chart paper to give a feel of what it will look like.

***Please get your prototypes and come to class for the next session.**

Take Home Activity: Solutions Research

For this assignment, you will have to do more research on the solution just as you did for the problem itself. When you identify a problem, more often than not there is already a solution out there!

Find out whether:

a. People have tried to solve this before
b. If a solution to this problem already exists
c. If there is already a solution, why hasn't it been implemented it
d. What you plan to do with your solution would help the different stakeholders

Use the space below to write your responses:

Feedback and User Survey

: 60 minutes

Module: Design Thinking and Rapid Prototyping

Grade: 6th to 9th

Learning Goals:

1. Learn about the problem discovery process
2. Learn about creating user survey and valuable feedback

As we saw in the previous session, A prototype is used to test different working aspects of a product before the design is finalized. One of the main advantages of prototyping is that we understand the experience of the user and improve on the model

User feedback is essential to guide and inform your decision making and influence innovations and changes to your product

For ideas to be workable we have to make products that your users like. How do we get inputs from the minds of our users It is difficult but not impossible! The best way to improve your product is to understand through customer experience.

Measuring user satisfaction allows you to understand potential problems at an individual and aggregate level. More importantly, it helps you improve over time!

In this session, let us try improving our design with the feedback given from the users of our product!

A user survey help to provide insights and help with overall quality of product. If you are in the early stages of your design project and just want some simple and rough feedback, it's good enough to test on your classmates. However, towards the end of your project, when you create more detailed prototypes, you should test on a users from your community to get the most relevant feedback.

Materials Required :

1. Colourful Pens
2. Post-it notes
3. Chart Paper
4. Wall space if available to stick post-it notes
5. Any other materials in your environment!

Activity: Creating a User Survey

For this activity, we will be creating a User survey. To prepare the questionnaire, work with your groups in which you had worked with for your previous session. Appoint one person to write neatly on a blank sheet of paper or use the space below and create multiple choice questions as this sheet will be shared with other groups. Following are some sample questions that you can have in your User survey

1. Name, age, occupation?
2. Which area are they living in?
3. What are some of the problems they are facing in and around their community?
4. What is their opinion on the idea you have come up with?
5. Do they think it will work ?
6. What are some ways they can improve on this idea?

Use the space below to write your sample questions for your user survey. You have 15-20 mins for this.

The User survey should be short, simple and direct to the point. User will not have time to talk to you for more than 10 minutes so make use of all the time you get!

Presenting your Prototype

Now you will require to collaborate with groups. You will pair with another group and will be presenting your prototype to them.

Pair with your partner group and take 15 minutes to present your prototype and ask your customer survey questions. After this they will receive feedback from the other team for 5 minutes. Then the reverse will happen. The other team will present for 15 minutes and then take feedback for 5 minutes.

Some of the questions may not come in use because they are talking to students. So they can just ignore such questions!

Use the space below to write the feedback you received for your prototype.

Through these activities we came to know how effective and useful user surveys are to improve your prototype. Always keep in mind the guidelines that we had discussed while creating the user survey. We have almost come to the end of our final project with this step!

In the next session, we will present our final prototype to the class.

Group Presentations

Before presenting your final prototypes it is important to set some norms.

- Make sure that when a group is presenting, we must respectfully listen and support your peers.
- Each group has **15 minutes** to present.
- Make sure to encourage all your group members to participate and speak up
- Once the group presentation is done, make sure to encourage your peers and clap for a job well done!

Once the team is done presenting, it will be time for a feedback session. For this you will need to follow the format below while sharing your feedback

I like, I wish, What if

As we come to the end of the program, we hope all of you have some important things to take away from each module. It is essential to understand the values and thought process that drive hands-on-making and tinkering. What we hoped to achieve through this program was to foster problem solving and critical thinking while having a humanistic outlook to situations/scenarios.

let us take **5 minutes** and write on a piece of paper and write down 3 words to describe your experience with hands-on-making.

Materials Required :

1. Colourful Pens
2. Post-it notes
3. Chart Paper
4. Wall space if available to stick post-it notes
5. Final Prototype

: 60 minutes

Module: Design Thinking and Rapid Prototyping

Number of Sessions: 5

Learning Goals:

1. Learn about effective communication and self confidence

Team Awards

For this activity, you design unique **titles/awards** for each team member. The groups collectively decide which person gets what title and select one person to read the list out to the class and explain why they've got that title. Keep it funny, unique and appreciate all your team members in some way. For example - we can have one member's title as the 'fire extinguisher' - this person puts out everyday fire like a pro and always keeps calm and composed, the peacemaker during conflicts.

You have 5 minutes to present.

Reflection and Learnings :

1) Write down some new things you have learned about your community. Share your experience with the class or use the space below.

2) Coming to identifying problems in the community, we know it is never easy to find a solution but were you able to make a meaningful impact through your project?

3) What were some hiccups you faced during the solution finding process - did it help that you worked as a team?

4) What were the ideas that the team came up with and which was the final idea? What was the feedback they received for the prototype from the customers? Were you able to try out their idea and what happened because of it?

Use the space below to draw or write your reflections and learnings