

Computer Aided Educational Tools

We are all witnessing widespread developments in IT Education. More and more ICTs (Information Communication Technology) are being used in almost all aspects of our lives. In our education system all teaching-learning methods are witnessing a shift from teacher centred teaching to a more learner centred one. The possibility of making this shift is high by using computer aided tools to bring to life abstract mathematics and science concepts.

National Curriculum Framework (NCF) 2005 talks of a major shift in teaching education programme from passive reception to active participation in learning. From learning within the four walls of classrooms to learning in the wider social context. From knowledge as “given” and fixed to knowledge as it evolves and is created. From linear exposure to multiple and divergent exposure. Moving from a teacher centred lecture driven classroom to more learner centred classrooms. Using these computer aided tools as teaching-learning aids will enable teachers to make these shifts suggested by the NCF 2005. The children will be able to construct their own knowledge via hands on experimentation by using these computer tools. To enable children to connect these learnings and utilize the tools to the best possible extent, it is essential for subject teachers to facilitate this learning experience.

It is therefore important for the teacher to understand how to use these various tools and become confident users of the same to bring about maximum understanding of the subject using these tools as aids.

Integrating tool with classroom lessons

There is no one fixed solution that works for integration of computer aided tool usage with classroom chalk-talk lessons. It depends on the teacher, her students and the availability of computers. If the students have access to the computer in groups in the computer period, then one could follow the process outlined below.

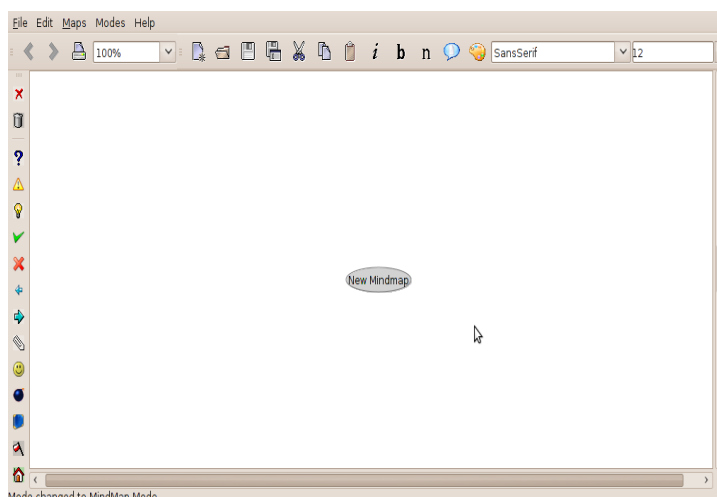
- ◆ Introduce the topic in the classroom with regular chalk and talk process
- ◆ Create an activity related to the topic to be done in the computer period in the lab.
- ◆ Discuss the topic and learning in the classroom again after the students have done the activity.

There may not be time available to cover each and every topic in this manner. The teachers must use their judgement to plan which topics they think are key or critical to integrate with the tool.

List of Tools and their usage

We give here some important tools and a brief description of how to incorporate them into lessons.

Freemind



About Freemind

Freemind is primarily a tool for creating and editing mind maps. It can be used by teachers to plan

lessons, plan stories, organize their academic year etc...

Resources of mind maps available for teachers

www.gnowledge.org has many mind maps created for teaching various topics in many subjects that can help you plan lessons and also get new ideas.

How to Install Freemind

Please see section on how to [Install New Software](#) in this document.

How to use Freemind

To Open from the desktop menu select

Applications > Office > Freemind

Once Freemind is open for Help select menu option Help > Documentation

To create a mind map, first select the mode as **Modes > Mindmap (shortcut ALT+1)** then select **FILE > NEW (shortcut Ctrl+N)**. You should see a screen as follows:

To save select menu option **FILE > SAVE AS** to see the window below, select the folder

/home/bindu/Documents/ITFC/TCoL) to save file and also the name (story) of the mind map.

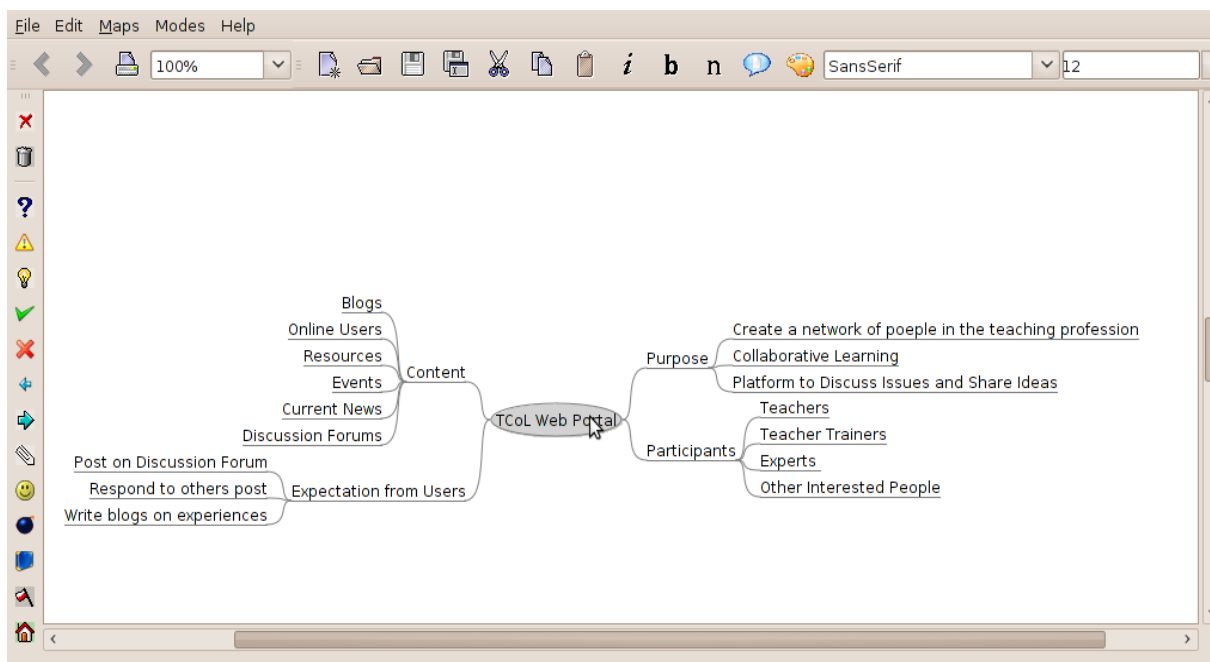
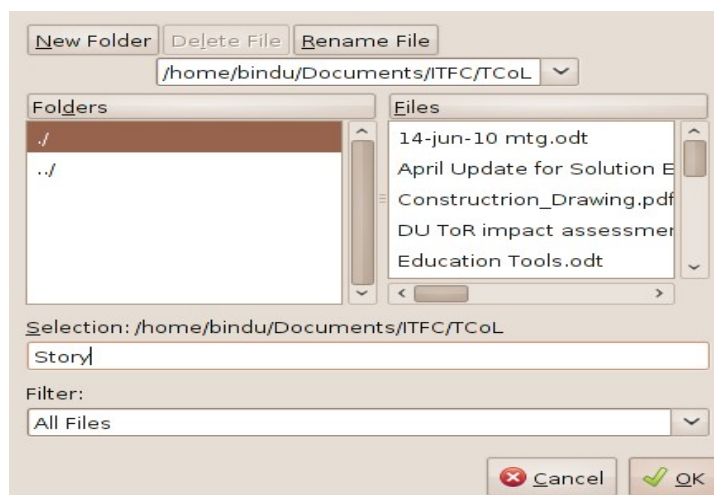
Note: [./ - means current folder; ../ - means parent folder]

To start writing the mind map use the following options selecting from the menu option

Edit > Edit (Shortcut F2)

Edit > Edit a Long Node (Shortcut Alt +Enter)

Edit > New Child Node (Shortcut Insert)



Science

Simulating Experiments using a Computer Tool

Science is best learnt by doing and observing. When for different reasons the students do not have access to physics laboratory, making use of computer aided tools to simulate these phenomenon provide students with a virtual laboratory. Using these tools that simulate a science lab is useful to bring children closer to visualize the concepts better and therefore understand some of the complex

and abstract phenomenon.

Audio visual aids played an important role to classroom teaching and learning. But in the present context of constructivist learning, interactive software becomes very relevant as it enables children to construct their own experiments and observe the results.

PhET

How to install PhET



Please see the section [Additional Installation Guidelines](#)

PhET is a tool that has several science simulations already built-in. There are simulations in Physics, Chemistry and Biology. The power of this tool is that it is possible to simulate experiments that are difficult to perform. It is also very effective for analysing phenomena that occur. This is how the PhET window looks. We will now click on the orange tab which says “**Play with sims....>**”

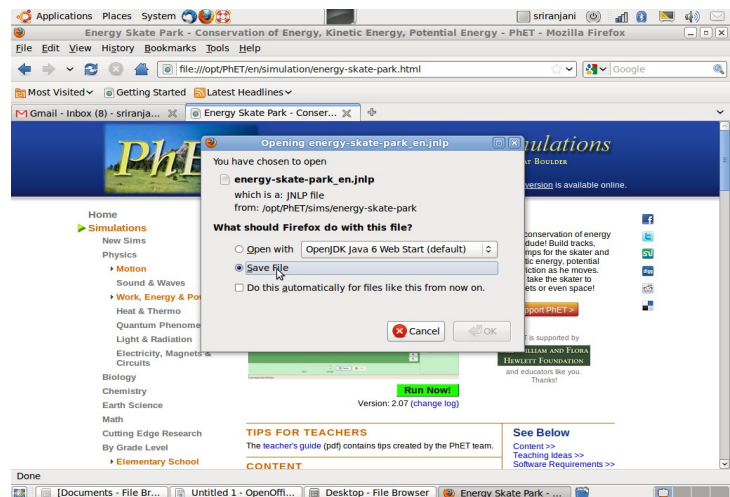
PhET Opens in the Firefox Web Browser. When you install the Ubuntu public software, PhET simulations are already downloaded on your machine, so you do not need internet access.

How to open a simulation

As an example a simulation in Physics is shown below.

This will open a page of simulations with an index on the left. Click on Physics and Motion under Physics on the index. You will see all the simulations listed here.





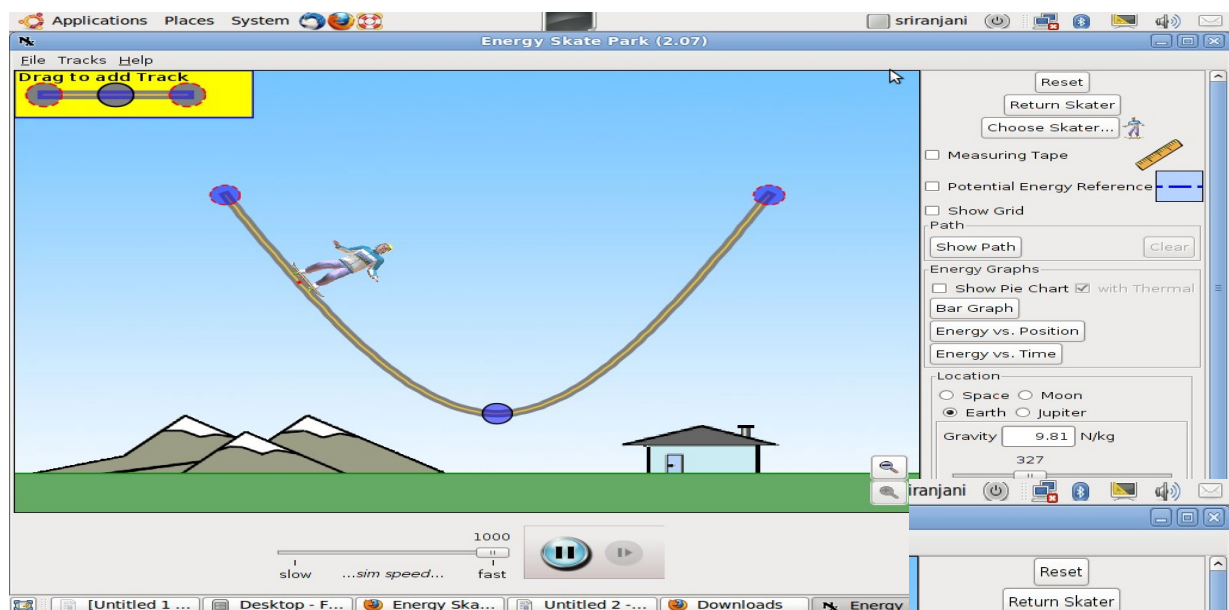
Now select **Energy Skate Park** .

This simulation shows total energy is conserved and how Potential Energy-Kinetic Energy conversion takes place.

When we click on this simulation the application will prompt you to either Open or Save it locally. As all files are already saved locally click on **open** to start the simulation.

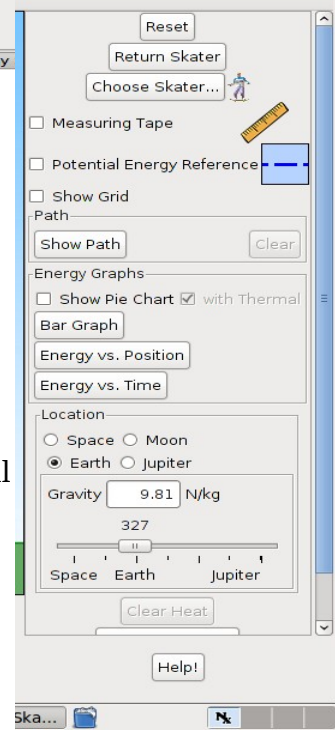
Lesson plan using a simulation

The simulation window will open which looks like this.



The simulation settings in more detail below.

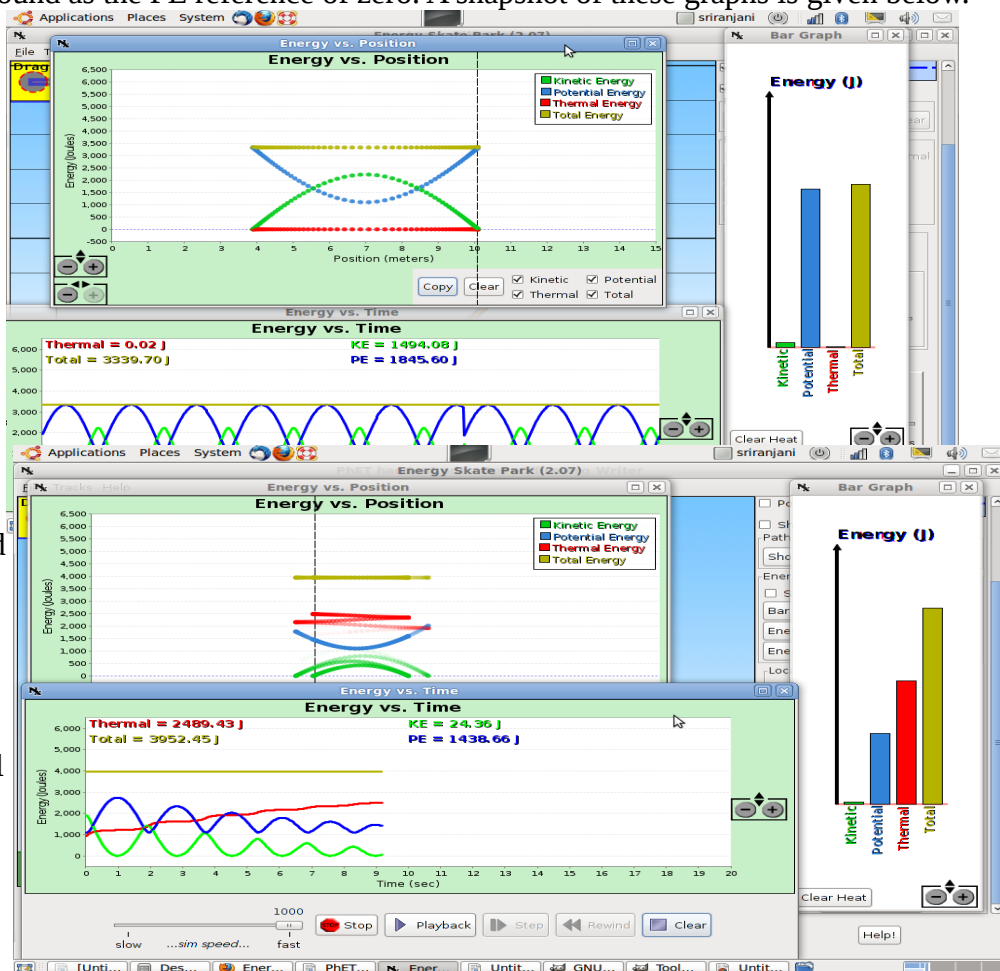
- There is a track along which the skater can move.
- We can choose the skater; the mass.
- You can choose to add measuring tapes; this will help measure distance. If you mark the potential energy reference, you can see where the PE is zero. The grid will help plot the position.
- You can also choose to see the path – the points will be marked on the simulation as the skater goes back and forth. The display of KE, PE and total energy can be shown through a bar graph. The “pie chart” gives you the legend.
- You can also plot the energy changes with respect to time as well as position of the skater. One key parameter in the simulation is gravity.



- You can simulate this experiment on the moon, Earth or Jupiter. You can also simulate it in space. The value of “g” in the box will change when you click on these different options. Notice that gravity is given as N/Kg; what we refer here is acceleration due to gravity and has the units m/s^2 .
- We can also add track friction (not visible in this snapshot) and demonstrate what happens to the skater.

Process

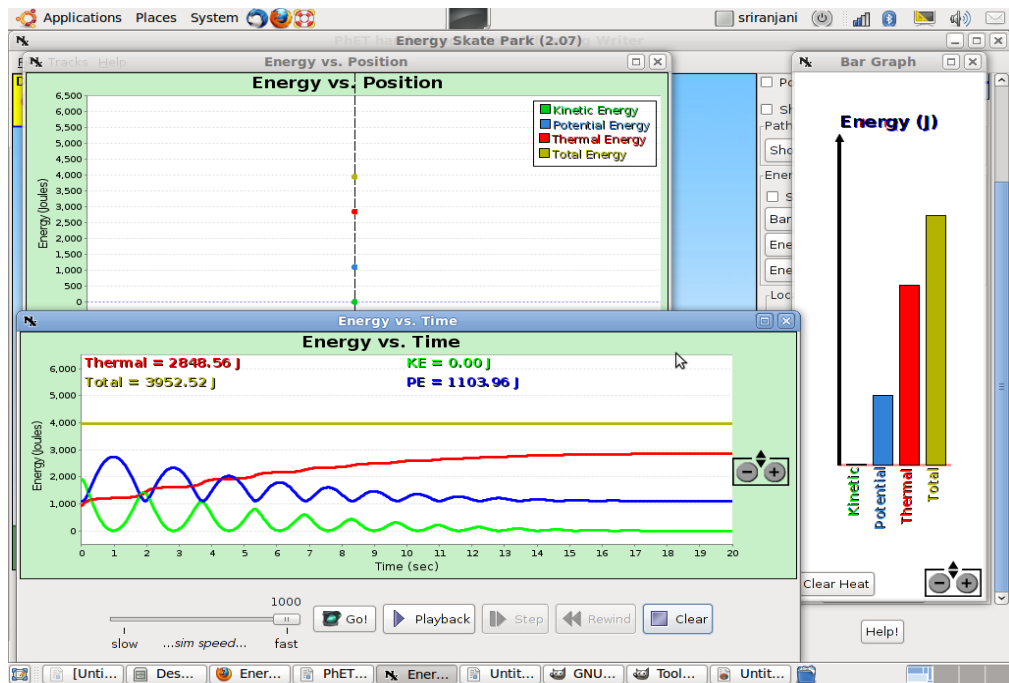
- Now start the simulation; after adding the grid.
- Add add the PE reference at 0 metres to be 0.
- Now we will click on the Bar Graph: This will show the changes between PE and KE. Notice that the thermal energy is zero.
- Energy Position Graph Energy-time graph. This will display the PE and KE with respect to position above the ground.
- The Energy Time Graph will show the PE and KE swings across time.
- Notice that in all these graphs the KE reaches zero; but the PE is never zero. The PE is never zero because we the lowest part of the track is still above the ground; we have defined the ground as the PE reference of zero. A snapshot of these graphs is given below.



Now we will look at what happens to the skater when you add track friction and we plot all these graphs. This is how the graph will look as the skater slows down due to friction and the KE reduces to zero.

Now the skater has come to rest and the KE has come to zero.

Now you can reset the simulation and run it for different values of acceleration due to gravity.



Questions for discussion:

What do we mean by PE reference?
 What does change in PE mean with respect to the reference?
 What are the implications of adding friction?
 Can you connect this to the gravitational force of attraction?

Step

About STEP

STEP is an interactive tool for Physics; it can be used for simulating complex interactions in mechanics.

Installing Step

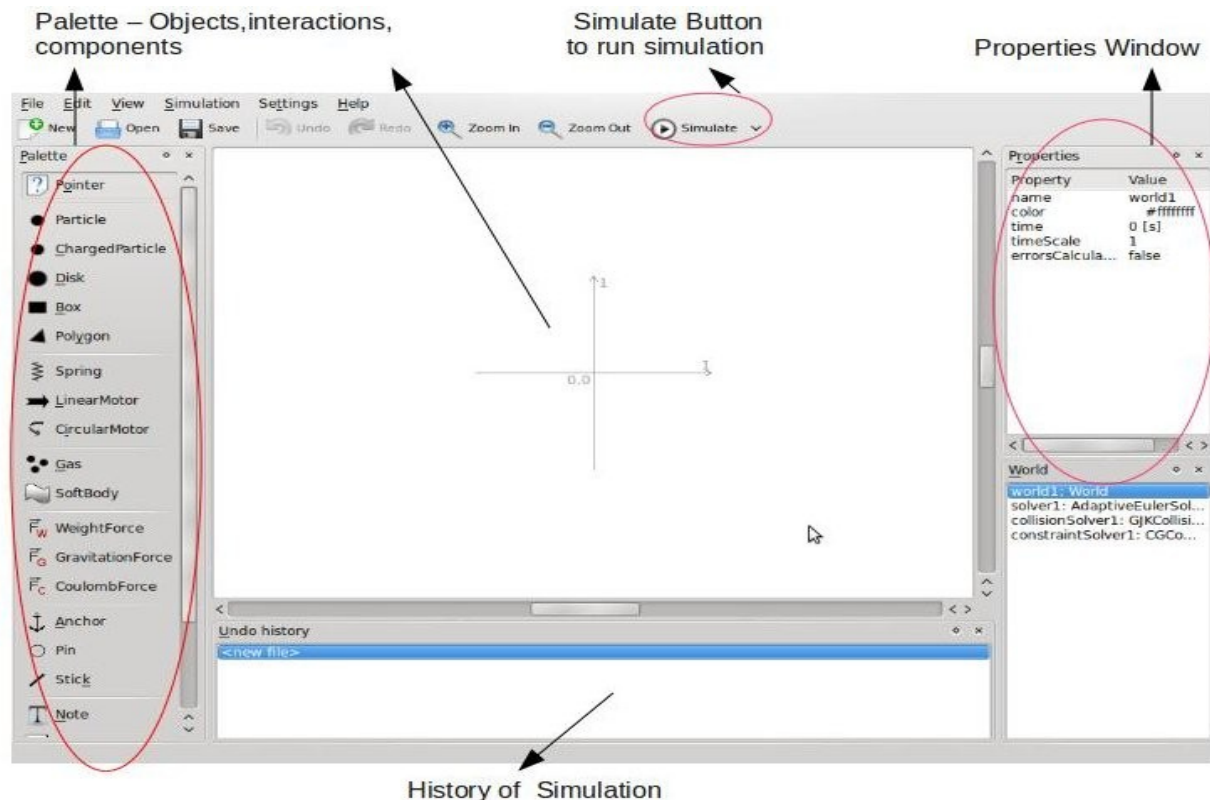
Please see the [Install New Software](#) section to install it if it is not available on your Ubuntu system. You will need to be connected to the internet for this.

Opening STEP

On the desktop click **Applications > Science > Step** **OR** **Applications > Education > Step**

The STEP Window

This is how the STEP window looks. The main components :



Palette – which contains the objects, interactions and components

World Scene - where the objects interactions and components are added to create the simulation

Properties Window – Where properties of objects from the palette can be viewed and edited

History Window – Where the history of the simulation is recorded

Simulate Button – To start and stop a simulation

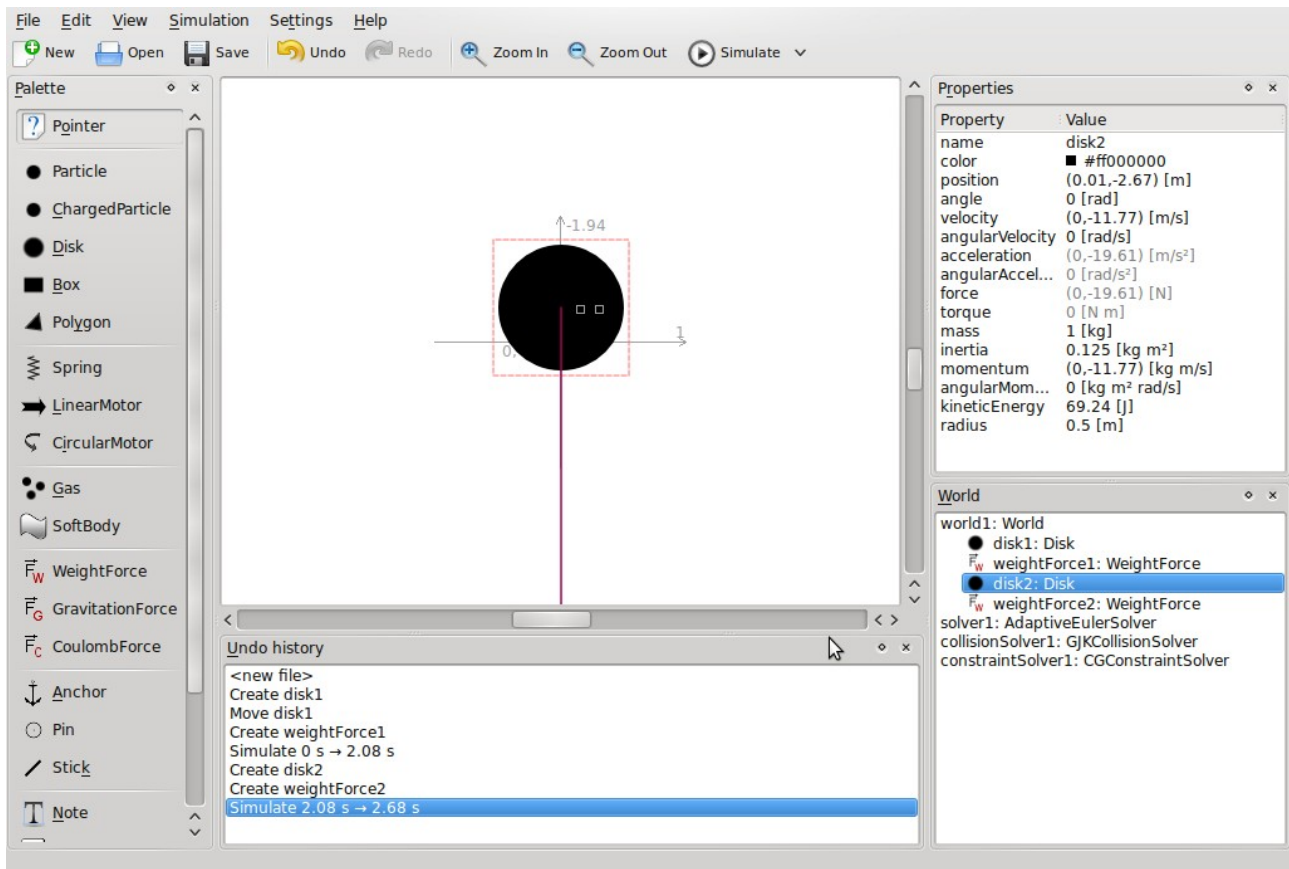
Lesson Plan using a simulation

Purpose

Learn to create a simulation in STEP. This activity will simulate free fall of an object.

Process

- Click on a **Disk** in the palette window and then click on the world scene to add the object
- Once an object has been added, an interaction can be added to the object
- Click on **Weight Force** in the palette window and then click on the disk in the world scene . A red line will appear indicating that the interaction has been added.
- Now click on **Simulate** to view the simulation.
- To restore the objects to their original position click on **undo**
- Observe the disk properties in the properties window and discuss



To save a simulation in STEP .

- go to menu item **File** -> **Save As**
- All files will be saved with the extension “step”.
- Once you save a simulation, you can simply open a simulation and demonstrate.

K Tech Lab

About K Tech Lab

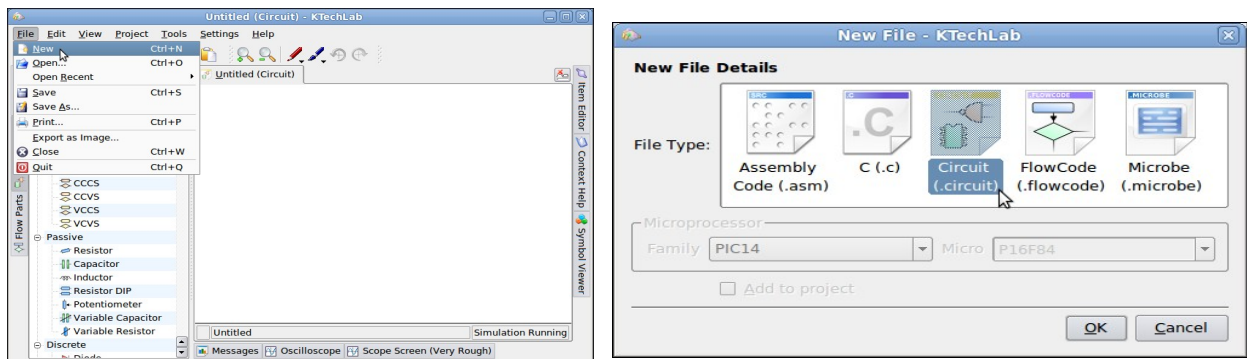
K Tech Lab is a free software which helps to make different types of circuits (electronic & electrical) and conduct experiments. Various electronic components like resistor, diode, switch, transistor, micro controllers etc. can be run using this software. Since it works in GUI mode, it is very easy to handle. The components required for electric circuits can be easily dragged into the work area using a mouse. When we join the pins using mouse, the circuit is formed. The properties of each component is displayed when bring the pointer above it. Students are not able to do some experiments which involve real devices and consumables, even in groups. But these experiments can be done in KTech Lab environment. Thus loss due to the damages and lack of consumables can be avoided. Using this software students can easily form the circuits and can repeat the experiments a number of times.

How to Install K Tech Lab

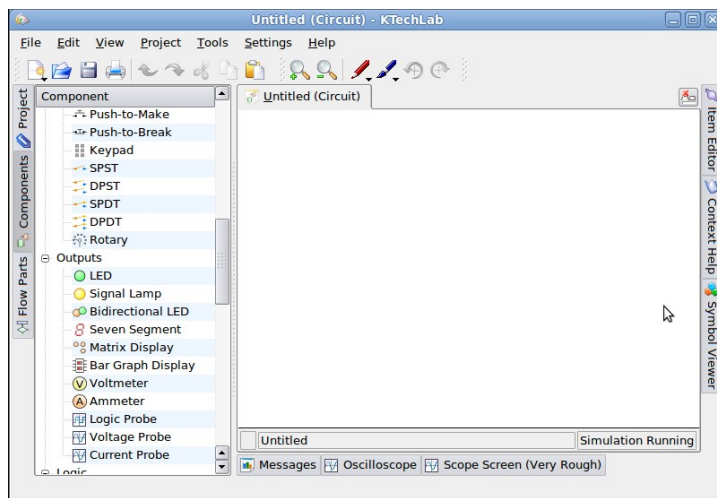
- You will require Internet connections
- Go to <http://sourceforge.net/projects/ktechlab/>
- Click on the green download button and click save.
- The file ktechlab_0.3-6_i386.deb will be downloaded.
- Go to Ubuntu Menu **Places** > **Home Folder**
- Select Downloads folder
- Double click on ktechlab_0.3-6_i386.deb, the software will be installed

Introduction to K Tech Lab Interface

First in the File Menu Option Select **File > New** and Select **Circuit** as shown below



K Tech Lab Window



Component Tab

This tab contains different electronic components that can be used in K Tech Lab. It includes various

electrical components, discrete components, switches, output devices, logic components, connection, Integrated Chips etc.

Sources : This section contains various voltages, current sources.

Discrete : Resistors, Condensers, Diodes, transistors etc. are available here.

Outputs : Output components such as LED, Signal Lamp, devices like Voltmeter, Ammeter, Oscilloscope etc. are arranged in this section.

Work Area: This is the space for building the electronic circuits.

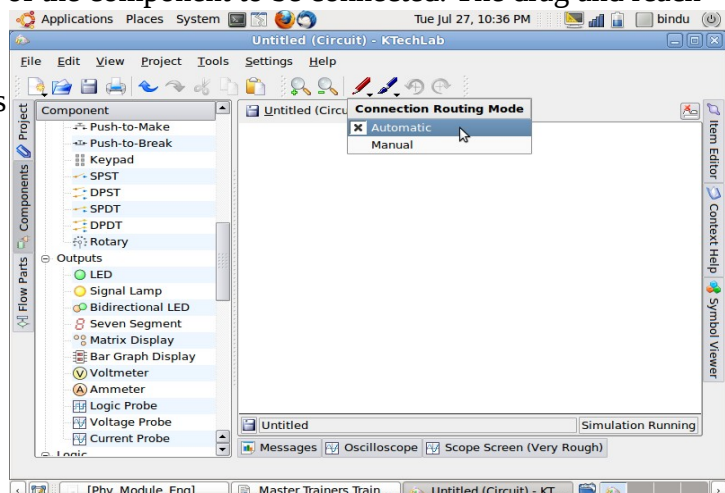
Oscilloscope: It helps to recognise the signals with wave form in graphical mode.

All components can be dragged and dropped in the Work Area to create a circuit.

To connect the components to make a circuit select either 'Automatic' or 'Manual' as shown below. Please use Automatic as a beginner.

Automatic : Select 'Automatic' from the connection routing mode in the toolbar. The pointer changes its shape when brought to the lead of the component to be connected. The drag and reach near the lead of the other component. The colour of the line changes and the connection is completed when the mouse is released.

Manual : Select 'Manual' from the connection routing mode in the toolbar. To connect the leads of the electronic components in this mode, bring the mouse pointer near the first lead. The mouse pointer changes, then click at the point and drag in the direction we require. To have a bend



in the circuit click and move the mouse according to our need. When we reach the next lead the colour of the line changes, then click and complete the connection.

To change the orientation of the electronic components: Right click on the component, which is in the work area, and then change the orientation of that electronic component as required.

Activity 1: Basic Circuit

Purpose: To learn to make a basic circuit with battery, switch, signal lamp and voltmeter

Process

1. Drag and Drop a battery, switch (SPST) and a signal lamp in the work area.
2. Use 'Automatic' connection and the mouse to connect the circuits as shown below.
3. Click on the switch to see the lamp glow.
4. Add a voltmeter and observe the reading when the switch is turned off versus on.
5. Save a K Tech Lab Circuit file

Save File : Select **File > Save** and enter file name **Activity_1** and save the file. It will save with a .Circuit extension. Click on **Save**

To open a file select **File > Open** and select file to open

Discussion Points

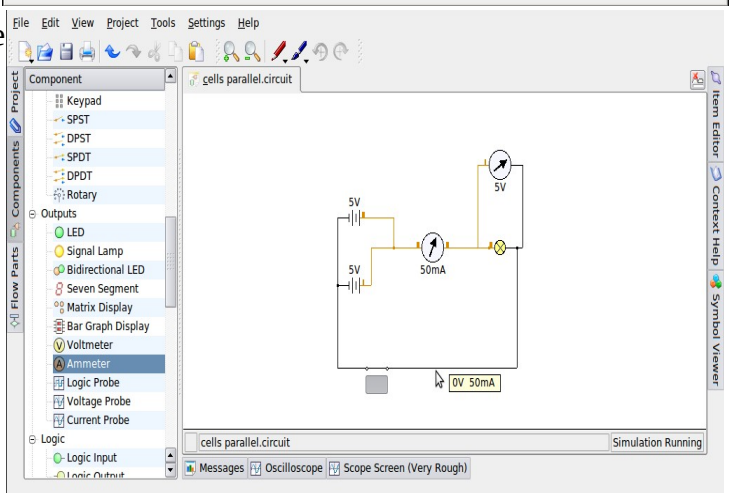
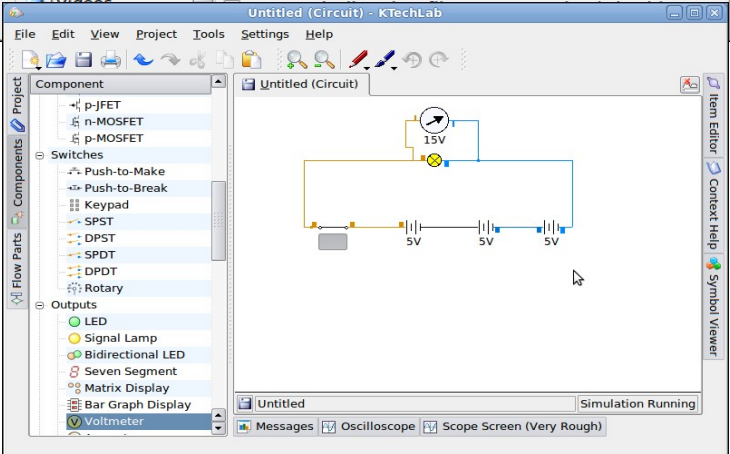
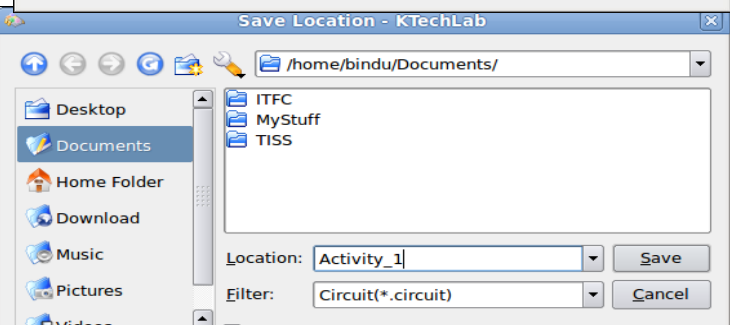
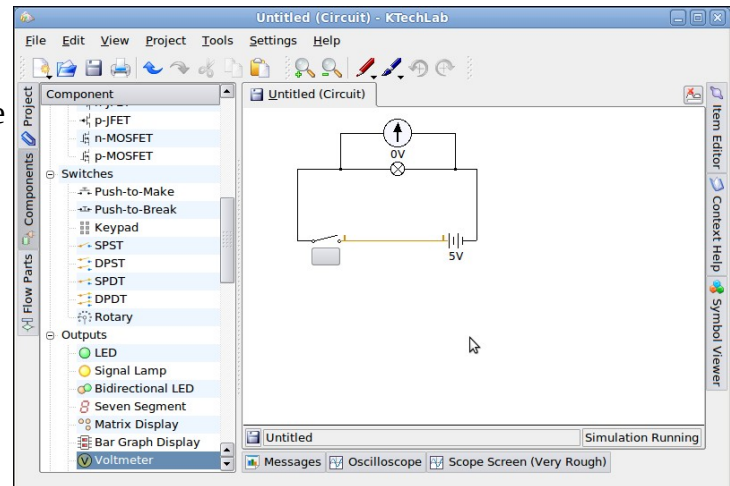
- Discuss this with reference to a torch.
- Discuss what happens when the circuit is broken (switch is off), so children understand that a switch breaks a circuit.

Activity 2: Cells in Series/Parallel

Purpose: To connect cells in series and observe the voltmeter and ammeter readings

Process

1. Drag and Drop 3 batteries, switch (SPST), a signal lamp and voltmeter as shown in the figures in the work area.
2. Use 'Automatic' connection and the mouse to connect the circuits as shown below, first the cells in series, then the cells in parallel.
3. Click on the switch to see the lamp glow.
4. Observe the reading of the voltmeter when the switch is turned off/on versus on.
5. Save the file as Activity_2



Discussion Points

- You may discuss what happens to the current and voltage (potential difference) when connected in series.
- Compare water flowing through a pipe, and current flowing through the circuit and see if it can be explained this way.

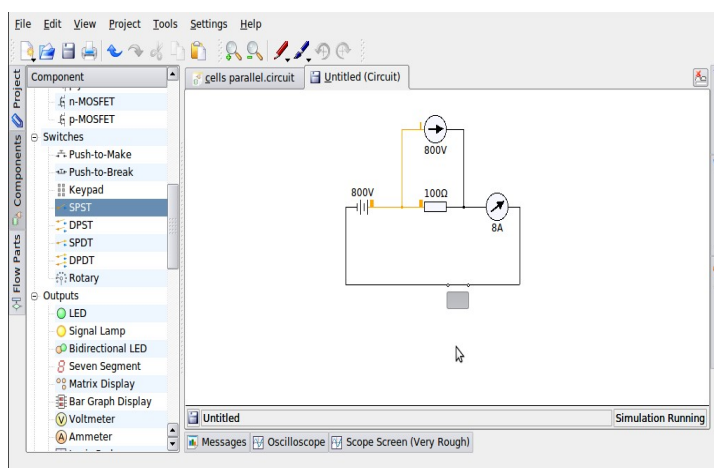
Activity 3 Ohms Law Verification

Purpose

To verify Ohms Law

Process

- Drag and Drop a batteries, switch (SPST), an ammeter and voltmeter as shown in the figure here.
- Use 'Automatic' connection and the mouse to connect the circuits as shown below.
- Click on the switch and record the voltmeter and ammeter readings
- Click on the resistor and change the value of the resistance and record the readings of the meters.
- Click on the battery and change the voltage of the battery.
- Record the different readings.
- Save the file as Activity_3



Social Science

KGeography

About KGeography

KGeography is a Geography educational tool that allows you to explore maps by continents, countries. Children can explore states, their capitals, flags etc of each country.

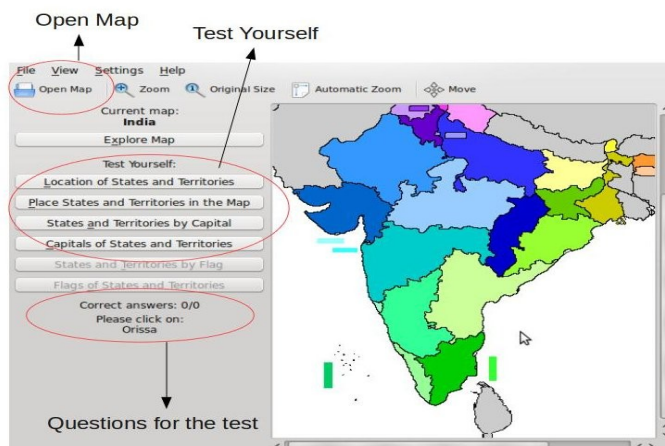
Purpose

In an interactive and fun way allow children to explore the world maps and create activities to enhance the children's knowledge about a specific continent, country or state. Can introduce children to concept of direction (north south east west), routes etc...

How to Install KGeography

Please see section on how to [Install New Software](#) in this document.

Activity 1: To open and use the basic Explore Map option.



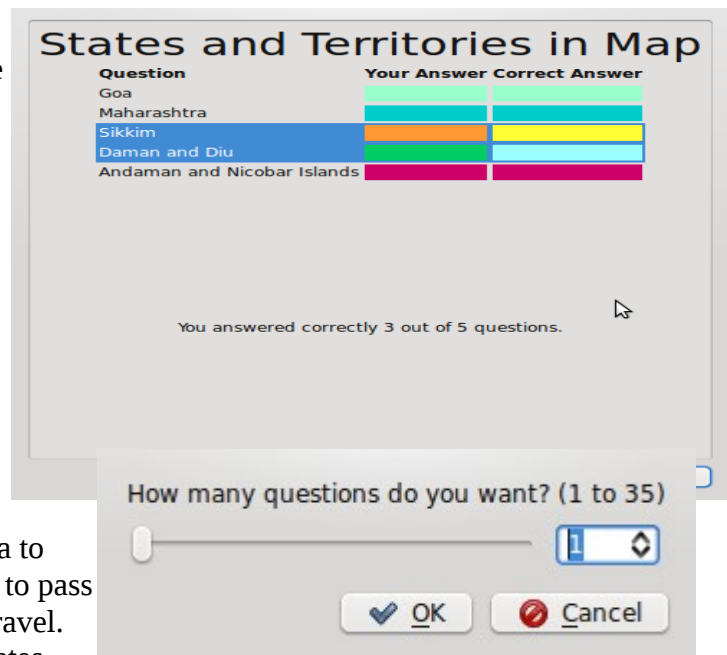
To access KGeography click on **Applications**

> Education> Kgeography

- To explore a continent or country click on **File > Open Map** and select a country and click **OK**
- Place mouse over the region in colour and left-click to view Name and Capital

Computer Lab Activity Ideas:

- First explore India, and all the states and capital
- Point out the islands of India and talk about what islands are.
- Explore North South East West directions
- Talk about what a capital of the state means, also talk about the capital of the country.
- Ask if someone has to travel from place A to B (Bangalore, Karnataka to Puri, Orissa) what states they need to pass and which direction they need to travel.
- Identify the smallest and largest states
- What states are called the “Seven Sisters”. What is Karnataka called ?

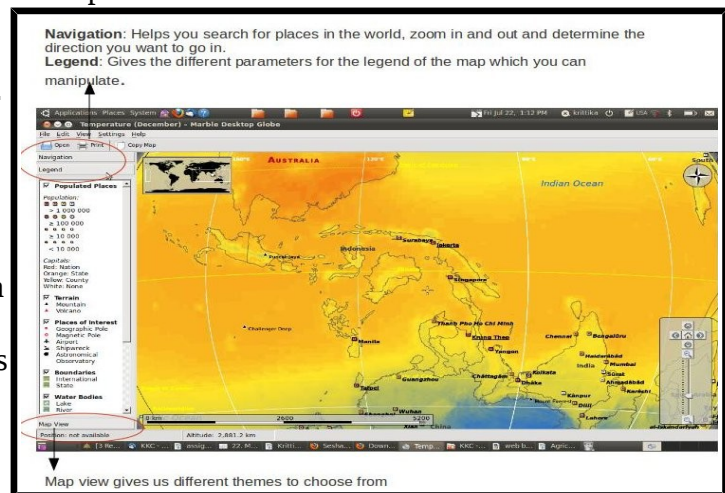


Activity 2 : Test yourself

- To test yourself , select any tab (**Location of States and Territories**) in **Test Yourself** as seen in image in previous page.
- The window below will appear, select the number of questions (1 to 35) and select OK
- The question will appear on the left hand panel
- When all questions are completed the results are shown below. Each state is marked by a distinct colour and the result shows the correct answer and what the user marked.

Marble

Marble is like a desktop Atlas that you can use to learn more about Earth. You can zoom in and out looking at different places in the world. There are different thematic map here: A classroom-style *topographic map*, a *satellite view*, *street map*, *earth at night* and *temperature and precipitation maps*. All maps include a custom map key, so it can also be used as an educational tool for use in class-rooms. For educational purposes you can also change date and time and watch how the starry sky and the twilight zone on the map change. Not only do you get globe view, but you can change it to a Flat Map as well.



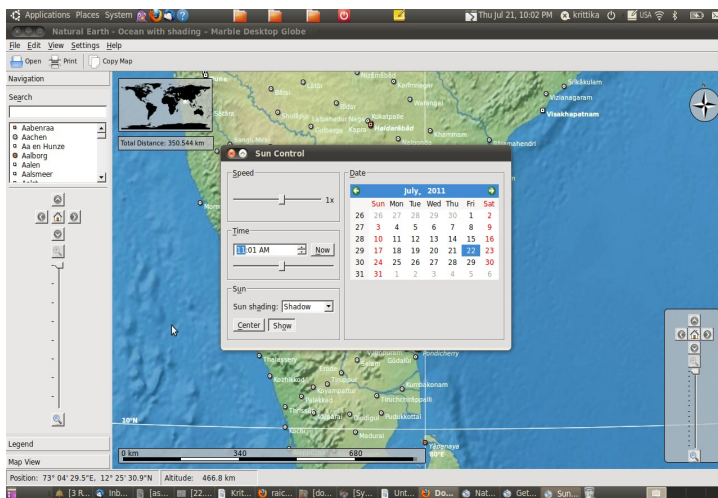
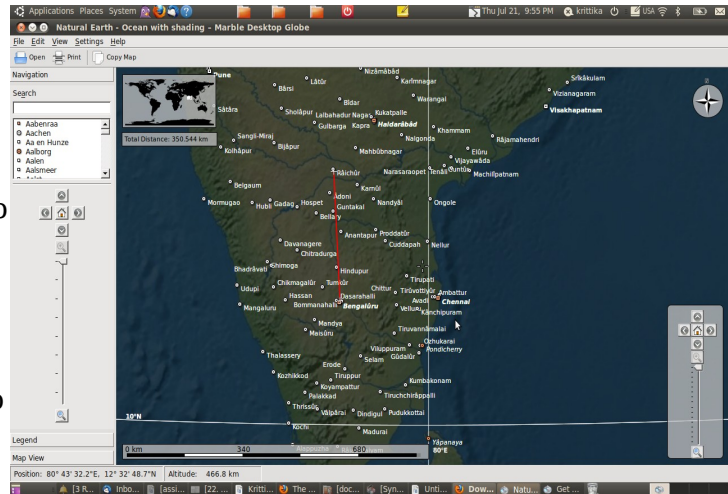
How to install

- Go to system – Administration – Synaptic Package Manager.
- Type Marble in the search bar.
- It will usually be the first option that you get. Right-click – Click on Mark for Installation.
- Click on Apply
- Once this is complete, Marble will be available in Applications – Education – Marble.

How to Measure Distances

To measure the distances between two places on the earth, right click on the first location and click on “add to measure”. Click on the second location.

- A red line is drawn between the two locations and the distance can be seen on the top left corner in a box.
- How to Set the time
- You can change the time to whatever you like on Marble. Go to View – Sun Control
- Use this window to play around with the time
-



- How to Download new maps
- Go to file – Download Maps. Click “install” on the maps you want to download. (you need to be connected to the Internet for this). For more information on how to use Marble, please click

<http://docs.kde.org/development/en/kdeedu/marble/>

KStars

About KStars

KStars is a Desktop Planetarium for KDE. It provides an accurate graphical simulation of the night sky, from any location on Earth, at any date and time. The display includes upto 100 million stars, 13,000 deep-sky objects, all 8 planets, the Sun and Moon, and thousands of comets and asteroids. To access KStars click on **Applications > Science > KStars**

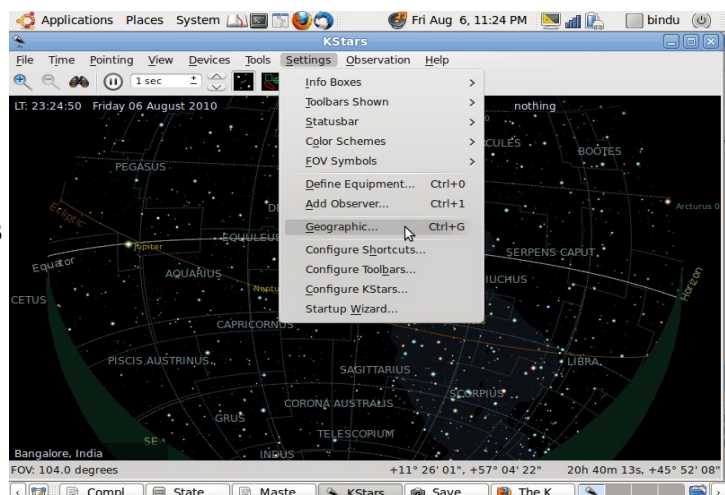
Activity 1 Solar Eclipse

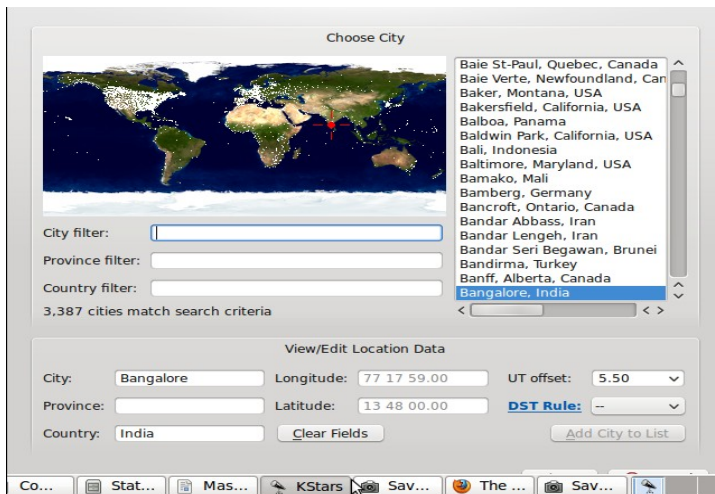
Purpose

To view the solar eclipse as seen in Bangalore on January 15th 2010.

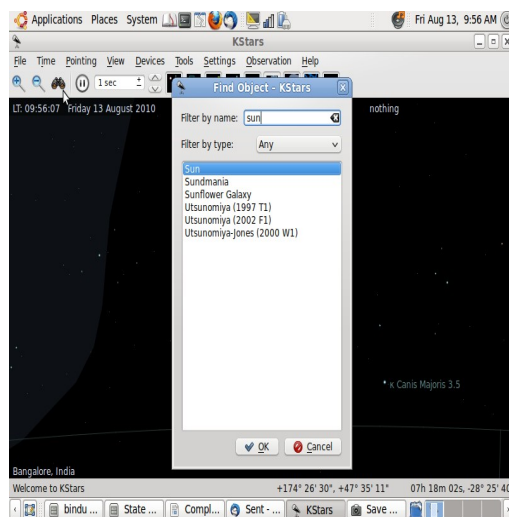
Process

1. Set the location as Bangalore by selecting file menu option **Settings > Geographic** or pressing **Ctrl+G**
2. Select Bangalore, India as the location.

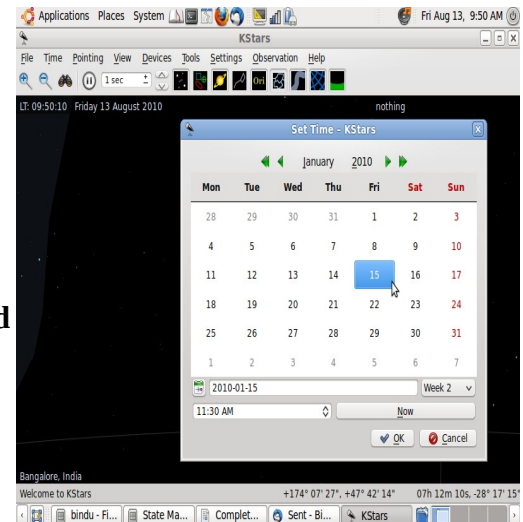




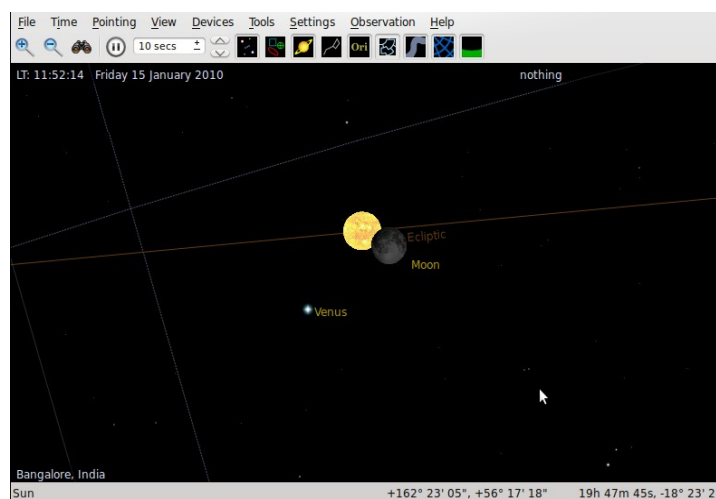
4. 4. Press **Ctrl+F** and find the sun on the map.



3. Set the time by selecting file menu option **Time > Set Time** or pressing **Ctrl+S**



5. Press the play/Pause button to start the simulation, and keep the time at 10seconds

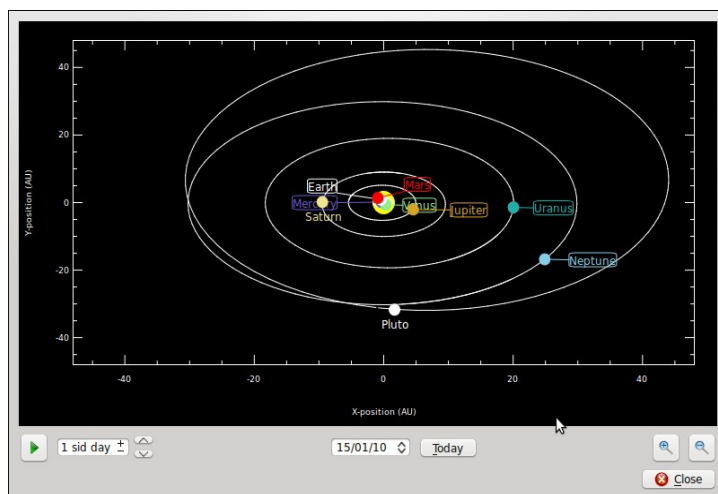


Activity 2 Solar System Purpose

View the solar system. And see the revolution of the planets around the sun.

Process

1. Set the location as Bangalore by selecting file menu option **Tools > Solar System** or pressing **Ctrl+Y**
2. Press **Play** button to simulate the movements of the planets
3. Use the scale to place an orbit of any planet at 0 , when the planet is at position 0, note the clock measure and stop the clock when it comes back to zero position to measure how long the planet takes to complete one revolution.



Mathematics

Geogebra

Introduction to Drawing in Geometry

In many of our schools we are seeing children struggling to grasp mathematics concepts. Sometimes explaining concepts such as point, line, plane, chord, radius become very vague for children and hence prevents them from grasping the concepts completely and hence they struggle to progress in the subject.

There are many new methods that are being adopted to make concepts less abstract in mathematics like using pictures, cutting shapes out of cardboard etc... Often these aids are very time consuming. IT based tools allow us to easily manipulate drawings and allow children hands-on experience and visual stimulation to make mathematics come alive and be less vague.

Geogebra is a good example of a computer aided tool, which helps us in learning Geometry, Algebra and Calculus. It is a free software, which functions in GNU Linux Operating System.

Geogebra cannot replace children using the compass box to draw. The children in classes must use the compass box and pencils to draw and construct. This tool must be used by teachers to animate some concepts and theorems to enable them to use it as a teaching aid to further their own teaching methodologies.

About Geogebra

Geogebra is dynamic mathematics computer aided tool for schools that combines **geometry**, **algebra**, and **calculus**.

One part of Geogebra is an interactive geometry system. You can do constructions with points, line segments, parallel lines, line intersections, polygons, circles and more.

Another part of Geogebra allows you to enter equations and coordinates directly. Thus, Geogebra has the ability to deal with variables for numbers, vectors, and points.

You can also see the algebraic expressions of the figures you draw and change the values in algebraic expressions to dynamically see the change in the geometry figure and vice-versa.

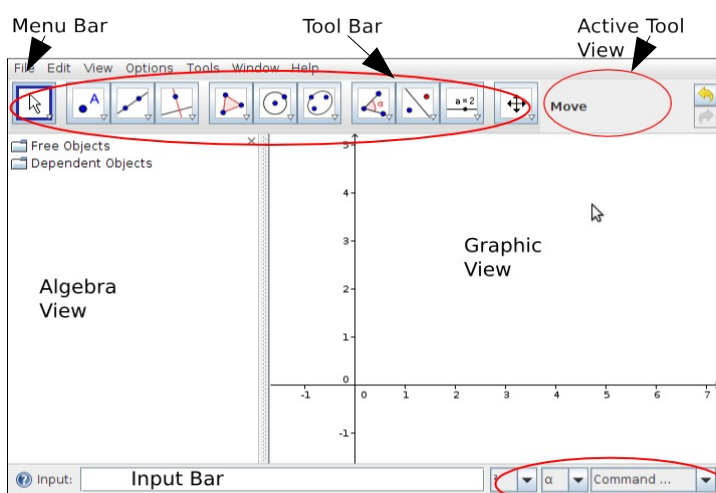
Opening Geogebra

On the desktop click **Applications > Science > Geogebra or Applications > Education > Geogebra**.

Installing Geogebra

Please see the [Install New Software](#) section to install it if it is not available on your Ubuntu system. You will need to be connected to the internet for this.

The Geogebra Window



The figure shows the default Geogebra Window. The details of each section are explained below.

Menu Bar: Typical windows command menu bar. We will be using the **File** command only.

Tool Bar: Has all the tools (compass box) to use in the graphic view

Display for Tools: It tells you which tool is active to use on the graphic view

Graphic View: Used to draw the geometric figures. This window can never be closed.

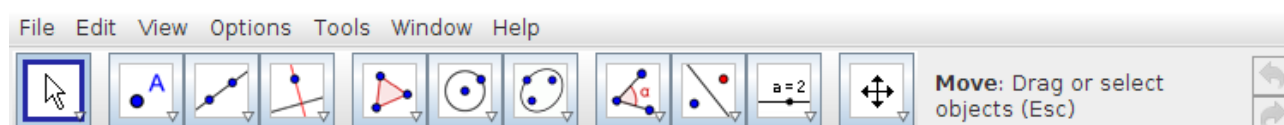
Algebra View: Shows the algebraic expressions. This window can be closed if you are working only on geometry.

Input Bar: This is used to enter more complex mathematical expressions that may not be available on the Tool Bar. (*Not used in this training session*)

Commands: To use along with the Input Bar, to select from a list of available commands. (*Not used in this training session*)

Tool Bar

We can consider the Tool Bar to be like a compass box. Today we will consider the Geogebra tools

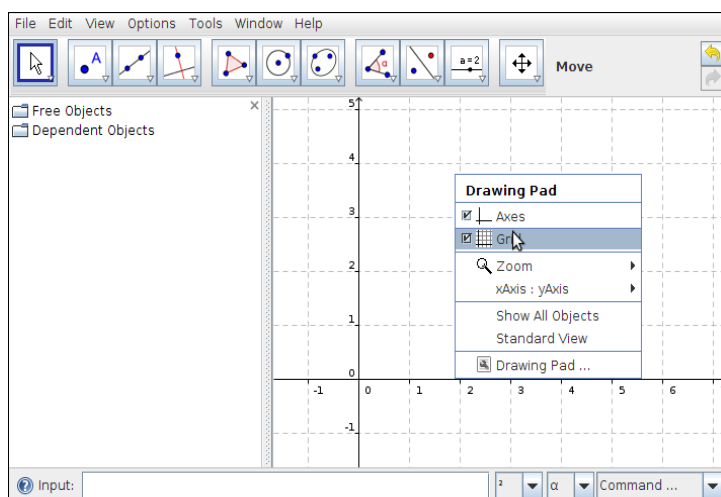
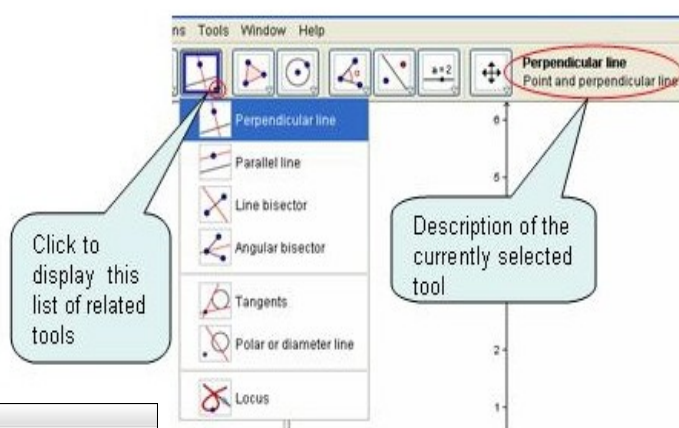


that correspond to using a pencil, a ruler and a compass in a compass box.

To see the list of related tools, click on the arrow at the bottom right hand corner of each tool as shown below.

Basic Use of Tools (Refer to above diagram, left)

- Activate a tool by clicking on the button showing the corresponding icon.
- Open a toolbox by clicking on the lower part of a button and select another tool from this toolbox.



Graphic Window with Grids Displayed (Refer to above diagram, right)

- Place the mouse pointer over the **graphic view** area. Right Click and check the Grid option. To remove the grid view, un-check the option. See diagram below.

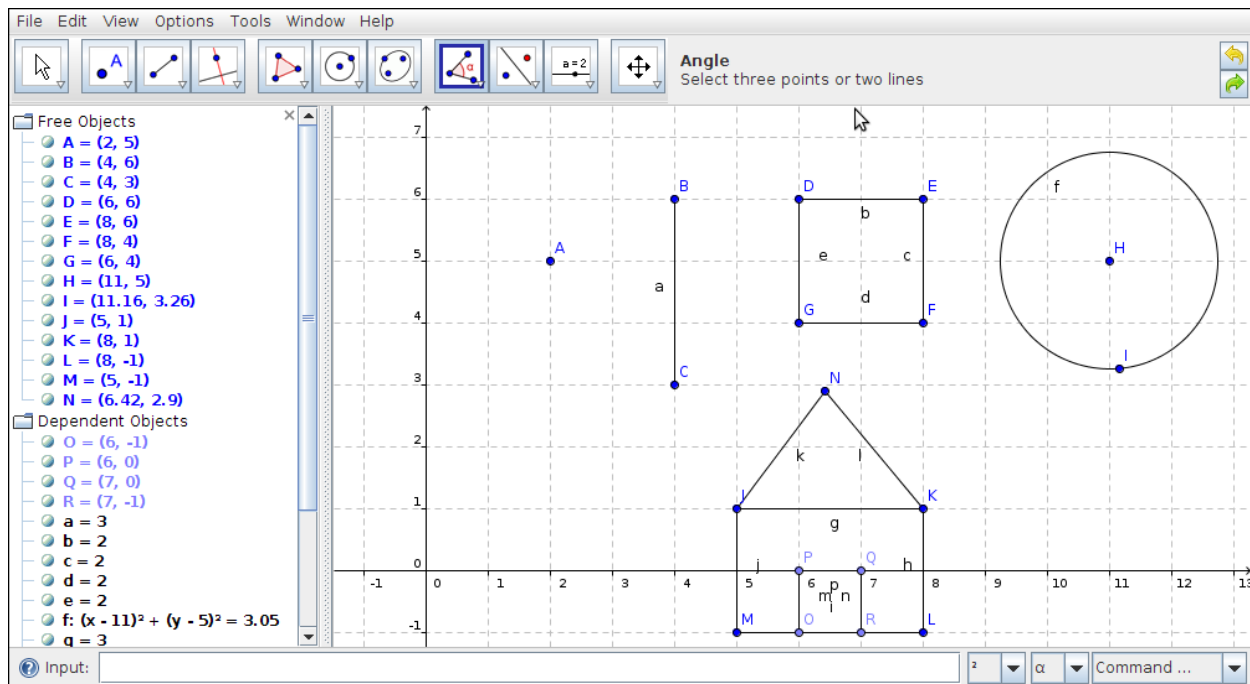
Activity 1: Drawing pictures with Geogebra

Purpose: To familiarize oneself with the Geogebra window and some of the basic geometry tools.

Process

Use the mouse and the following selection of tools in order to draw figures on the drawing pad.

Start by drawing the following : [**A Point, A Line Segment, A Square, A House, A Circle**]



Hint Box

- Observe the Algebra View
- Geogebra is **case sensitive** and uses mathematical naming norms
- If you move the cursor close to the grid intersection, it will show you the point of the intersection and you can click to place the object at the intersection coordinates
- Use the **move** icon to move the figure you have drawn and observe the algebra window
- You can also move the labels to make the diagram more readable

Activity 2 : Saving/Opening Geogebra files

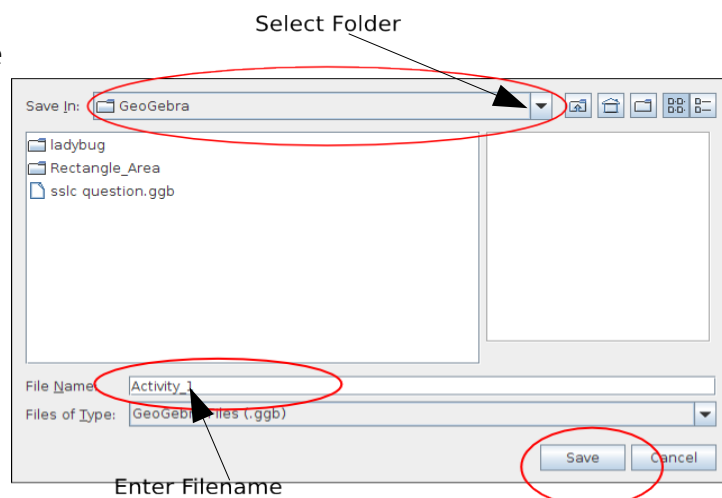
Purpose

Save and retrieve Geogebra Files.

Process

1. Open the File menu (Menu Bar) and select **Save**.
2. Select the folder **Your Name > Workshop > Geogebra** in the pop-up dialogue window.
3. Type in a name for your Geogebra file.
4. Click the **Save** button to save the file.

To Open an existing Geogebra file select menu **File > Open**. A Open Window (just like the save window) pops up. Select the folder that you had saved the file and look for the file with extension '.ggb' in the box on the left side and click **Open**.



Hint Box

- A file with the extension '**.ggb**' is created. This file extension can only be

opened with Geogebra.

- Give simple short names for your files like **Activity_1.ggb**.

Activity 3 (Measurement)

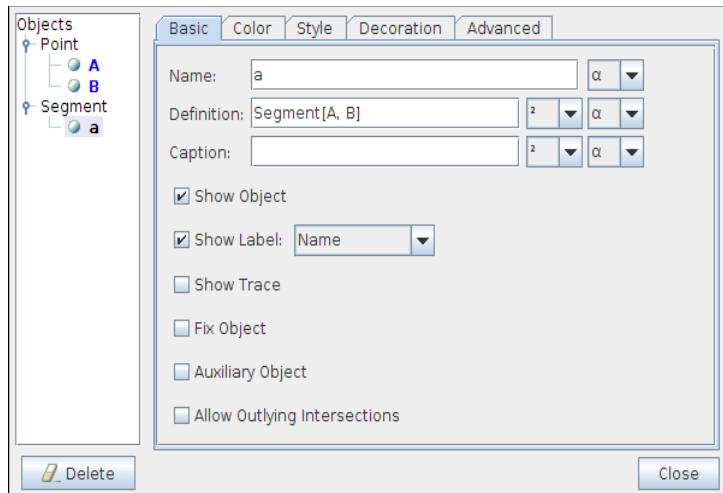
Purpose

To learn to use the measurement tools

Angle and **Distance and Length**.

Process

1. Open file 'Activity_1.ggb'.
2. To measure select the tools from the Angle toolbar. Use these tools to measure the following
 - i. Measure the Length of the Line Segment (**Distance or Length**)
 - ii. Measure the Angles of the Square (**Angle**)
 - iii. Measure the Circumference of the circle (**Distance or Length**)



Hint Box

- When you select an object on the graphics window, it gets highlighted.
- You can right click on any object, select properties and can change properties such as colour, what to display : Name, Value etc... (See Diagram Below)
- To measure interior angles, the three points must be selected clock-wise , so the middle point selected is where the angle is measured.

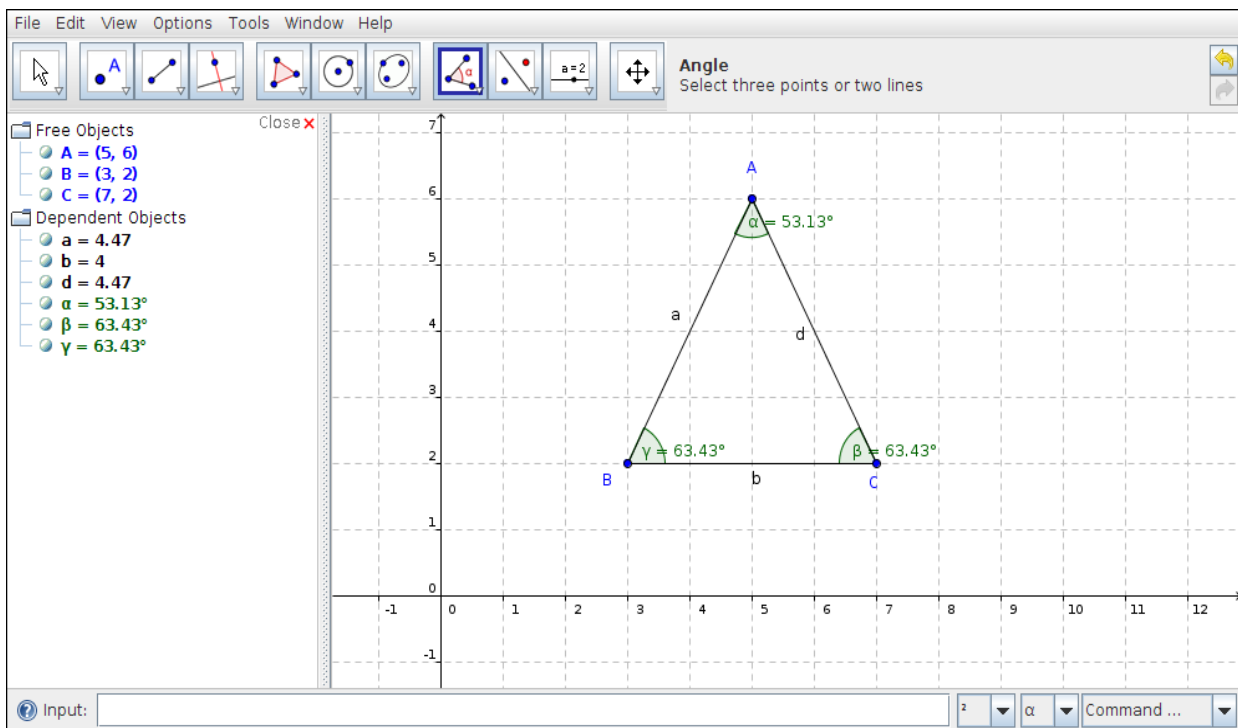
Activity 4 Triangles

Purpose

To verify that the sum of the interior angles of a triangle are 180 degrees.

Process

1. Draw three points A, B, C (**New Point** tool)
2. Draw three line segments AB, AC, BC (**Segment between two points** tool)
3. Select the **Angle** tool to measure each of the interior angles of the triangle.
4. Now verify that the sum of all the interior angles equals to 180 degrees.
5. Select one of the vertices of the triangle (A,B or C) and move the points (**Move** tool) to change the shape of the triangles.



Hint Box

- Remember to save the file as 'Activity_4.ggb'
- Notice which objects are free objects and which objects are dependent objects. You can move only free objects

Constructive Corner

- You may make the children do this exercise before you prove the theorem in class, allowing the children to arrive at the theorem themselves.
- Observe what happens when you move all three points A,B,C to lie on a straight line.
- Creating tables like the one below and asking them to write down the values, would help them focus on what to observe.

Angle BAC	Angle CBA	Angle ACB	Sum of all Angles

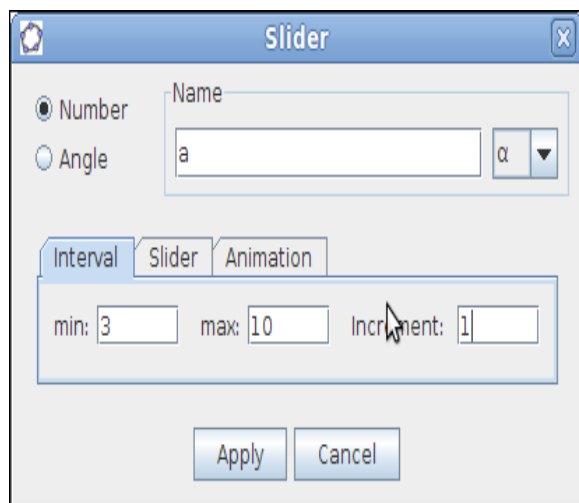
Activity 5 (Explain different types of polygons)

Purpose

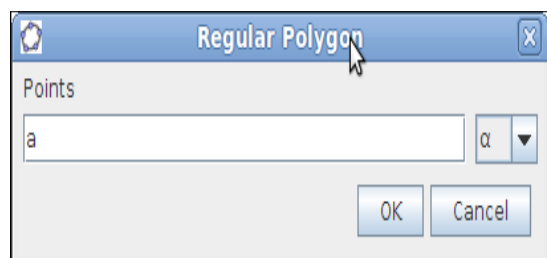
To demonstrate the different types of polygons .

Process

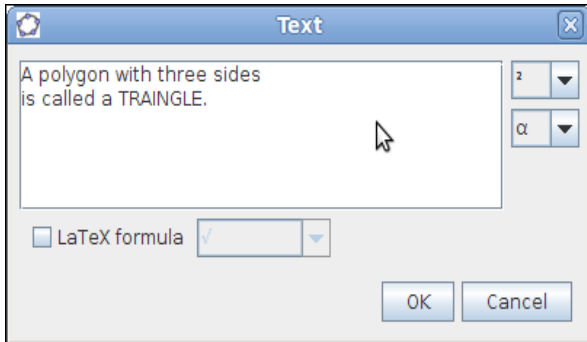
1. Create a slider by clicking on the **Slider** tool



2. Select Radio Button: Number,
Name: **a**,
min: **3**,
max:**10**,
Increment: **1** and press **Apply**.

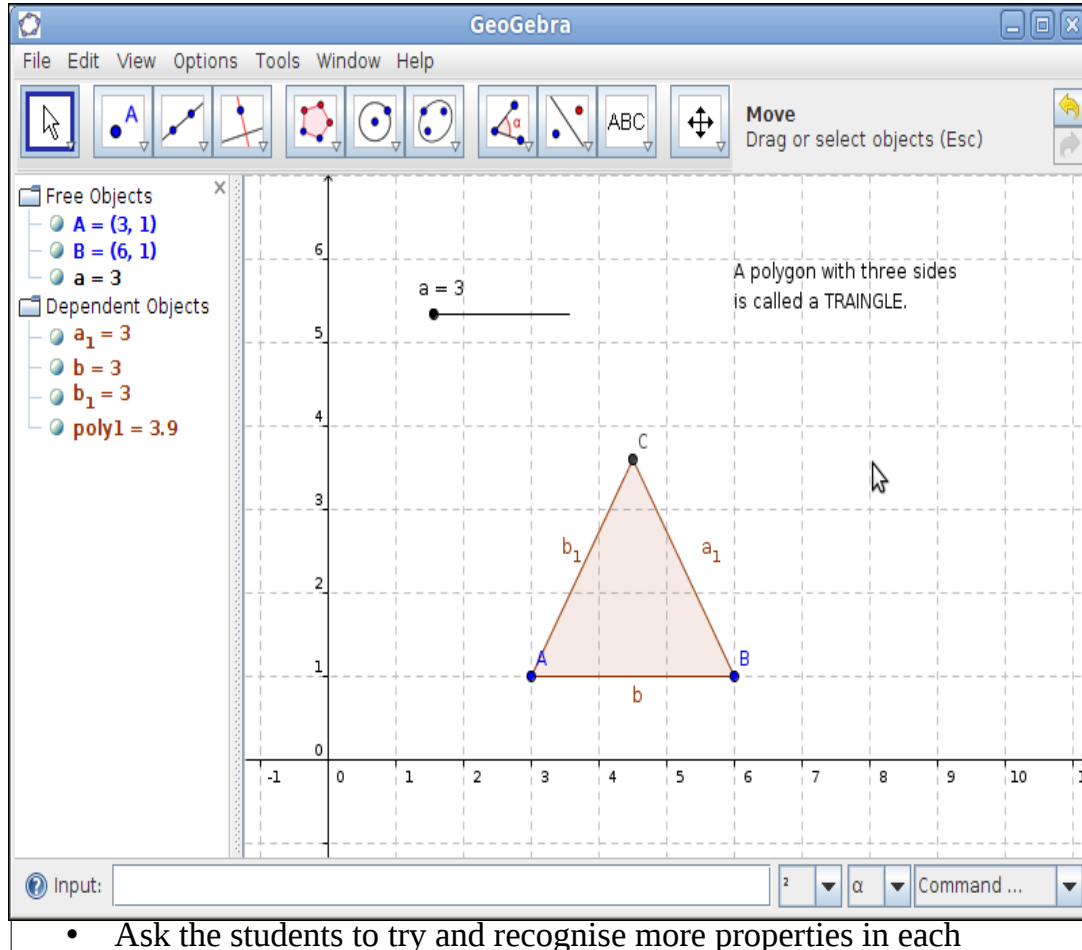
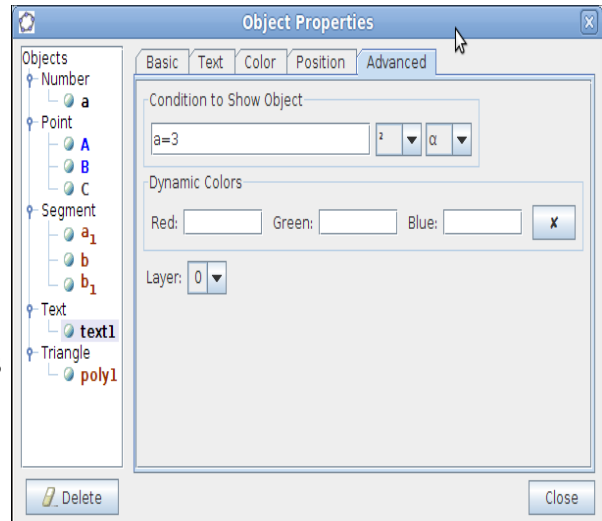


3. Select the tool **Regular Polygon** and mark the two points A and B of one side of the polygon on the drawing pad. You will be prompted with a window as shown. Please put the **slider name “a”** in the box provided and press **OK**.



4. Select the **Insert Text** tool and write the text: *A polygon with three sides is called a TRIANGLE* as shown in the figure alongside and press OK.

5. Right click on the text created and select object properties. Click the **Advanced** tab. Enter **a=3** in **Condition to Show Object** and press OK.
6. Repeat steps 4 and 5 for as many polygons 7 more times to show up to 10 sided polygon.
7. Select the **move tool** and demonstrate the different polygons.



- Ask the students to try and recognise more properties in each

polygon.

Activity 6 (Explain different terms related to circle)

Purpose

To enable understanding of different terms and definitions related to a circle.

Circle: The collection of all the points in a plane, which are at a fixed distance from a fixed point in the plane, is called a circle. The fixed point is called the **centre** of the circle and the fixed distance is called the **radius** of the circle.

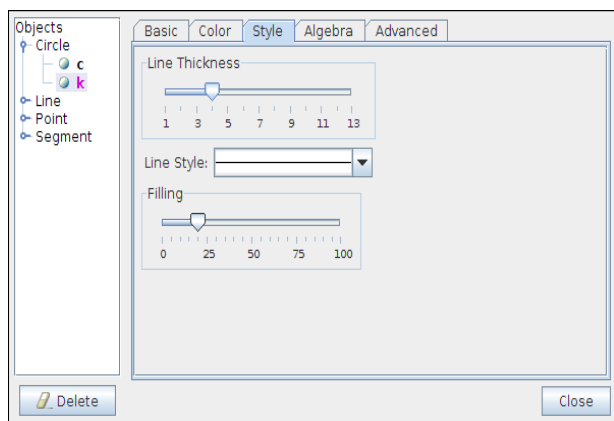
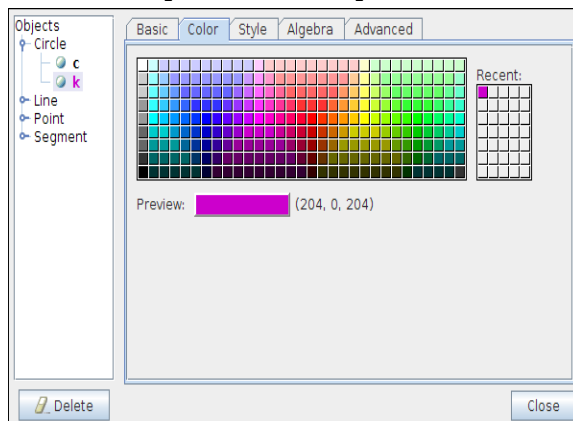
Process

1. Draw a Circle using the **circle with centre through point** tool
2. Draw multiple line segments using the **line Segment tool** where one point is on the circle centre and the other point anywhere on the circumference of the circle.
3. Observe the value of the line segments.

A circle divides the plane on which it lies into three parts. They are: (i) inside the circle, which is also called the **interior of the circle**; (ii) **the circle** and (iii) **outside the circle**, which is also called the exterior of the circle. The circle and its interior make up the circular region.

Process

1. Draw a Circle using the **circle with centre through point** tool.
2. Select the circle, right click and select **object properties**.
3. Select the **colour tab** in the object properties window and choose a colour
4. Select the **style tab** in the object properties window and change the line thickness and filling values.
5. Then explain the three parts described above.



Chord: If you take two points P and Q on a circle, then the line segment PQ is called a chord of the circle. The chord, which passes through the centre of the circle, is called a **diameter** of the circle. A **diameter is the longest chord** and **all diameters have the same length**, which is **equal to two times that of the radius**.

Process

1. Draw a circle using the **circle with centre through point** tool.
2. Draw many chords for the circle using the **line segment** tool that do not pass through the centre of the circle.
3. Draw multiple chords of the circle using the **line segment** tool that pass through the centre of the circle (Diameter).
4. Draw a line segment that represents the radius of the circle.
5. Then explain the three parts described above.

KTurtle

About KTurtle

Kturtle is a tool to understand basic concepts of programming in computers. The commands are simple and can be visualized by children and hence understood easily. It can be seen as giving instructions to a robot (the turtle) and making the turtle “do what you want it to do”.

Purpose:

Introduce children to the basic idea of programming and the generic logic constructs. Can make the concept of computer programming less intimidating for both teacher and student. In today's digital world, mathematics education may be seen as many areas of learning coming together. These parts are conceptual understanding of the mathematics, using the algorithms to internalize and apply the conceptual understanding pattern recognition and logical reasoning especially to understand theorems and proofs. K Turtle helps teachers build logical reasoning and pattern recognition with children. As it is visual, many geometric properties can also be understood through the use of K Turtle, like making the turtle draw a square requires the child to understand the properties of a square. Thus it is very useful to teach logical reasoning side by side with mathematics. This tool provides an interactive and easy method to do the same with children starting in the upper primary classes.

Activity 1

Open application **Applications >**

Education > Kturtle and introduce the user to the following windows, **editor** and **canvas**.

Editor : Space for entering the commands, please note the different colours that are used for keywords (blue) and the quantities (red) etc...

Canvas: Is see the turtle in action when the command being executed.

Now introduce four simple commands

reset ,forward, backward, turnleft, turnright

Reset :Clears the canvas and the turtle is positioned in the center of the canvas facing forward.

Forward <Number of pixels> : Turtle moves forward by the number of pixels specified

Backward <Number of pixels> : Turtle moves backward by the number of pixels specified

turnleft <Number of Degrees>: Turtle turns left (anti clockwise) by the number of degrees specified

turnright <Number of Degrees>: Turtle turns right (clockwise) by the number of degrees specified

Note: You can also go to menu option **Tools > Direction Chooser**.

Type the following commands in the Editor window:

Reset

forward 100

turnright 90

backward 100

turnleft 90

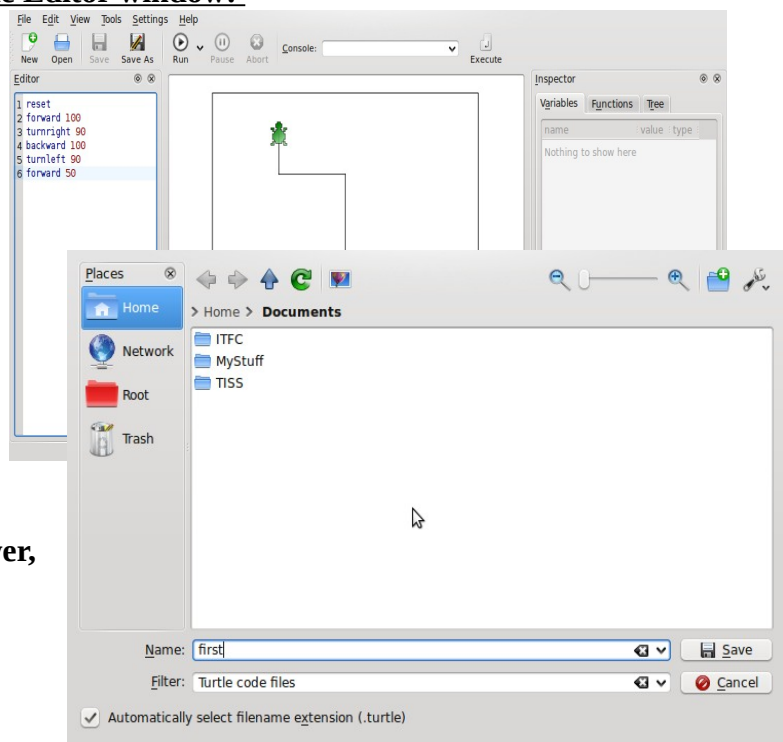
forward 50

Do the following:

1. Click **Save As** Save the

File as **first**

2. Click on **Run**, try all the options **full speed, slow, slower,**



slowest and step by step.

Activity 2 : Using the commands from activity 1 create a Square

```
Reset
Forward 100
Turnright 90
Forward 100
Turnright 90
Forward 100
Turnright 90
Forward 100
Turnright 90
```

Investigation

Talk about repeated commands and what they think should be done and lead them to the command

Repeat <No of Times> { <List of Commands>

Redo Square program as

```
Reset
Repeat 4 {
  forward 100
  turnright 90
}
```

Activity 3 : Using the commands from activity 1 & 2 discuss how a CIRCLE may be created.

Investigation:

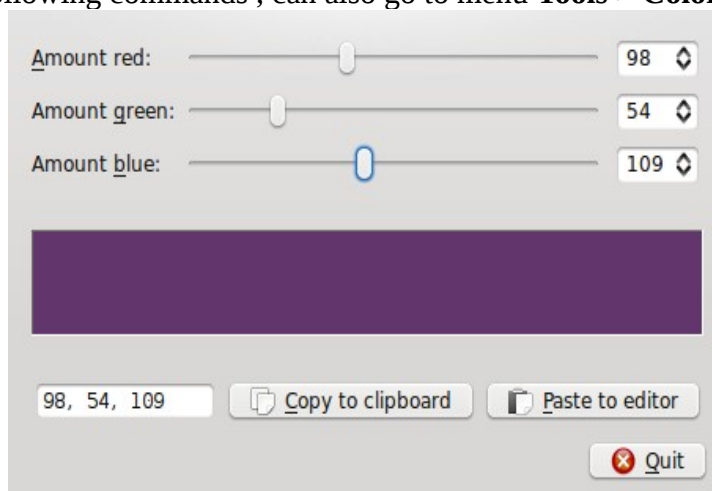
1. What is the definition of a circle really.
2. What is the relationship between the number of times the command is repeated and the command that is within the repeat loop.
3. Can we change the numbers, what happens

```
Reset
Repeat 36 {
  forward 10
  turnright 10
}
```

Table 1: Circle Program

Activity 4 Bringing some colour to the canvas.

Introduce the following commands , can also go to menu **Tools > Color Picker** for selecting colour



canvascolor <Amount of Red>, <Amount of Green>, <Amount of Blue> : Changes the colour of the canvas

pencolor <Amount of Red>, <Amount of Green>, <Amount of Blue> : Changes the colour of the pen (pencolor 0,0,0 is black)

penwidth <thickness of the pen>

Investigation

Learn the concepts of colour mixing with the primary colours red, green and blue

Activity 5 :

Create a flower or some Rangoli Pattern as shown below or any other pattern they come up with

```
reset
canvascolor 255, 115, 119
pencolor 0,0,0
penwidth 3
repeat 4 {
    turnright 45
    forward 200
    turnright 45
    backward 100
}
```

```
reset
canvascolor 255, 115, 119
pencolor 0,0,0
penwidth 3
repeat 12 {
    repeat 36 {
        forward 10
        turnright 10
    }
    turnright 30
}
```

