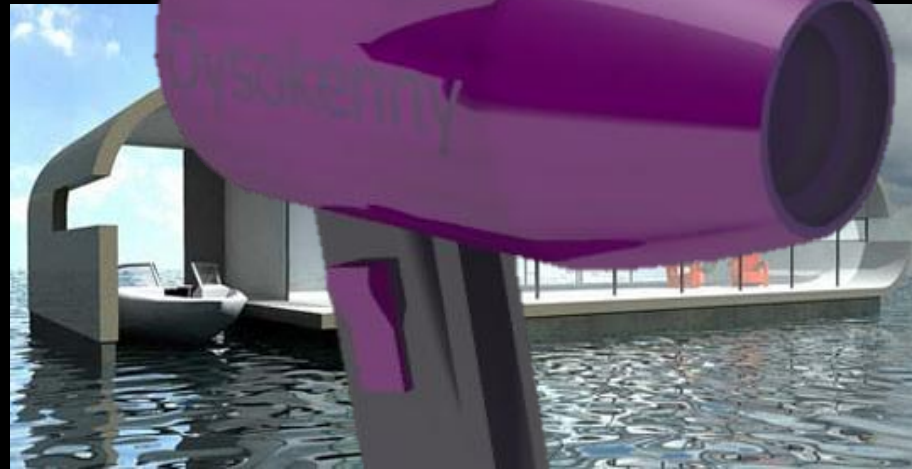CAD TUTORIAL 6: Hairdryer

CAD Skills

CAD Tutorial 6: Hairdryer

Level of Difficulty
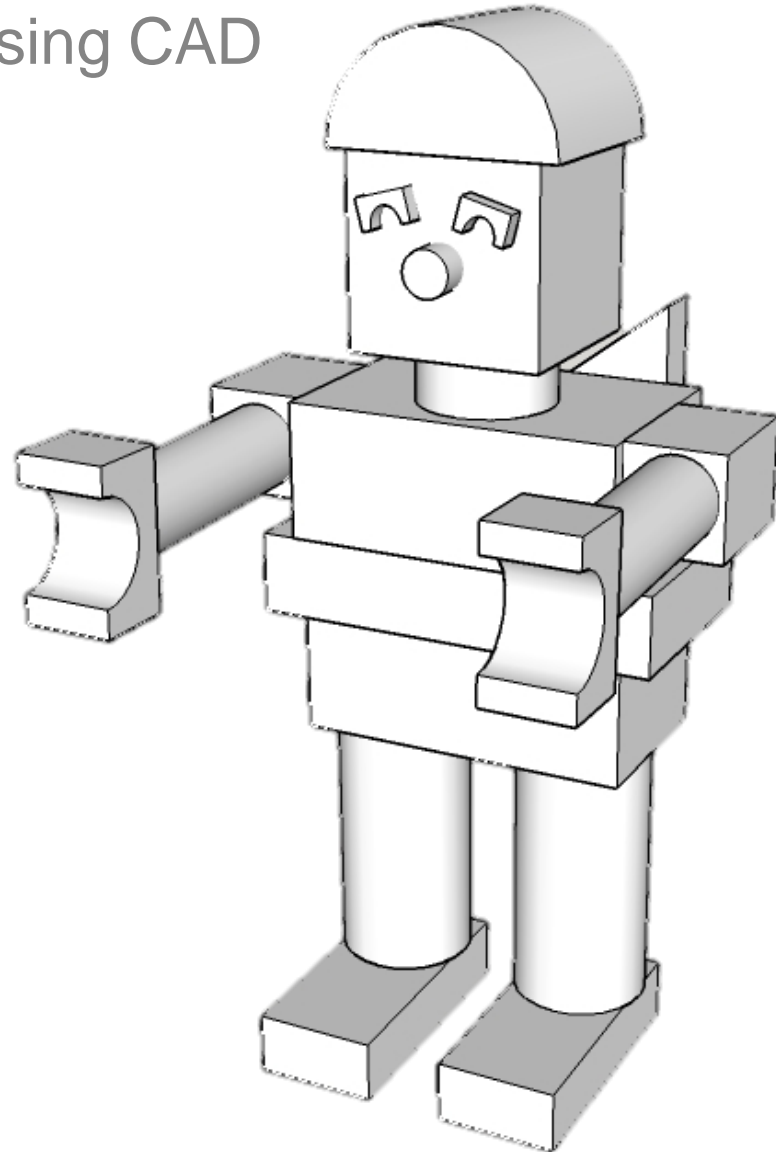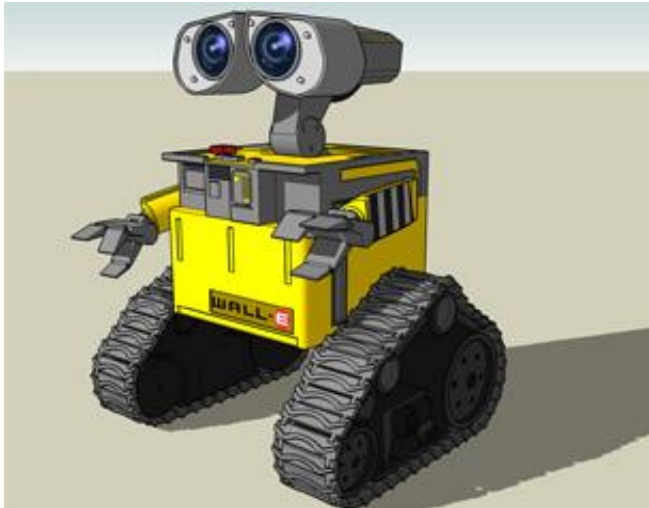
★ ★ ★ ★ ☆

Time
Approximately 50–60 minutes

Design & TECHNOLOGY FACULTY
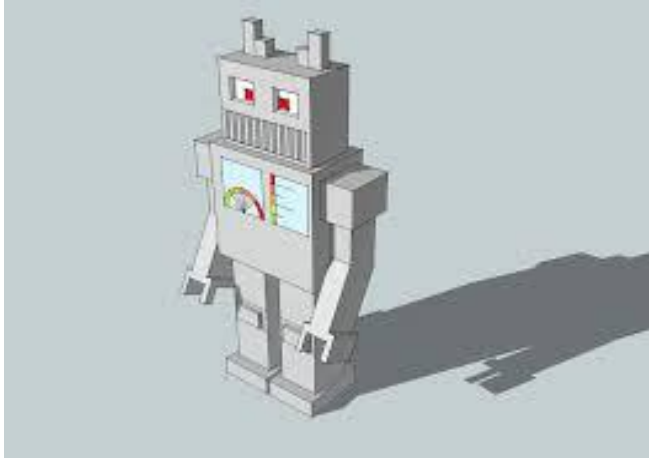
Starter Activity

- Design a Robot using CAD

Lesson Objectives…

- To understand the basic tools used in SketchUp.

- To understand the advantages of using CAD

- To be able to successfully use CAD independently to complete a range of tutorials in 2D and 3D

- To develop advanced skills and problem solving skills when using SketchUp

Lesson Outcomes...

By the end of this tutorial you will be able to...

- Create, Move and Rotate components
- Use the Follow Me tool to make objects
- Apply and position 3D Text on your design
- Colour and render your design

Skills to be used in this project...

Basic Skills	New and Higher Skills
Zoom tool	Rotate tool
Orbit tool	Move tool
Pan tool	Tape Measure tool
Line tool	Arc tool
Rectangle tool	Follow Me tool
Circle tool	Paint Bucket tool
Eraser tool	3D Text tool
Push/Pull tool	Making Components

Basic skills are those required to do very basic drawings and are detailed as part of this presentation.

New and higher skills may be new to the novice and are the focus for learning in this presentation.

Learning Styles

Visual : *Presentation*

Auditory: *Video*

Kinaesthetic: *Demonstration*

Sketchup Help Guide:

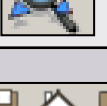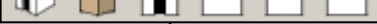| Drawing and Modification Tools	image	Description	Advantages
Modifying Tool 1. **Pencil tool**		used to draw lines in X, Y and Z direction. Can draw simple or complex shapes very quickly.	**Advantages:** Allows user to draw or modify shapes very quickly and can be used to construct 3D objects faster than traditional hand drawings
Modifying Tool 2. **Trim tool**		allows the user to remove overlapping elements.	**Advantages:** Allows user to erase overlapping lines and edges to draw complex 3D shapes very quickly.
Modifying Tool 3. **Push/pull**		tool used to turn solid objects into 3D objects instantaneously. Typing a size allows a user to extrude or pull an object to a certain size or height	**Advantages:** Allows user to draw or modify 3D shapes very quickly faster than traditional hand drawings. You can click on a face (plane) and adjust. Can be used to extrude shapes on 3D objects already drawn.
Modifying Tool 4. **Move Tool**		used to move entire shapes or pull lines on a drawing.	**Advantages:** Allows user to draw or modify shapes very quickly and can be used to construct unusual 3D shapes quickly
Modifying Tool 5. **Dimensions tool**		used to show sizes and radius of drawn objects	**Advantages:** Allows user to draw or modify 3D shapes very quickly faster than traditional hand drawings to correct size if drawn incorrectly. Drawing can be transferred onto the CNC machines directly
Modifying Tool 6 **Extrusion Tool (follow me)**		allows the user to highlight a path that turns blue. A chosen shape will then follow the chosen path	**Advantages:** Allows user to draw profiles of shapes and follow the path to draw complex 3D shapes very quickly.
Modifying Tool 7. **Arch tool**		*You can use the **arch** tool to draw a radius from two given points.* Can be used to draw corners etc..	**Advantages:** Allows user to rotate and position shapes quickly to draw complex 3D shapes very quickly.
Modifying Tool 8. **Circle tool**		allows the user to draw different sized radius circles and chamfered corners	**Advantages:** Allows user to draw profiles of shapes and follow the path to draw complex 3D shapes very quickly.
Modifying Tool 9. **Orbit tool**		*You can use the **Orbit** tool to change the angle that you are viewing your design from. You can do the same by pressing the middle wheel of your mouse*	**Advantages:** Allows user to rotate and see all angles of their design quickly
Modifying Tool 10. **Tape measure tool**		allows the user to draw guide lines to given sizes and mark out radius etc.	**Advantages:** Allows user to draw guides of shapes and draw complex 3D shapes very quickly.

Sketchup Help Guide:

Computer Aided Engineering: 15. Drawing and Modification Commands

Drawing and Modification Tools	image	Description	Advantages
Modifying Tool 11. **Square tool**		used to draw squares and rectangles.	**Advantages:** Allows user to draw guides of shapes and draw complex 3D shapes very quickly.
Modifying Tool 12. **Offset tool**		. *You can use the **contour** tool to draw parallel lines or lines within lines.*	**Advantages:** Allows user to draw duplicate lines and position them within shapes quickly to draw complex 3D shapes very quickly.
Modifying Tool 14. **Rotate Tool**		used to move rotate parts of a shape or entire shapes on x, y and Z co-ordinates.	**Advantages:** Allows user to draw or modify shapes very quickly and can be used to construct unusual 3D shapes quickly
Modifying Tool 15 **Scale Tool**		allows the user to select an object or part of an object and increase its sixe from the base point.	**Advantages:** Allows user to quickly resize objects to draw complex 3D shapes very quickly.
Modifying Tool 16 **Paint Bucket Tool**		allows the user to select a colour or materials to produce photo-realistic drawing of their object. Shadows etc. can be added.	**Advantages:** Allows user to quickly draw objects life like using materials, textures etc...
Modifying Tool 17 **Pan Tool**		*You can use the **Pan** tool to grab and move your object around the screen. Alternatively, you can pan by pressing the **Shift** key **and** holding down the mouse's middle wheel.*	**Advantages:** Allows user to move and position their object quickly
Modifying Tool 18 **Text Tool**		*You can use the **text** tool to add text to your object.*	**Advantages:** Allows user to add 3D text by clicking on the extrude button or 2D text
Modifying Tool 19 **Zoom Extents Tool**		*You can use this tool to automatically zoom into your entire project.*	**Advantages:** Allows user to quickly navigate to the entire drawing if they get lost.
Modifying Tool 20 **View Tool**		*You can use the **view** tool to quickly look at front side and top views as well as 3D views*	**Advantages:** Allows user to complete working drawings quickly as well as enabling them to show a top view for exporting onto the laser cutter.
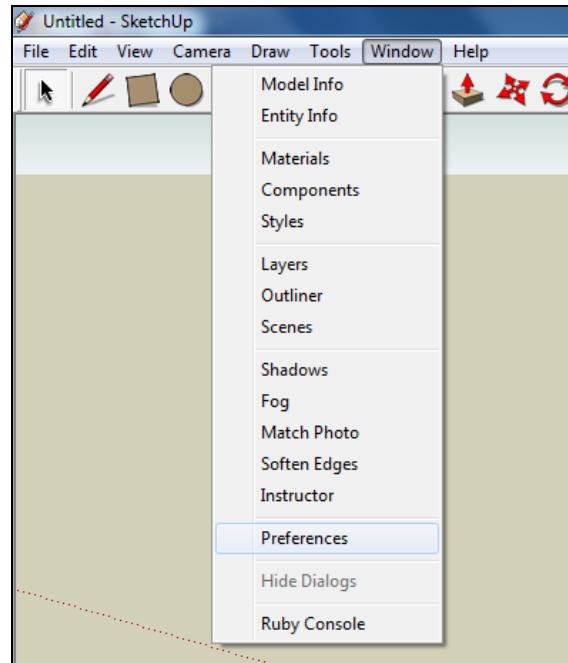
1. Open Library /Designoutthebox.com/ CAD Skills/ Lesson 6 / Hairdryer

Open the sketch up drawing. Once you have opened SketchUp, go to **Window** and select **Model Info**
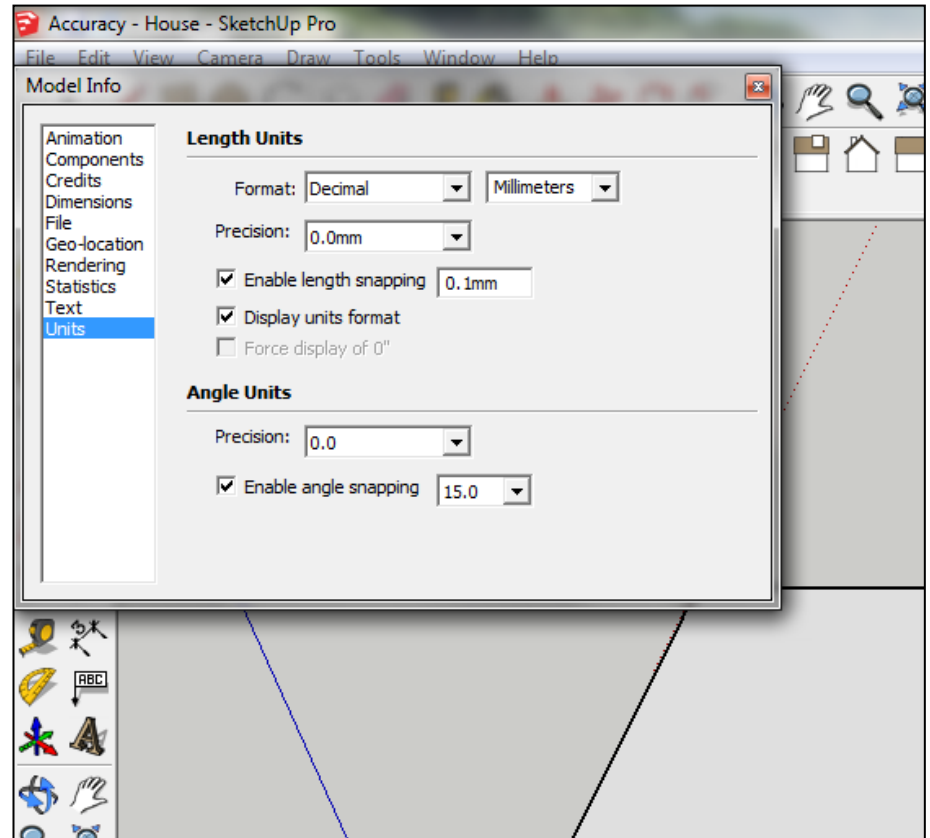
2. Select **Units** and choose **Decimal Millimetres**. We are using this template because we are doing a product design.

*Note: It is often necessary to start a new file to use the new template. Go to **File** then **New**.*

3. Now select the **View** then **toolbars** and ensure **Getting Started** and **Large Tool Set** are ticked
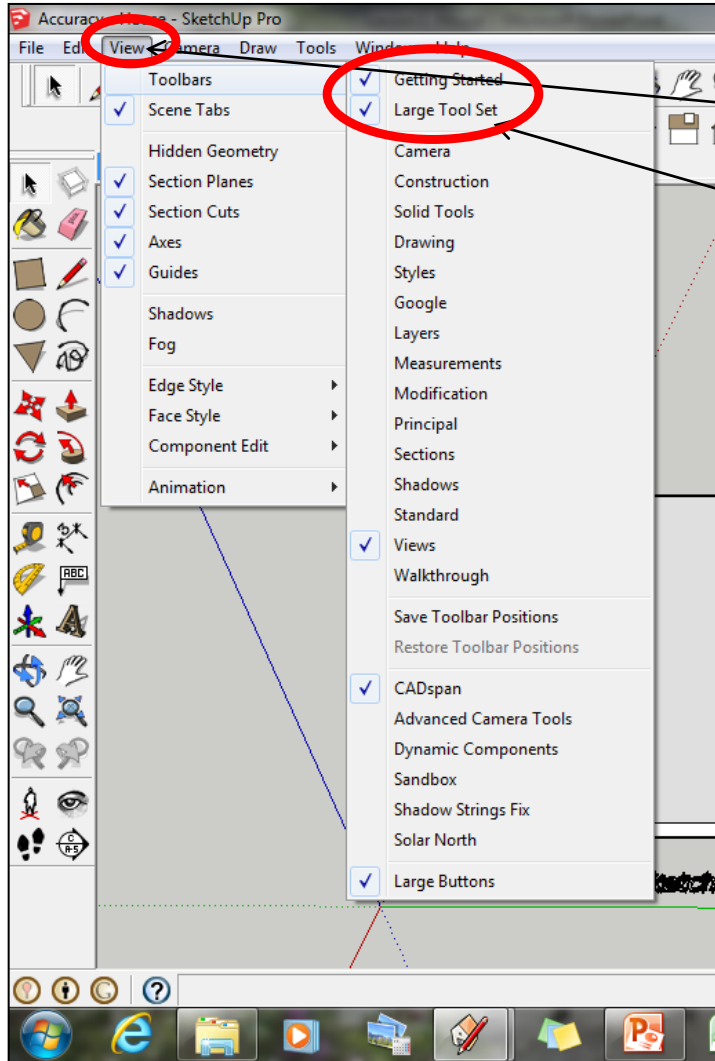
3a Select **View**

3b Tick Getting Started
3c Tick Large Tool Set

Note: this will place a tool bar across the top (getting started) and the side (Large Tool Set)

4. Select the *Circle* tool and draw a circle on the base starting by clicking on the *axis origin point* for the circle centre. *Look for the yellow dot that shows the origin point.*
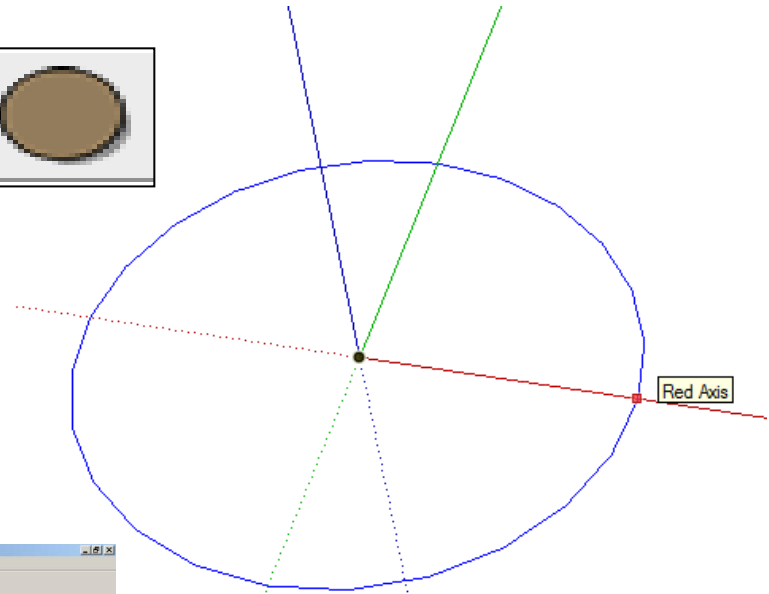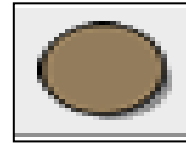
5. *Enlarge* the circle and type in *50* and press *enter*

Red Axis
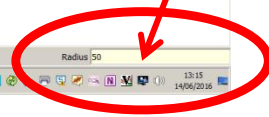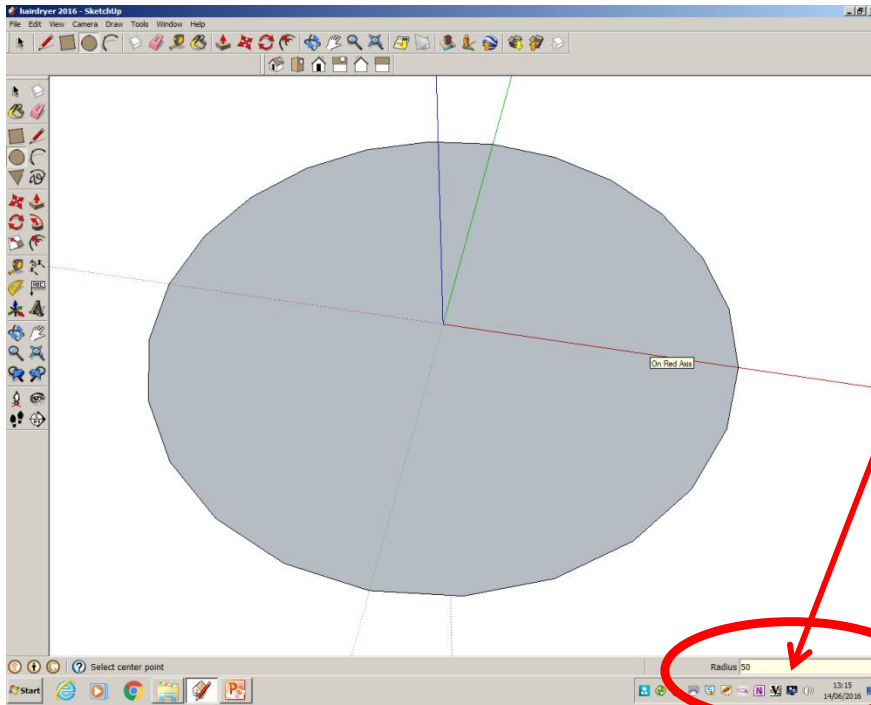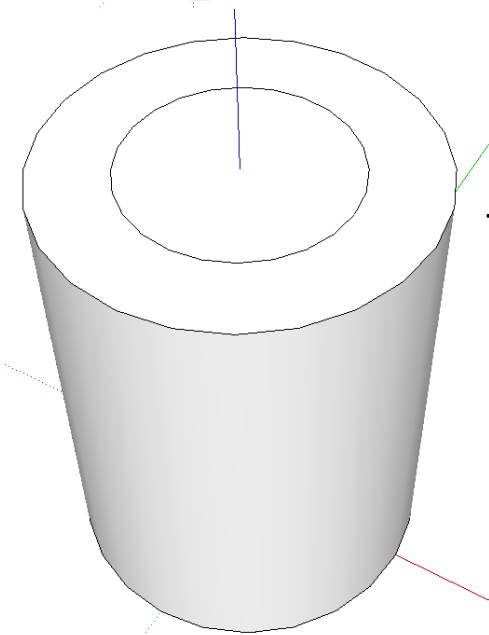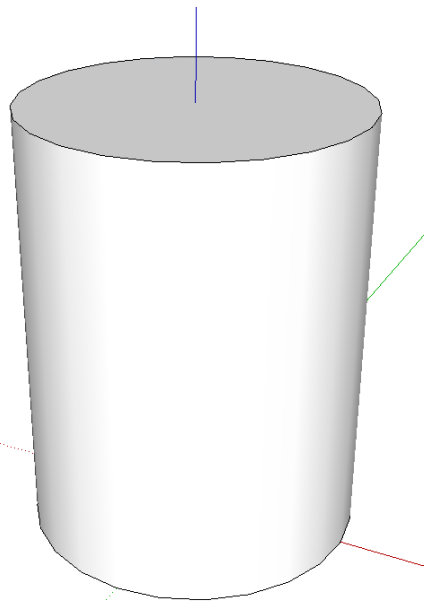
6. Select the *push pull* tool and extrude the shape upwards. Type in *150* and *press enter*

On Edge
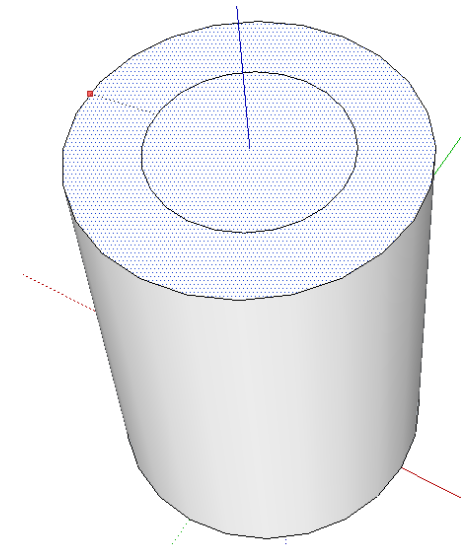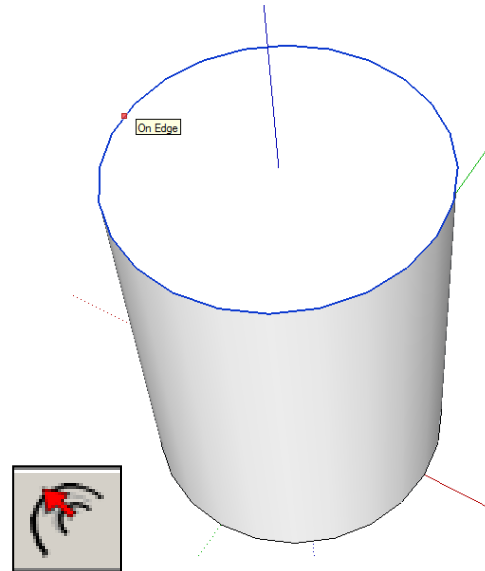
7. Select the *Offset* tool again and start by finding the *outside edge* of the top of the cylinder. *It helps to hover over the outer edges of the top first, then the centre will be indicated by a dark blue dot and a prompt box saying outside edge.* Click here, drag in a small circle and enter the number '20'.

8. Select the *pencil tool* from the toolbar. *Hover around the edge of the inner circle*. The pencil should the snap to the centre point.
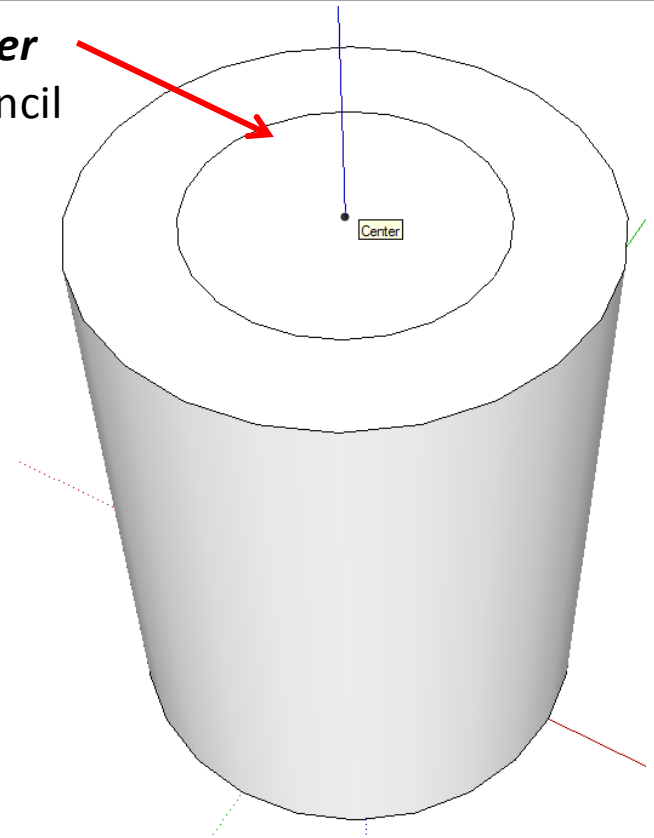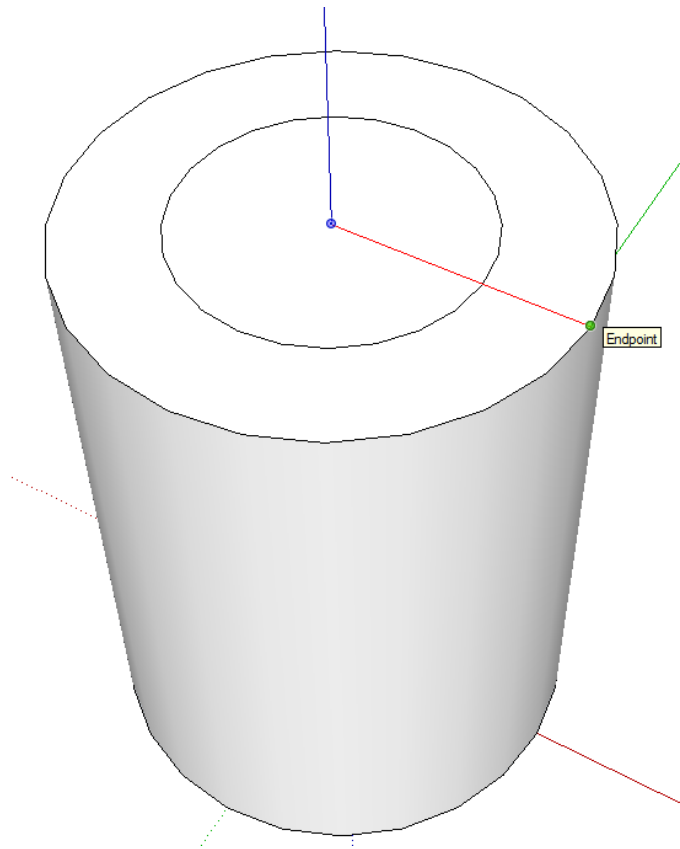
9. Make sure it follows the red axis. Click on the endpoint shown and it will turn black.
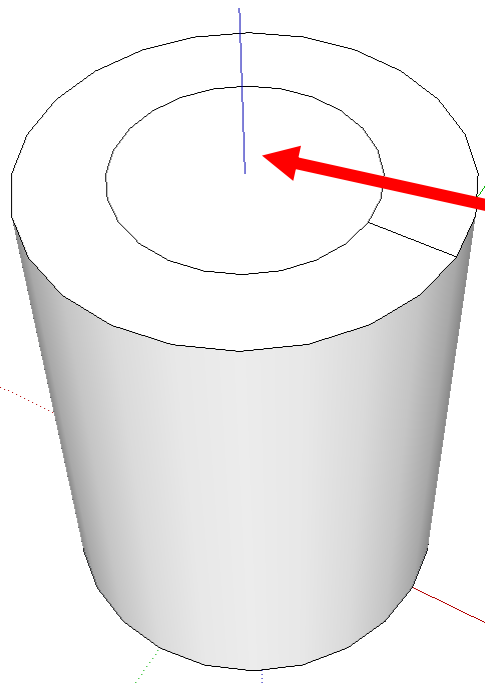
10. Use the **Eraser** tool to delete the line from the inside of the circle.

11. Then use the *Push/Pull* tool to extrude the inner circle by 70. (Click to highlight the inner circle, then drag it up, *type '70'* then press the *enter* key.)
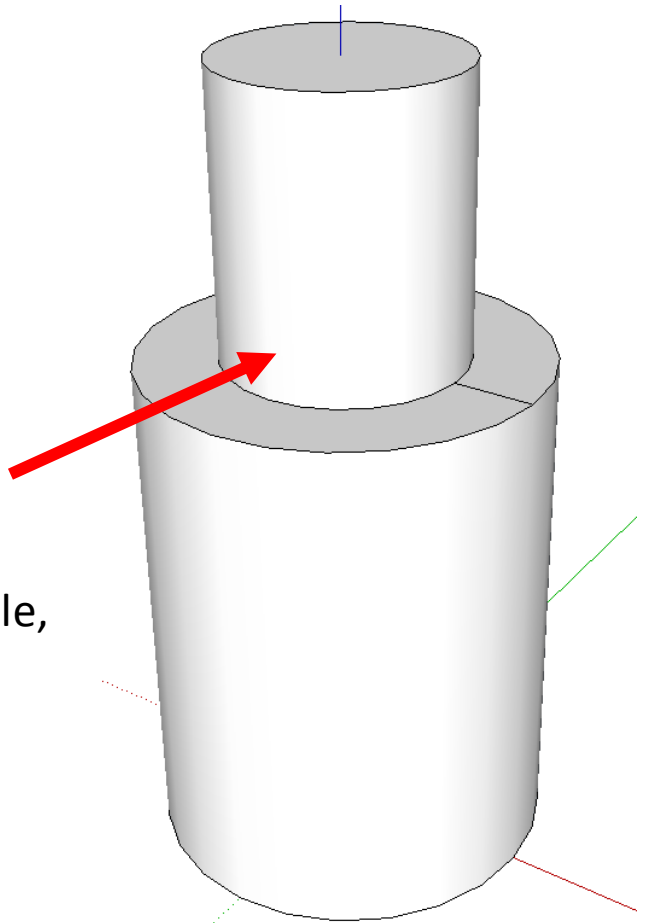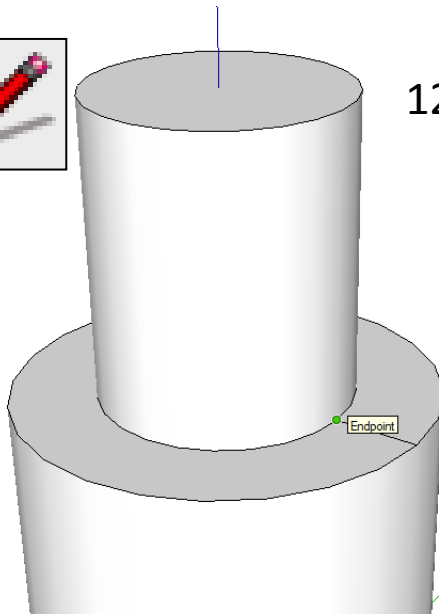
12. Select the *Pencil* tool and click on the end of the *horizontal line* shown. It will say *endpoint.*
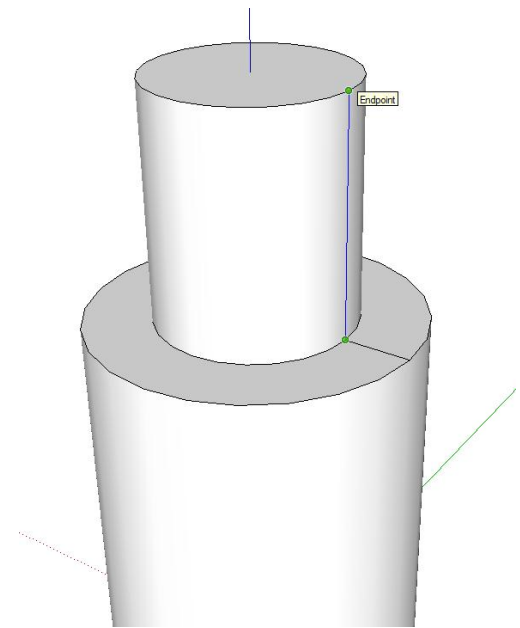
13. Using the *pencil tool* draw a line vertically up the **blue axis** to the top of the smaller cylinder. It will say *endpoint* again
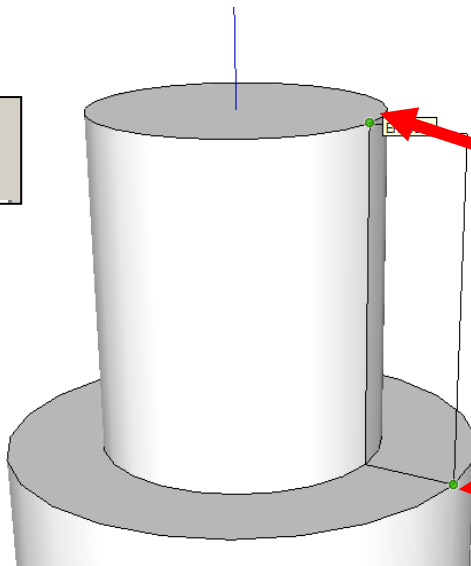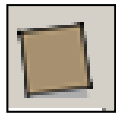
14. Using the *square tool* to draw a square from the end of the two pencil lines shown opposite
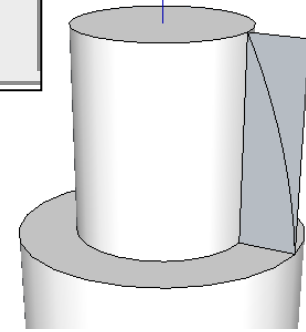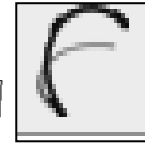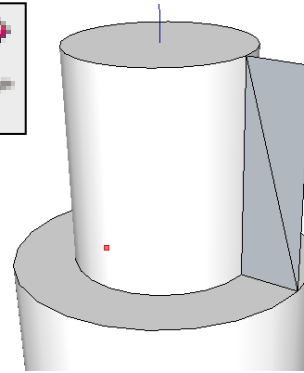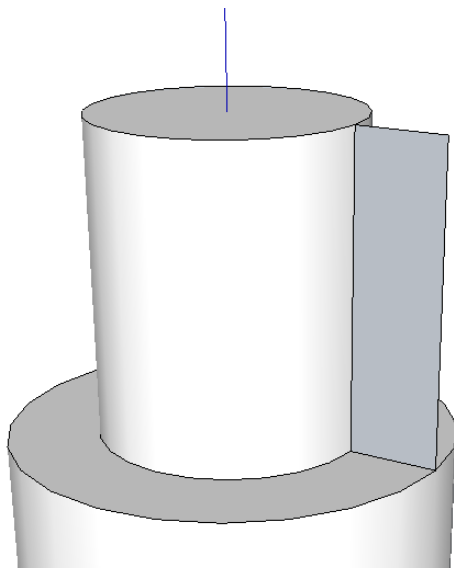
15. Using the *pencil tool* or *arch tool* draw the shape of the top of your hairdryer. Similar to the mobile phone tutorial you completed.

16. Use the *Eraser tool* to *delete* the outside of the shape.
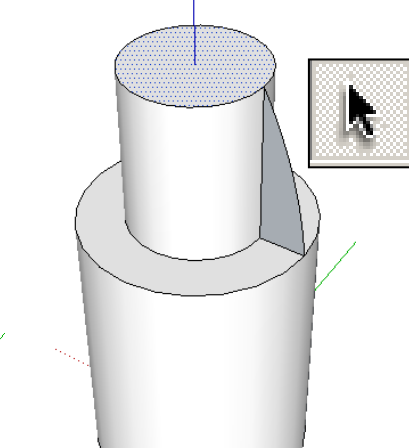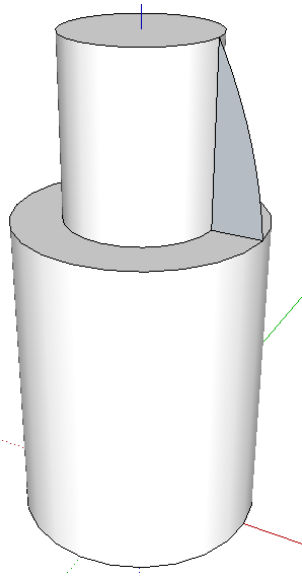
17. Use the *Select tool* and *click* on the *top circle*
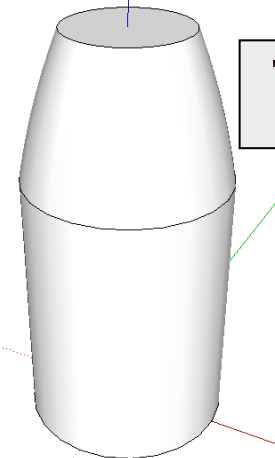
18. Select the *follow me* tool and *click the shape* on the side

19. Pull the inner circle in and type *3* and *press enter*
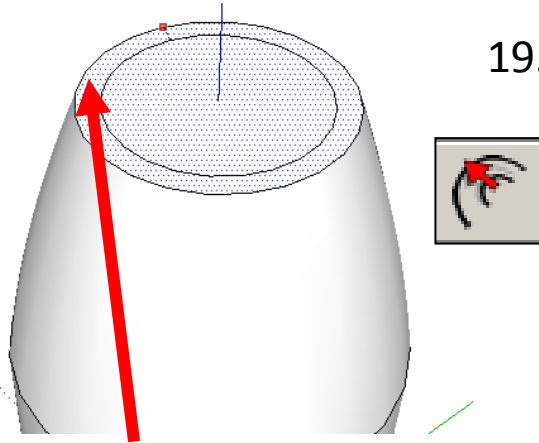
20. Select the *Offset* tool and click the *outside edge* of the *top circle*
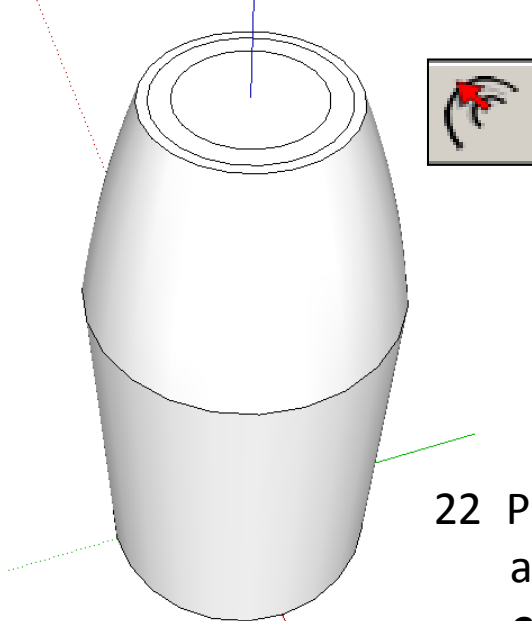
21. Select the *Offset* tool and click the *outside edge* of the *inner circle* this time
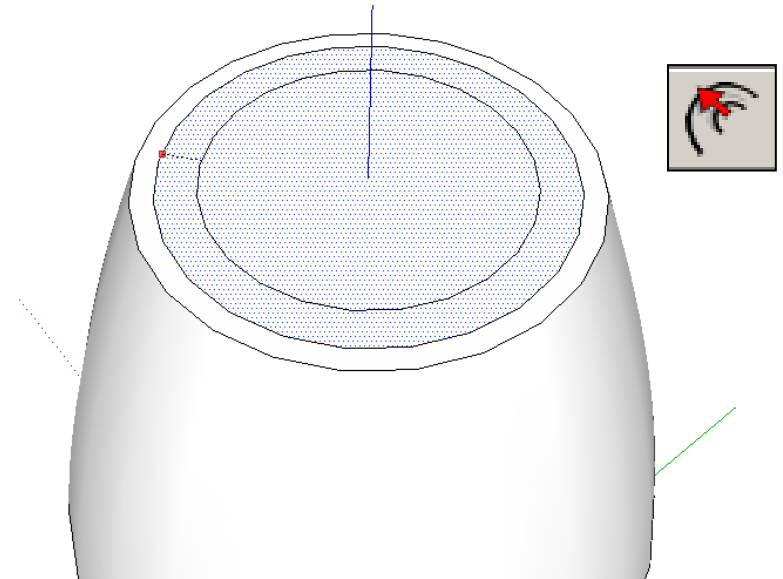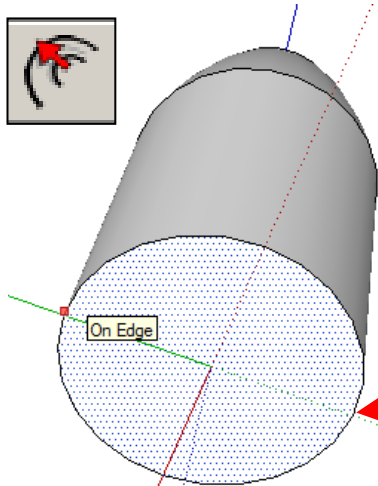
22 Pull the inner circle in and type *6* and *press enter*
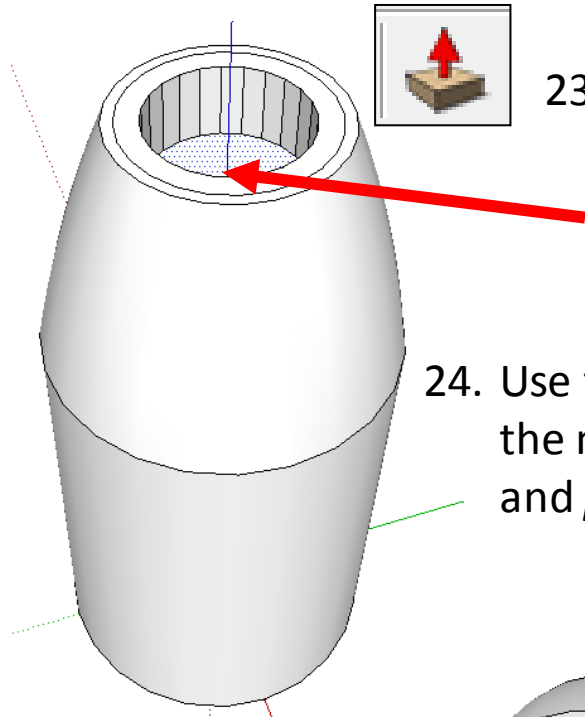
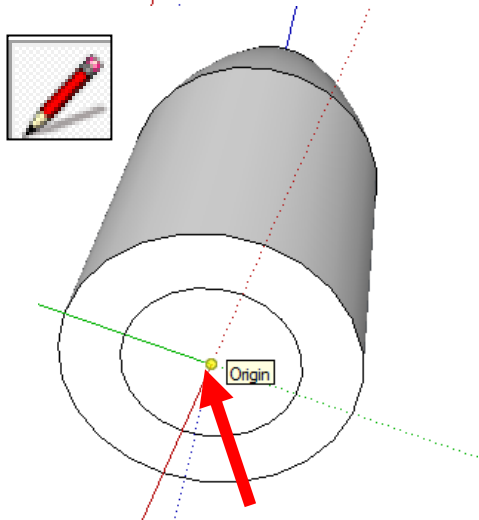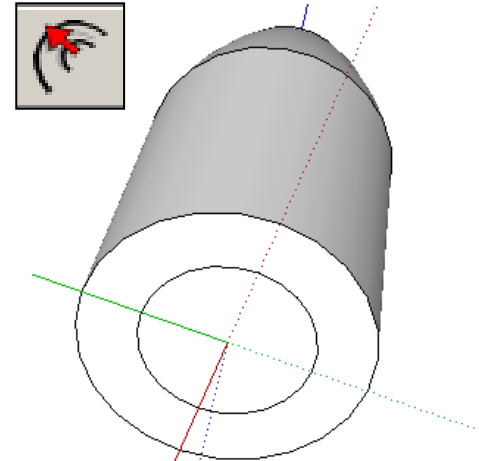23. Use the *Push/Pull* tool to push the inner circle. *Type in 20* and *press enter.*

24. Use the *Push/Pull* tool to push the middle circle. *Type in 10* and *press enter.*
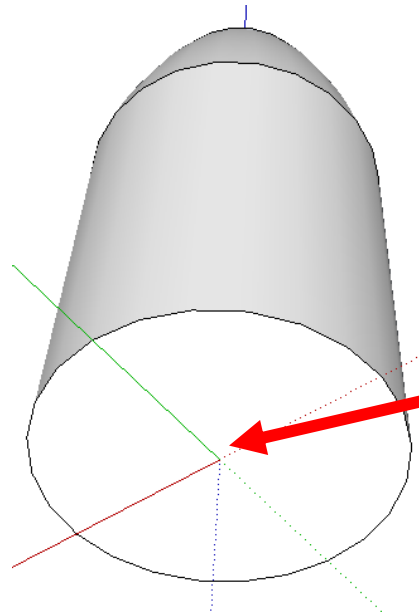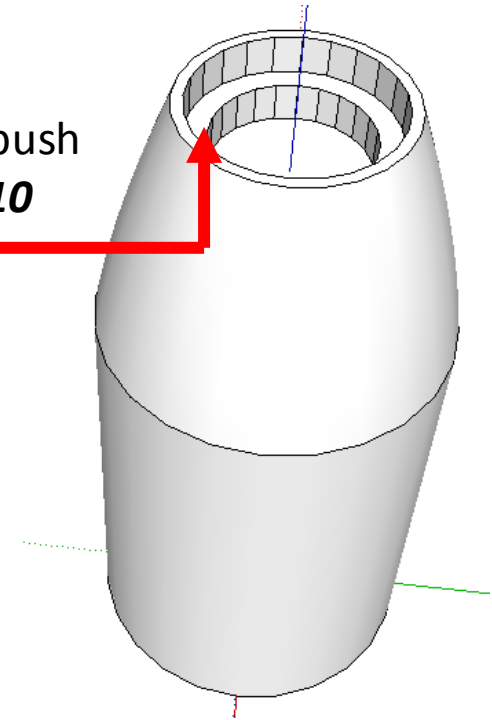
25. Orientate the hairdryer body so that you can view the other end. *You are now going to modify the shape of this end.*
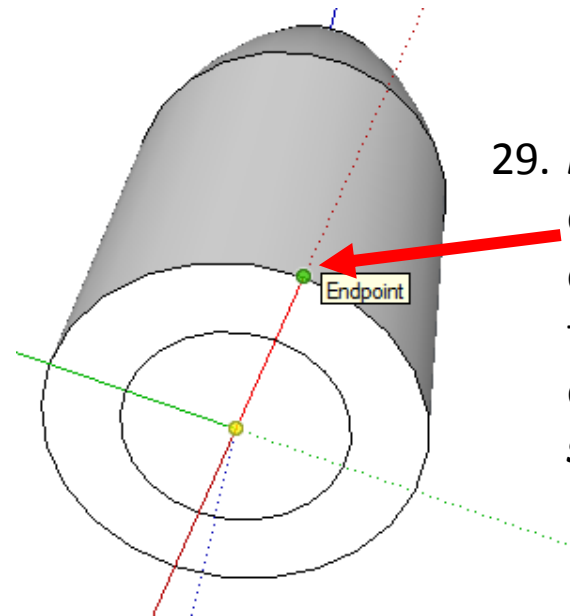
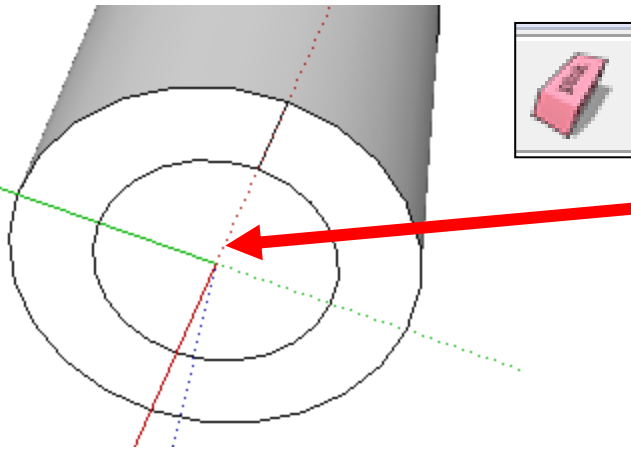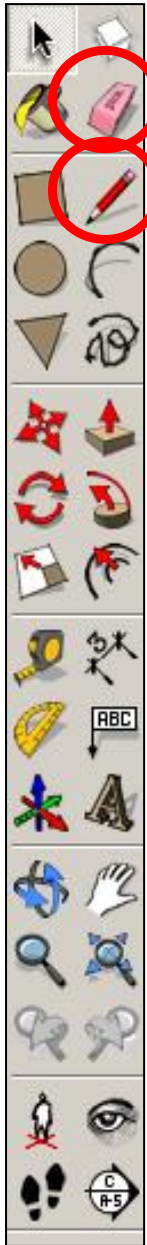26. Select the *offset too*l. Click on the outside edge (circumference) of the circle. It will say *on edge*.

On Edge

27. Pull the circle inwards. *Type in 20* and *press enter.*

28. Select the *pencil tool.* Snap to the *origin point* (centre of circle) where the **green**, **red** and **blue** axis meet
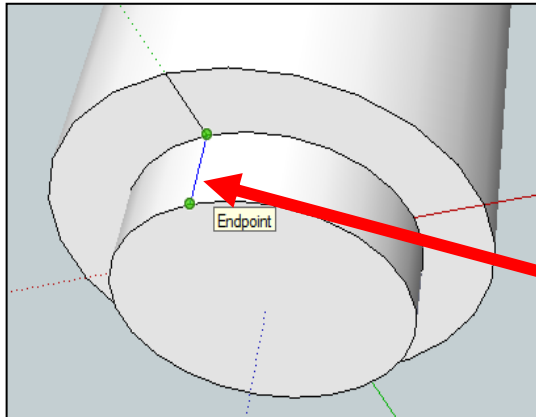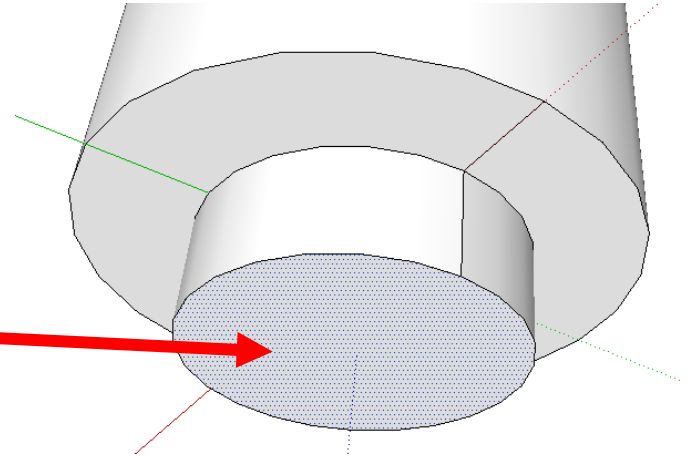
Origin

29. *Draw a line* on either the red or green axis to the outside edge*. It will say endpoint*

Endpoint

30. Now use the *Eraser* tool to delete the part of the line that is inside the inner circle.

31. Then use the *Push/Pull* tool to extrude the inner circle by 20 mm (type *'20'* then press the *Enter key*).
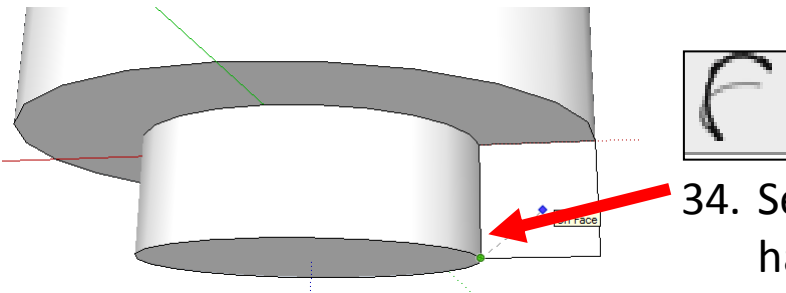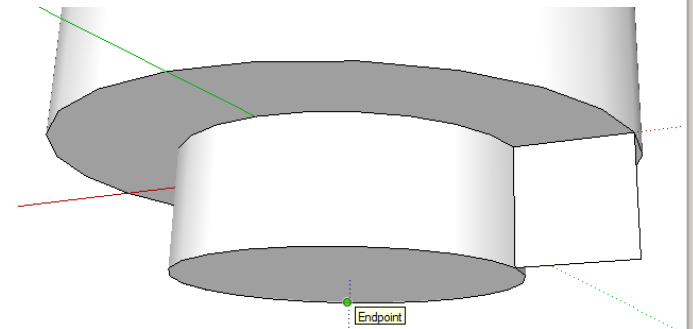
32. With the *pencil tool*, draw a line to join the endpoint (green dot) of the previous horizontal line to the edge of the new cylinder.
Note: *Make sure the line is **blue** as you draw it to be certain you are in the **blue axis**. It will turn black when you click the edge.*

Endpoint
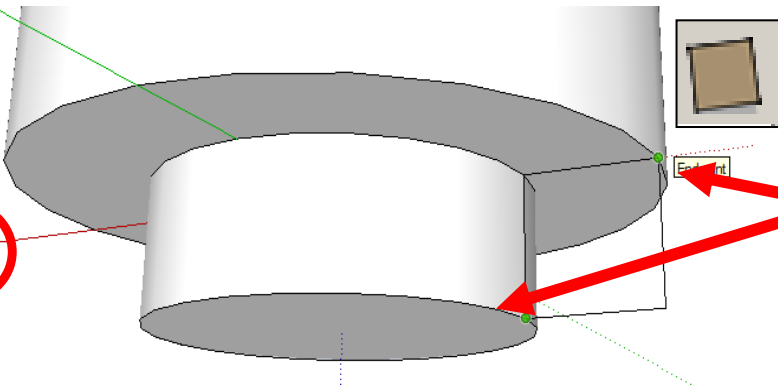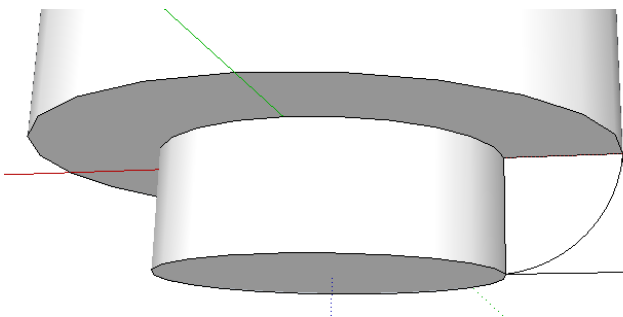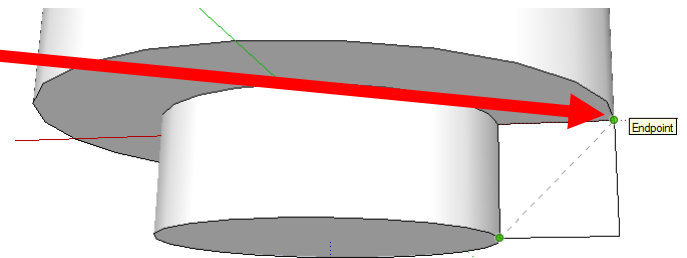
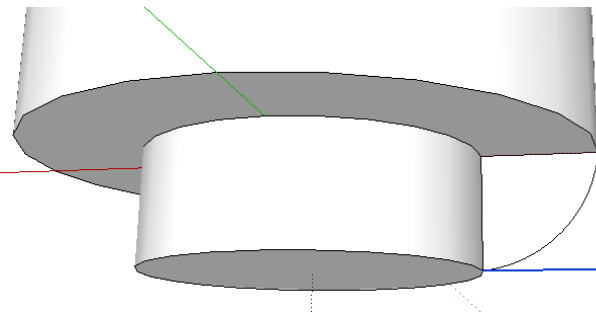33. Then use the *square tool* to draw a line connecting the end of the two lines as shown opposite

34. Select the *Arch* tool and *click bottom left* hand corner of the square.

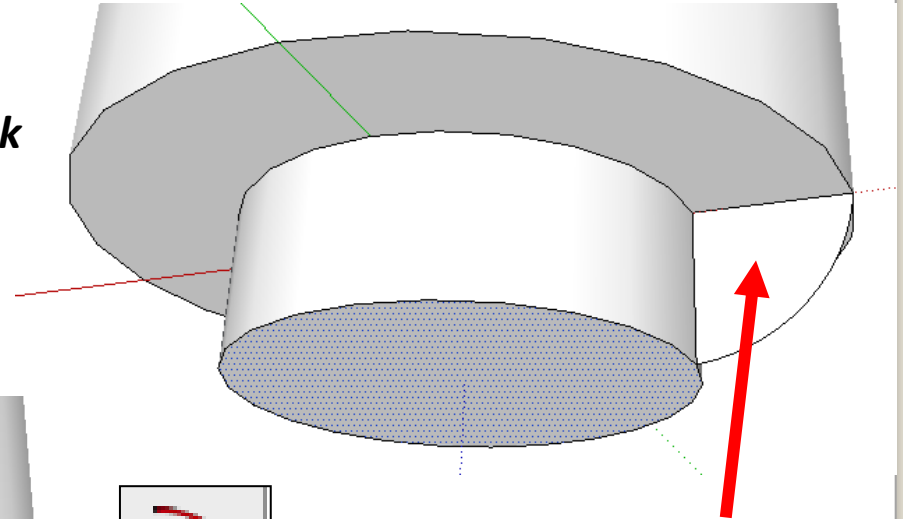35. Then click bottom the *top right hand* corner of the square.
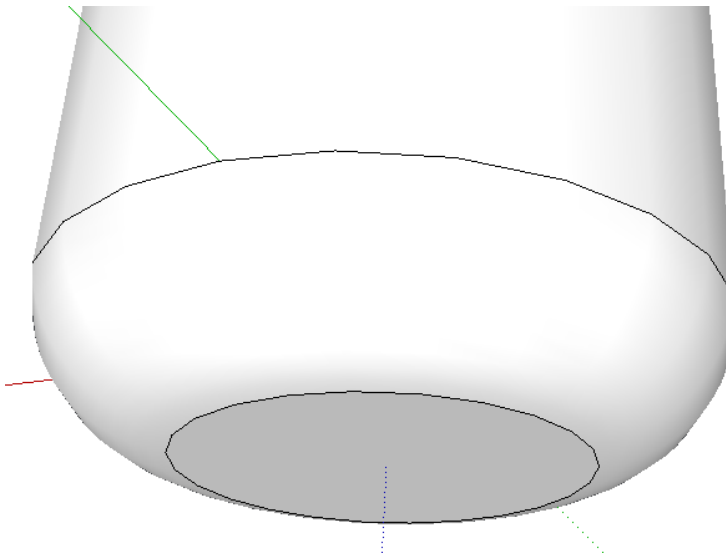
36. Draw the arch and *type in 5* and *press enter.*

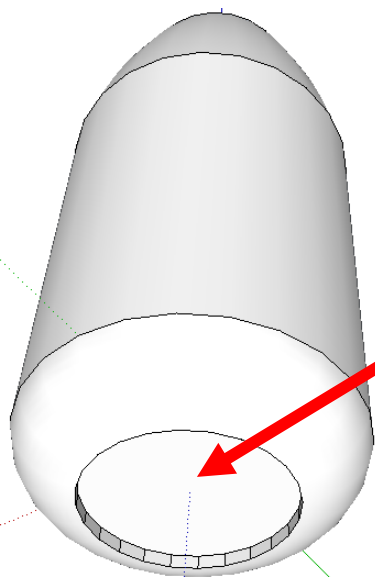37. Now use the *Eraser tool* to **delete** the outside part of the square that is shown in blue.

38. Use the *select tool* to **click** on the base. It will go dotted.

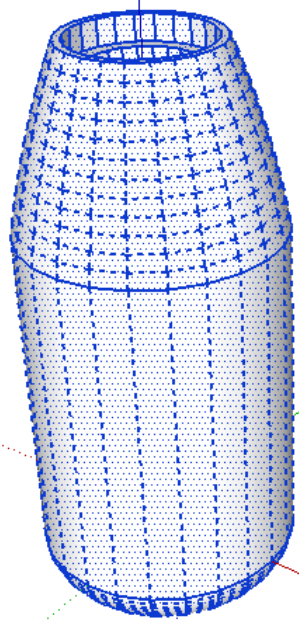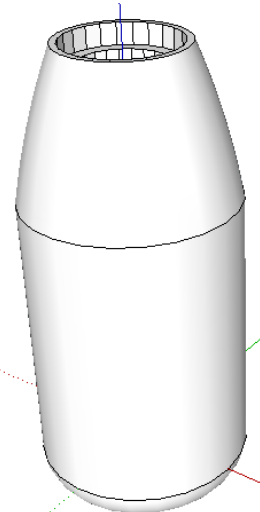39. Select the *follow me* tool and **click the shape** on the side

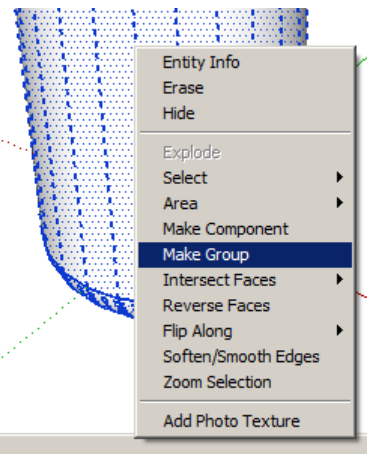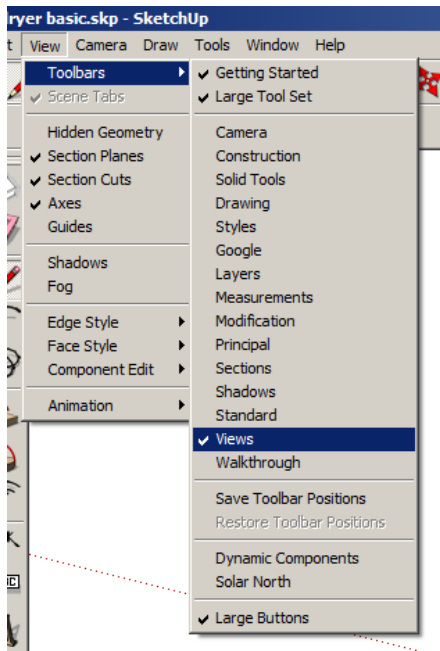40. Use the *Push/Pull* tool to push the inner circle. *Type in 5* and *press enter.*

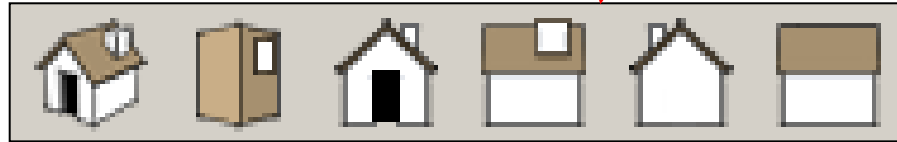41. Click on the *Zoom Extent* tool to show the entire object. Use the orbit tool to show a view you are happy with

42. Use the *select tool*. Click on the object *until its a* *highlighted* in blue.
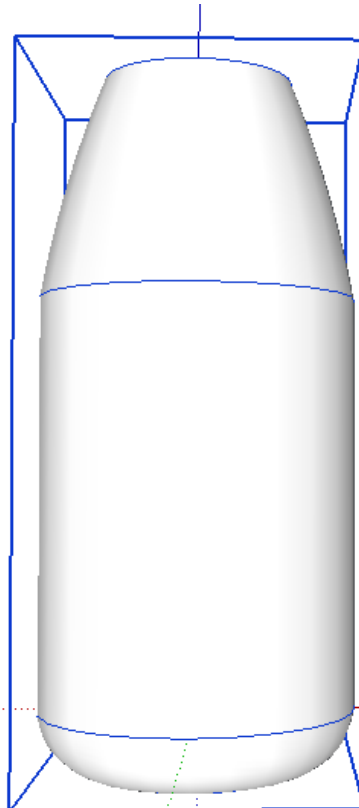
43. **Right click on the mouse** . Click on make group

Entity Info
Erase
Hide

Explode
Select
Area
Make Component
Make Group
Intersect Faces
Reverse Faces
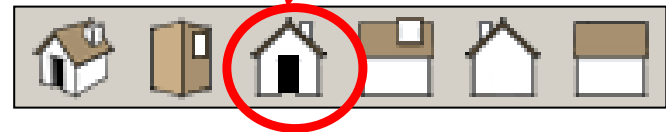Flip Along
Soften/Smooth Edges
Zoom Selection

Add Photo Texture

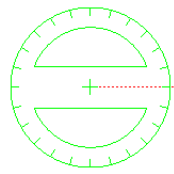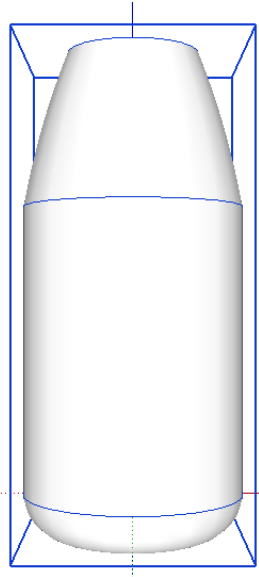44. Click on *view – Toolbars – views* to bring up the following toolbar

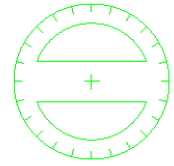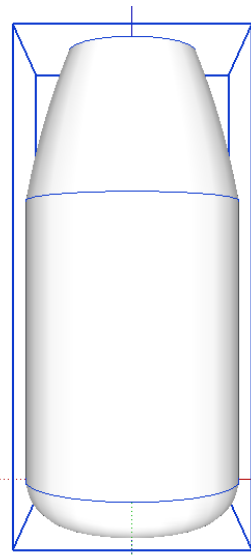45. Click on the *house with the front door.* This will give you a **front view** of your design

46. Use the *select tool*. Click on your object *it will be highlighted* in blue.

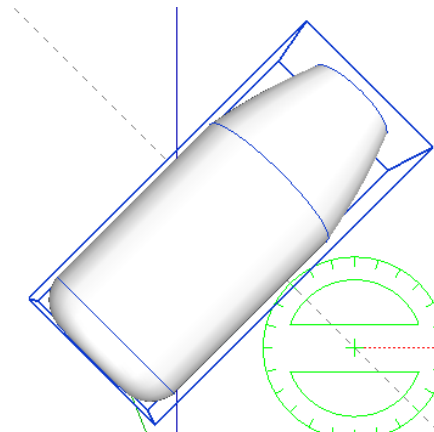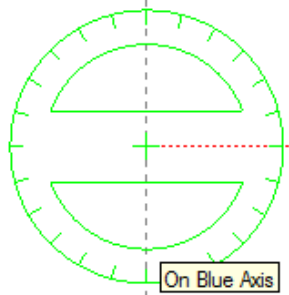47. Select the *rotate tool*. Position it so it goes either green or red.

On Red Axis
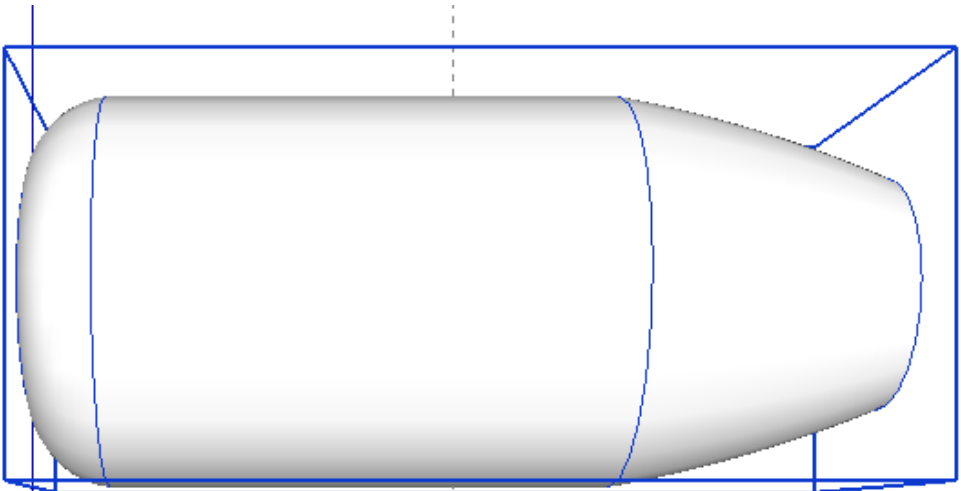
48. Click the *rotate tool* once to set it in place. Pull the line out horizontally. It should go either green or red.

49. Start to rotate.

On Blue Axis

50. Continue to **rotate tool** until the **angle shows 90** and click a third time to set in place. Or alternatively just **type 90** and **press enter**.
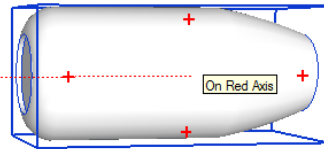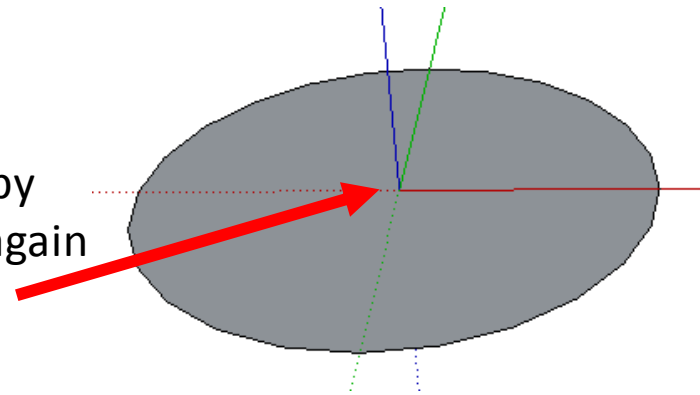
Ctrl = toggle Copy.

Angle 90.0

MAKING THE HANDLE

1. Select the hairdryer top part. Use the ***move tool*** to ***move*** the object along the red or green axis

2. To create the handle, you start off by making a circle at the origin point again This time, make its radius 20 mm.

3. Select the ***Tape Measure tool*** from the toolbar and click on the origin point (yellow dot).
   Move the cursor along the green axis and type ***'30'*** and ***press enter***. A black construction point will appear on the axis.
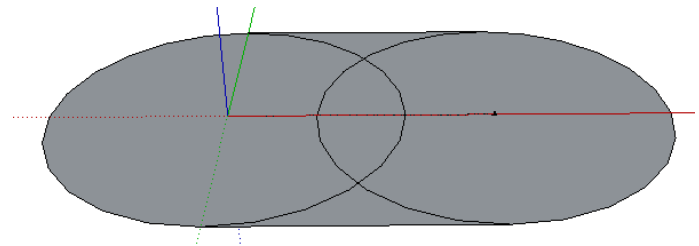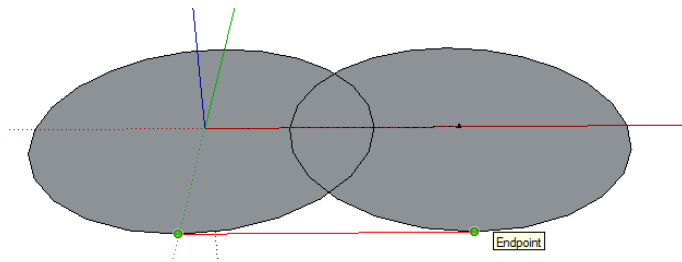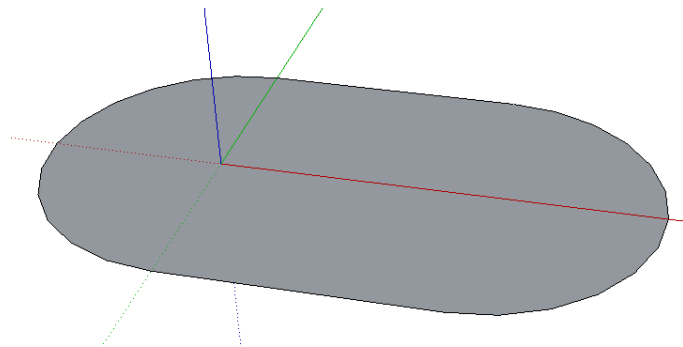
On Red Axis

30.0mm
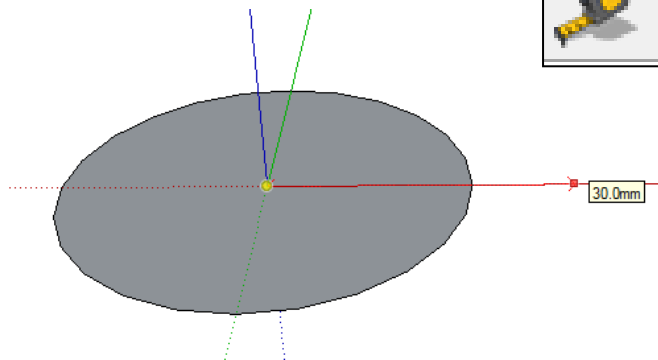
4. Starting at the end of the tape measure line it will say *guide point*. Use the *Circle tool* to draw another 20 mm radius circle, with this *guide point* as its centre.
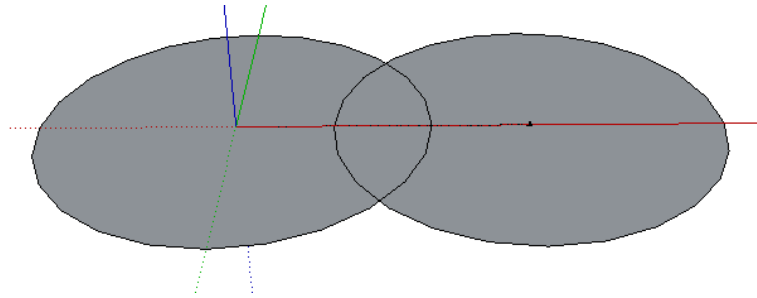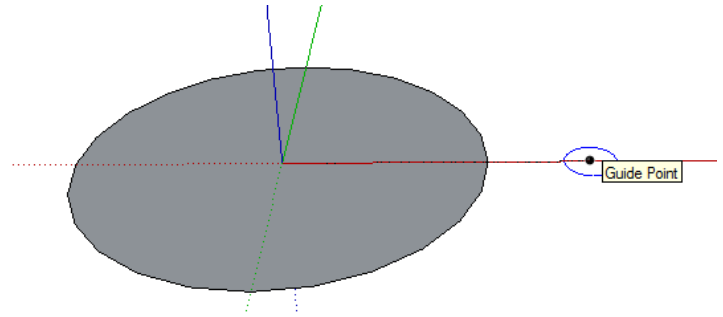
5. Now use the *pencil tool* to join the top of the two circles by drawing at a tangent to them. Look for the **Endpoint** prompts and make sure the line appears green or red.
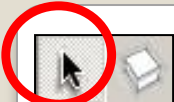
6. Use the **Eraser** tool to delete the unwanted inner lines.

7. Extrude the shape upwards by *150* using the *Push/Pull* tool.
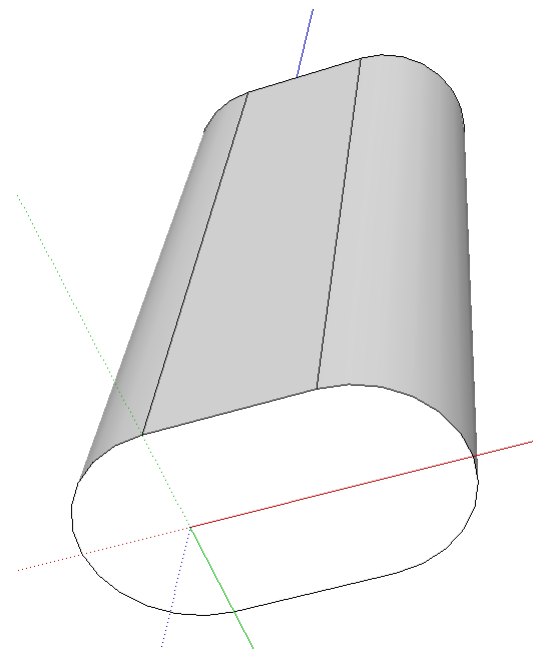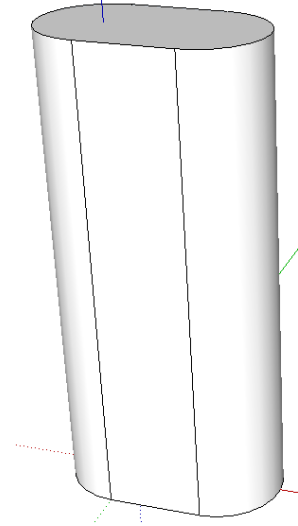
8. *Orbit* around underneath to show the base of the handle
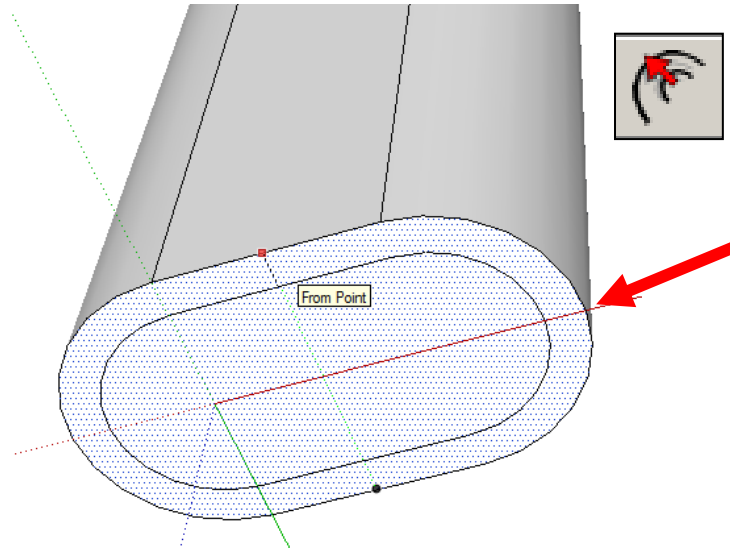
9. Select the *Offset* tool. Start by finding the *outside edge* of the handle. Click here, drag in a small circle and enter the number *'10'.*

10. Select the *pencil* tool. Start by finding the *midpoint* and draw a line across from one midpoint to the other
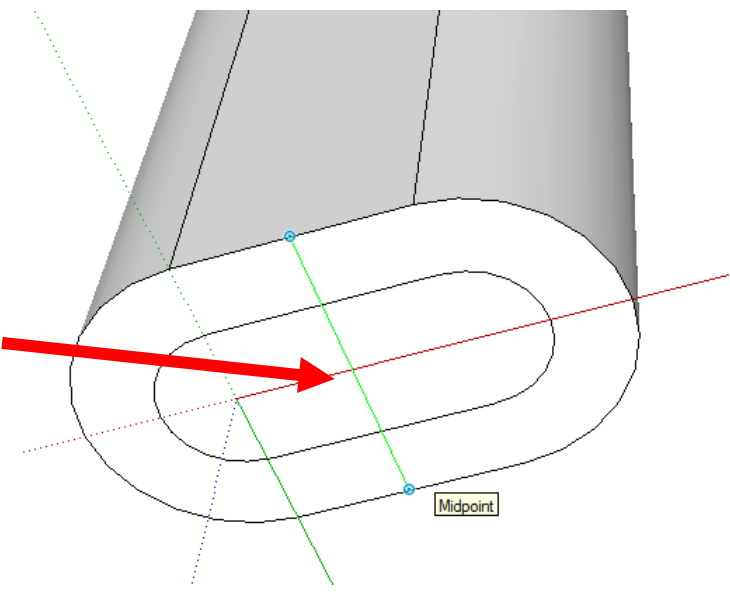
11. Select the *eraser tool*. Delete the two lines shown.
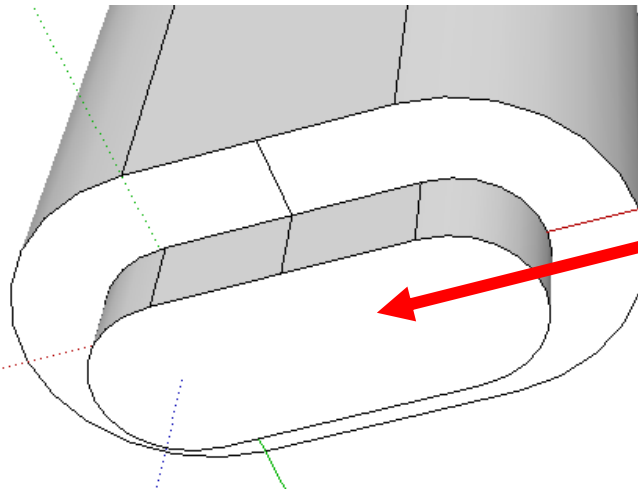
12. Select the *push pull tool*. Pull the centre oval down. Type in *10* and *press enter.*
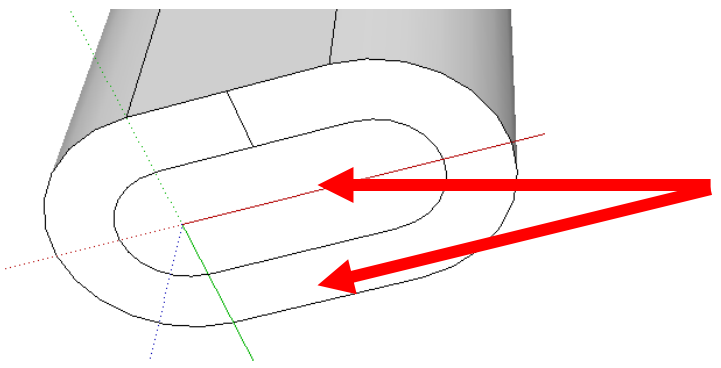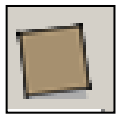
13. Then use the *square tool* to draw a line connecting the end of the two lines as shown opposite
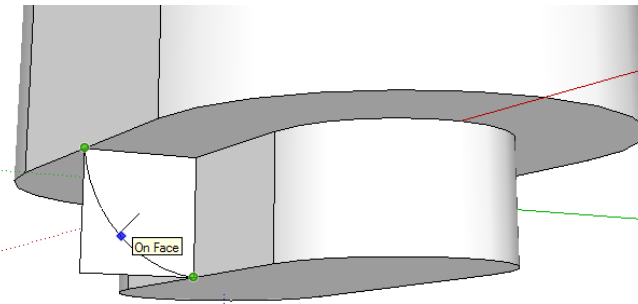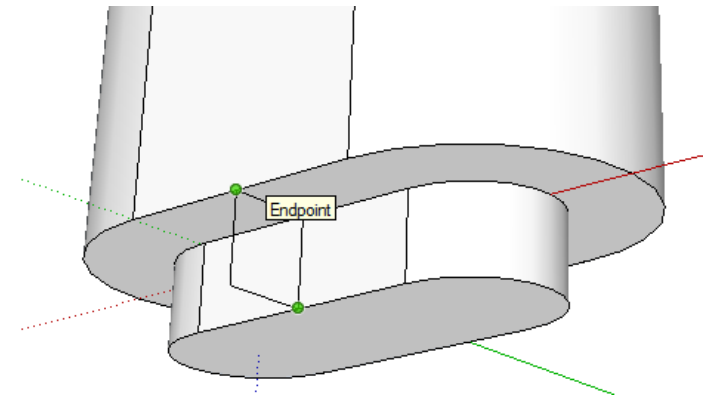
14. Select the *Arch* tool and *click bottom right* hand corner of the square.

15. Then click bottom the *left right hand* corner of the square.

16. Draw the arch and *type in 2.5* and *press enter.*

Endpoint

On Face
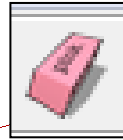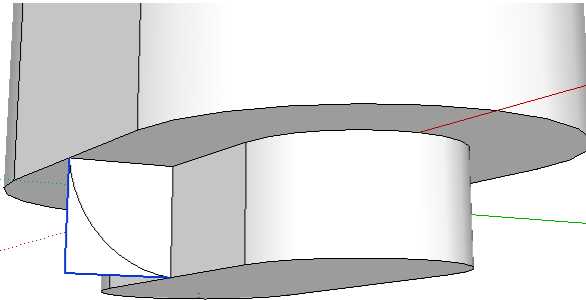
17. Now use the *Eraser tool* to *delete* the outside part of the square that is shown in blue.
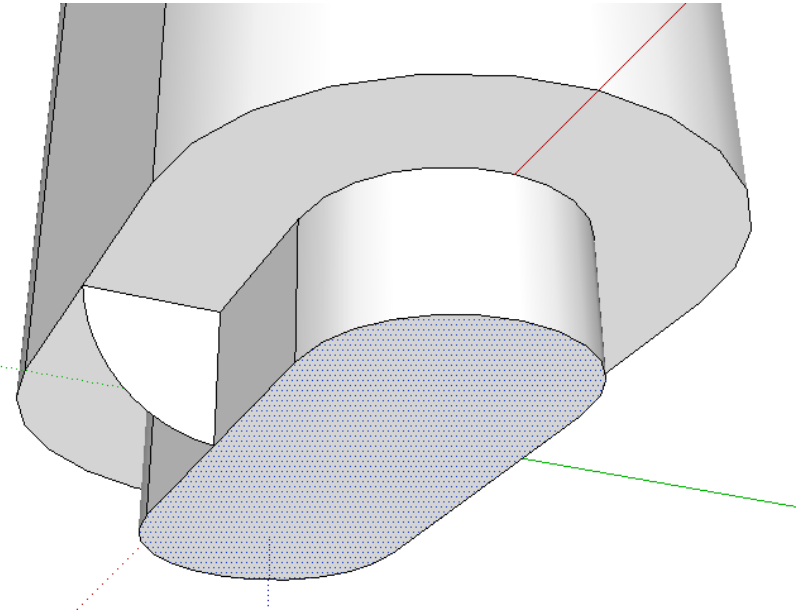
18. Use the *select tool* to *click* on the base. It will go dotted.
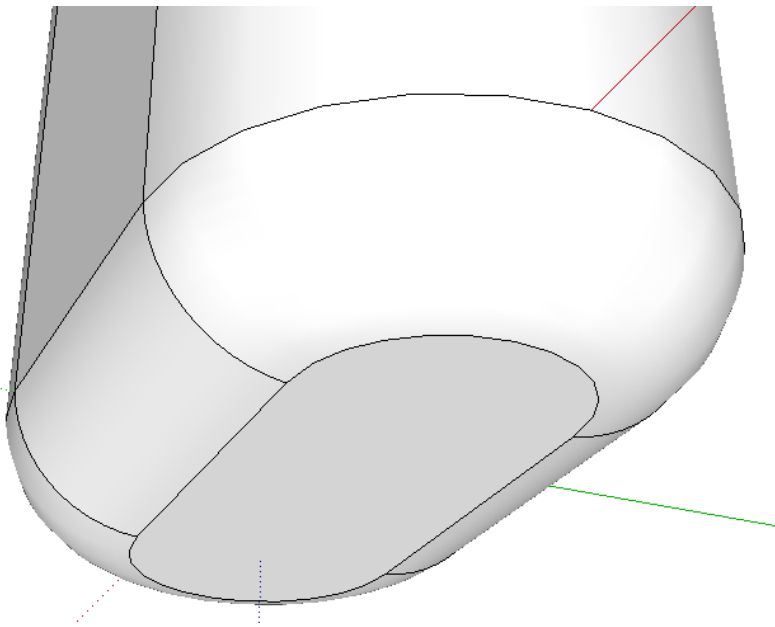
19. Select the *follow me* tool and *click the shape* on the side
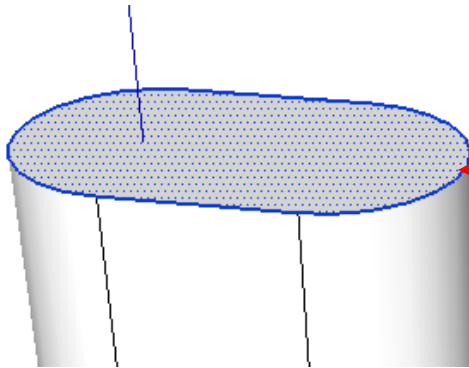
20. Using the *Select tool*, click on the top face *twice t*o highlight it and the edge also

Endpoint

21. Select the *Move tool* and click on the endpoint shown
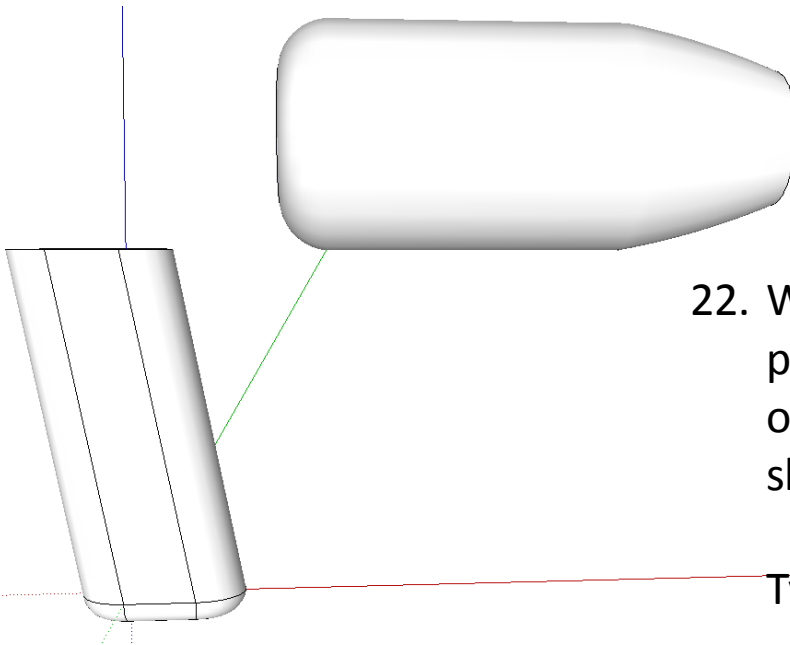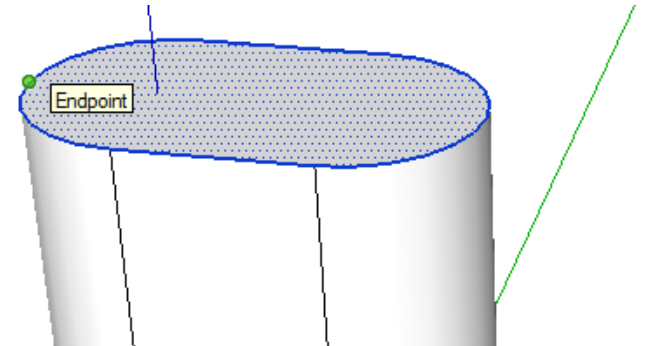
22. With the *Alt key pressed down*, gently pull the selected face along the green or red axis so that the handle looks sloped.

Type *'30'* and press *enter* to set it.
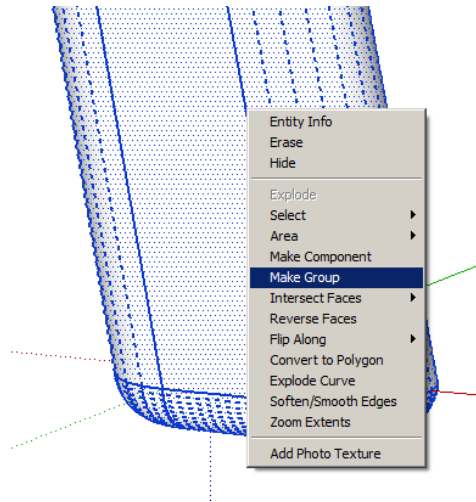
23. Using the *Select tool*, click on the handle until the entire the entire handle is highlighted. Right click and make group

Entity Info
Erase
Hide

Explode
Select
Area
Make Component
Make Group
Intersect Faces
Reverse Faces
Flip Along
Convert to Polygon
Explode Curve
Soften/Smooth Edges
Zoom Extents

Add Photo Texture
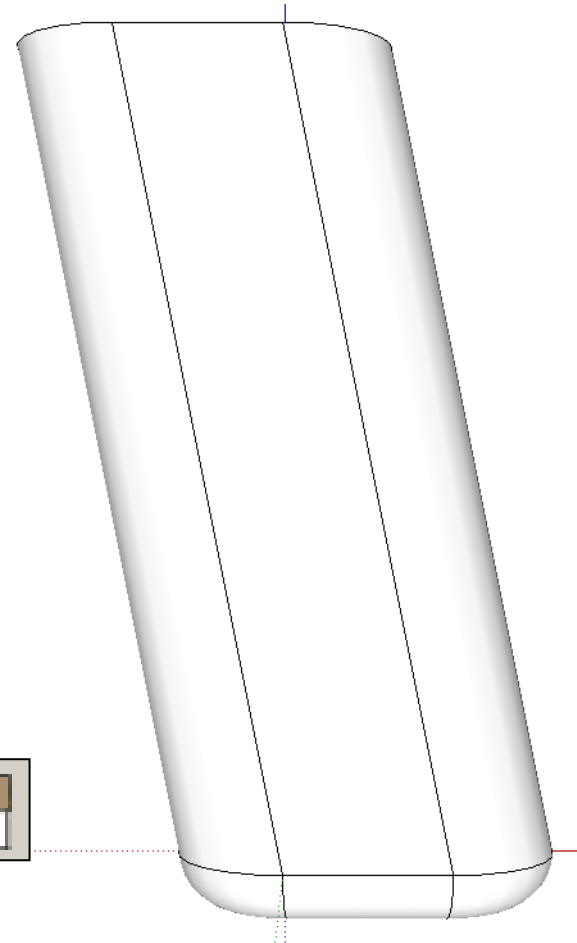
24. Click on the *house with the front door.* This will give you a **front view** of your handle design
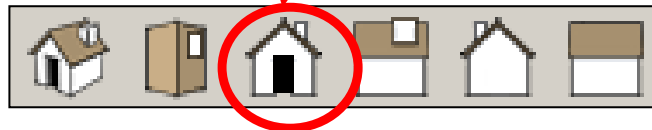
25. Use the **Rectangle** tool to draw a rectangle on the handle. Type '30,10' to set its size.
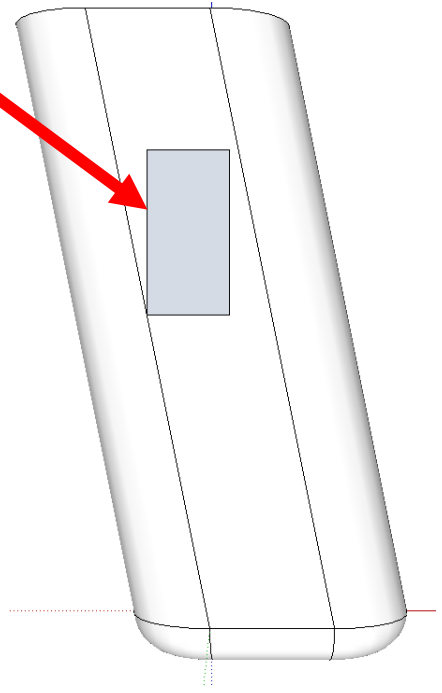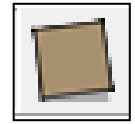
26. Then use the **Select** tool to highlight this rectangle.
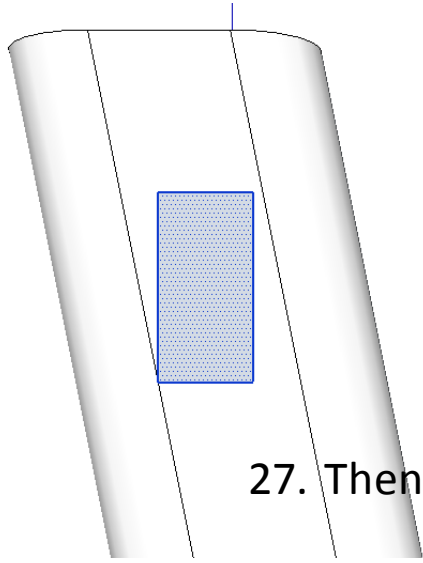
27. Then use the **Select** tool to highlight this rectangle.

28. Select the *rotate tool*. Position it so it goes either green or red. Place it approximately in the middle od the switch. Press once to set…………….

On Face in Group
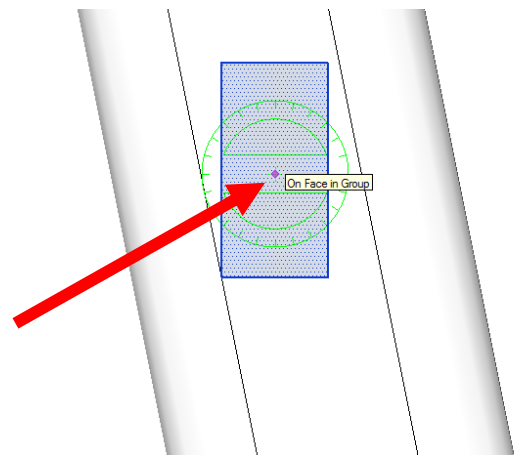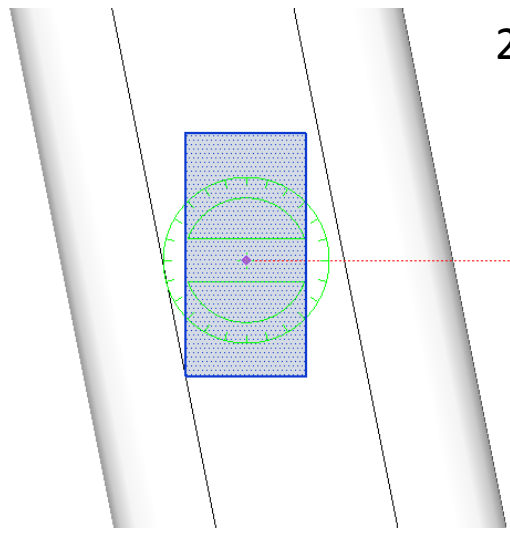
29. Pull the line out horizontally. It should go either green or red.

On Red Axis
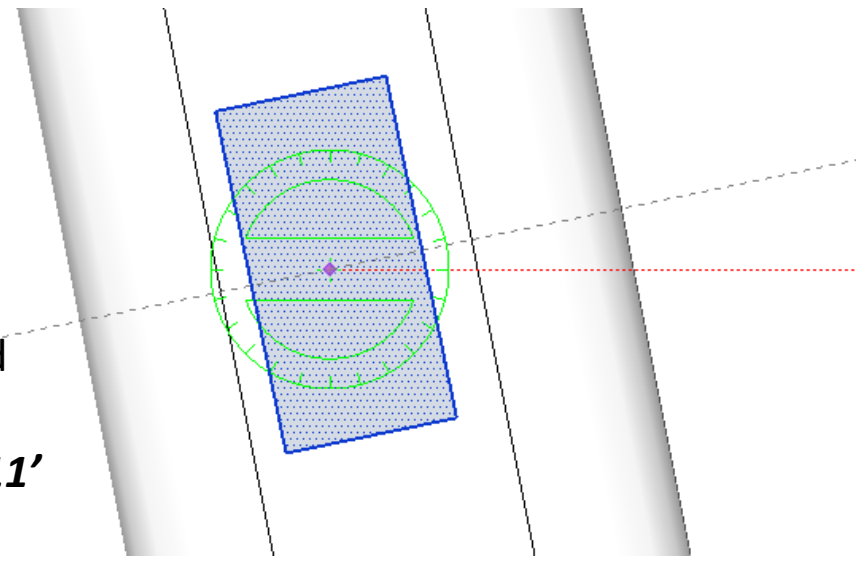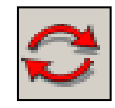
30. Start to *rotate*. Try and line up parallel to the outside lines or type *'11'* and *press enter.*
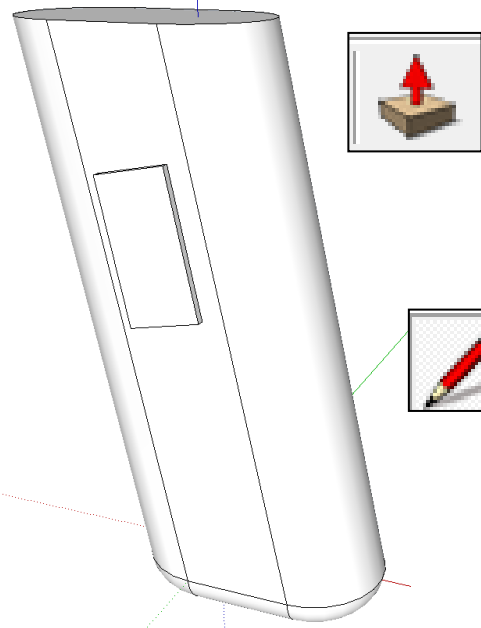
31. Extrude the shape upwards by *2* using the *Push/Pull* tool.

32. Select the *pencil* tool. Start by finding the *midpoint* and draw a line across from one midpoint to the other
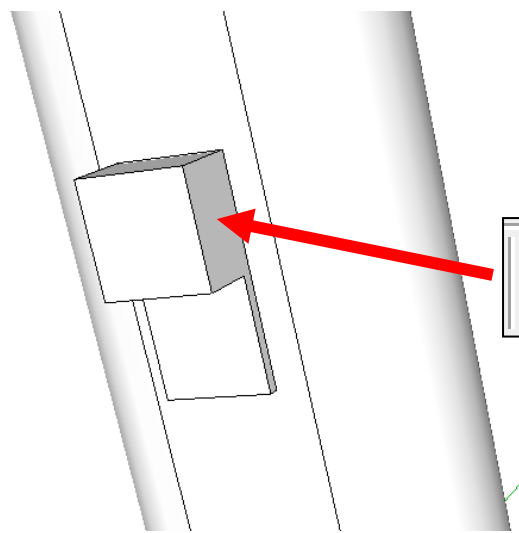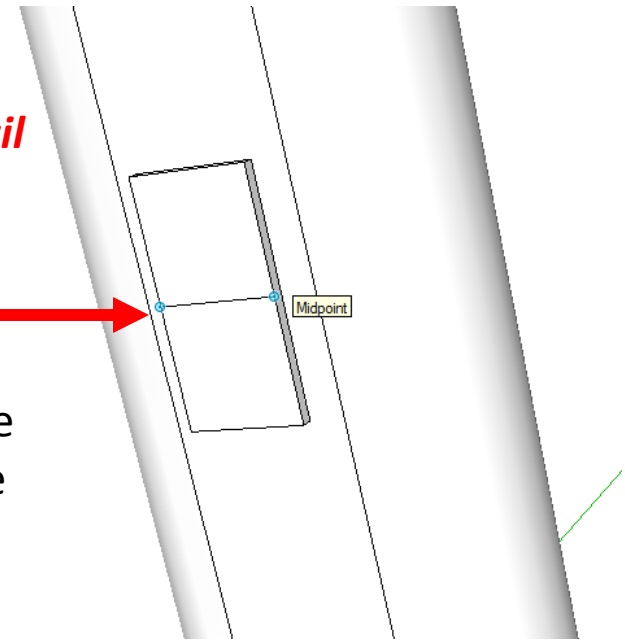
Midpoint

33. Extrude the top square upwards by *10* using the *Push/Pull* tool.

34. Select the *pencil* tool. Draw a diagonal line from the midpoint to endpoint shown opposite.
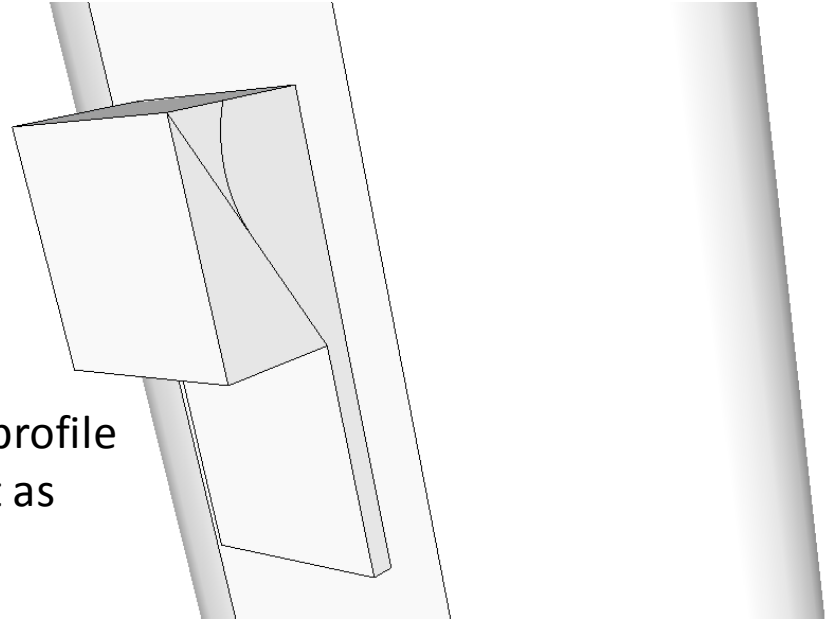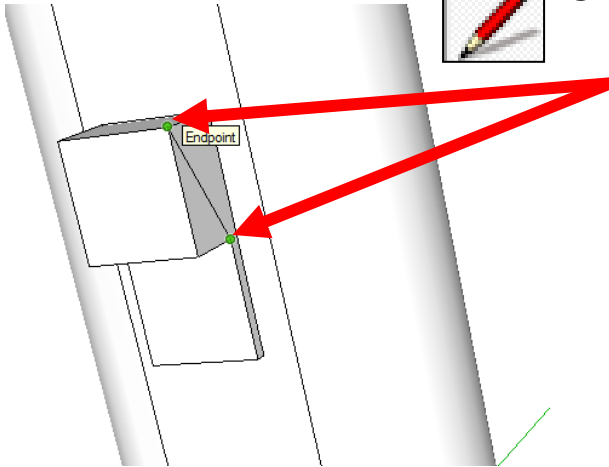
35. Select the *arch tool*. Draw a profile as shown so the switch is not as sharp
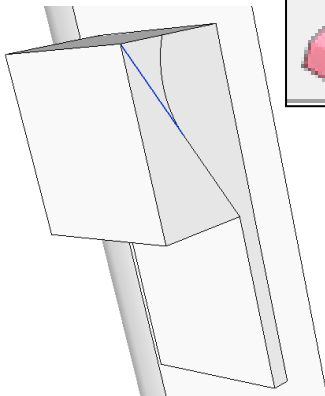
36. Select the *Eraser tool*. Delete lines not needed.
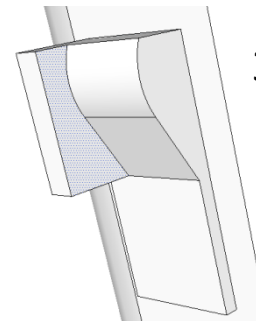
37. Select the *Push/Pull tool*. Remove top of the switch
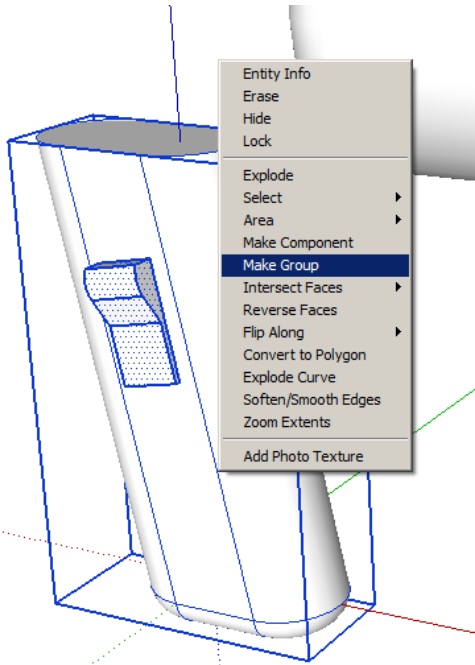
Entity Info
Erase
Hide
Lock

Explode
Select ▶
Area ▶
Make Component
Make Group
Intersect Faces ▶
Reverse Faces
Flip Along ▶
Convert to Polygon
Explode Curve
Soften/Smooth Edges
Zoom Extents

Add Photo Texture

38. Use the *Select tool*. Drag over the switch and handle. Right click on the mouse and **make group.**
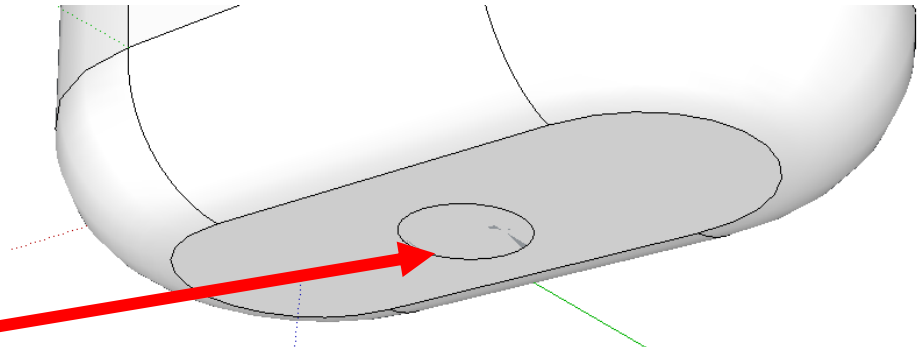
39. Use the **Circle** tool to draw a circle of 5 mm radius on the base of the handle.

40. Then extrude this circle by 15 mm using the **Push/Pull** tool.
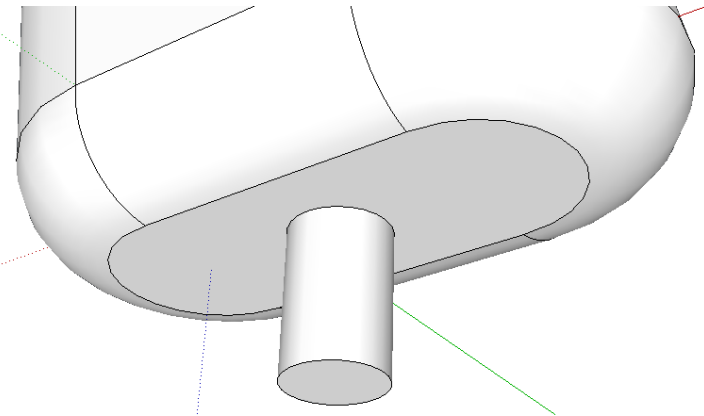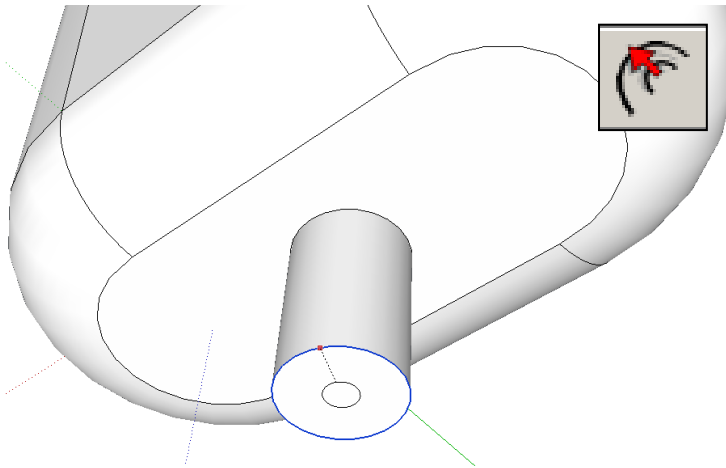
41. Select the *Offset* tool. Start by finding the *outside edge*. Click here, drag in a small circle and enter the number *'3'.*

42. Use the *Arc tool* to draw a line along the red or green axis (a green line will show) starting at the centre of the circle. **Use your judgement** and click to set the length of the line some distance away, as shown.

On Red Axis
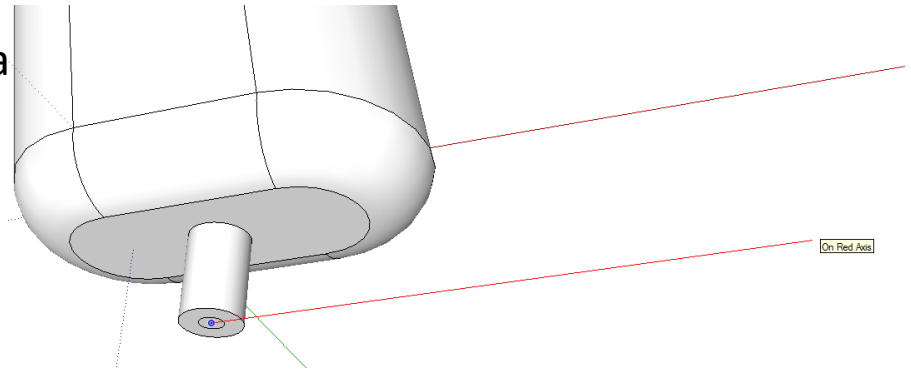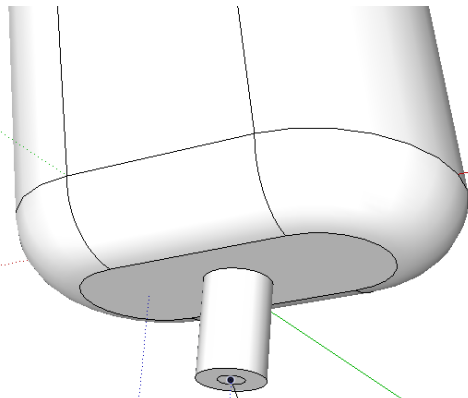
43. With the **two endpoints set**, bend the arc downwards, staying on the blue axis, to roughly form a semicircle.

44. Use the ***select tool*** to ***click*** on the arch. It will go blue.

45. Select the ***follow me*** tool and ***click the small circle*** on the side

Entity Info
Erase
Hide
Lock

Explode
Select ▶
Area ▶
Make Component
Make Group
Intersect Faces ▶
Reverse Faces
Flip Along ▶
Convert to Polygon
Explode Curve
Soften/Smooth Edges
Zoom Extents

Add Photo Texture
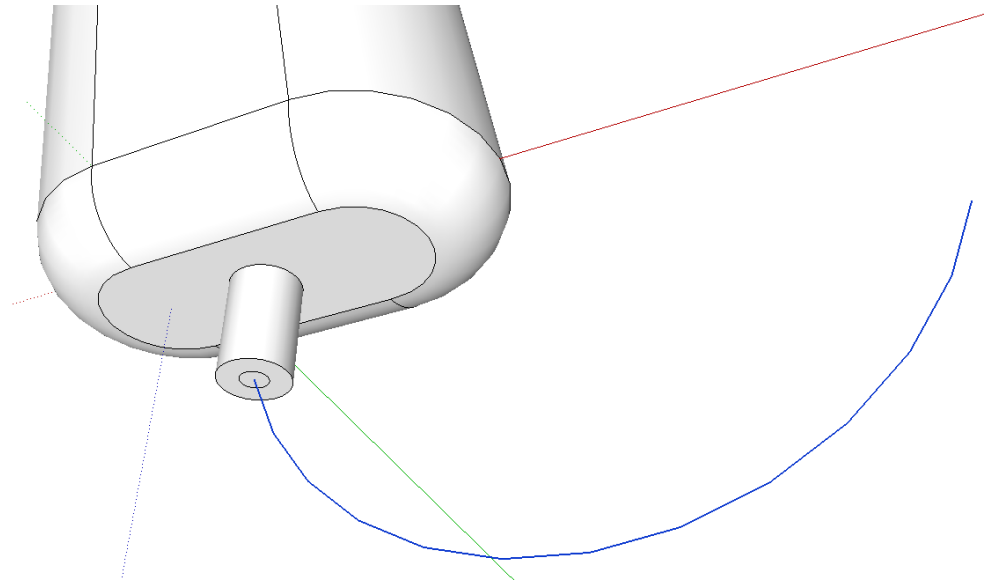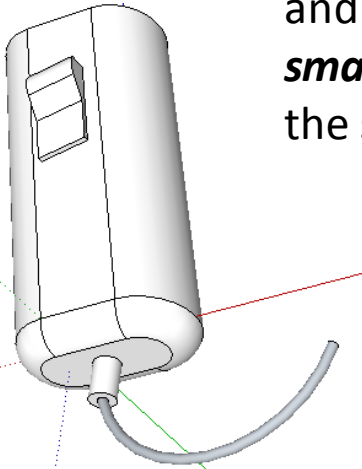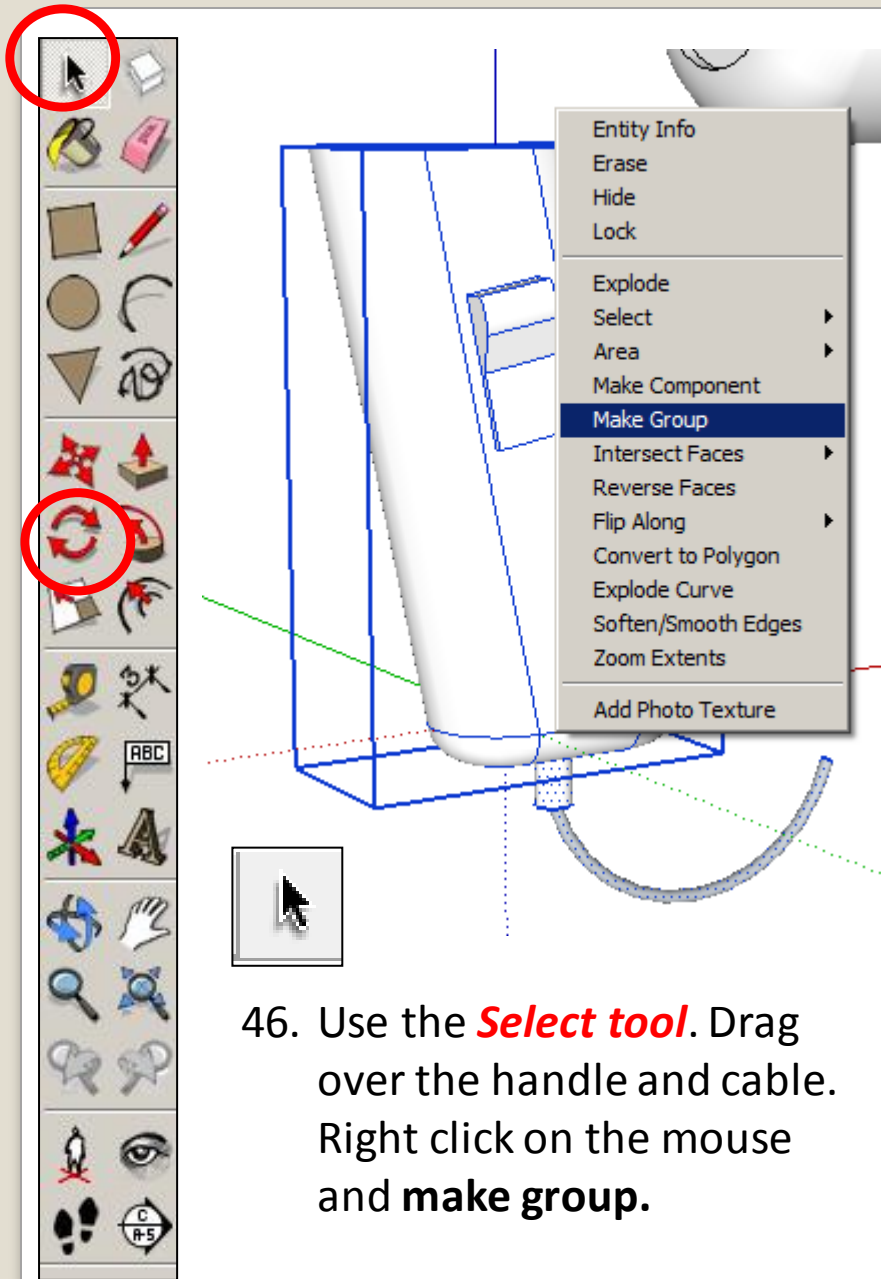
46. Use the *Select tool*. Drag over the handle and cable. Right click on the mouse and **make group.**

Branding and Rendering
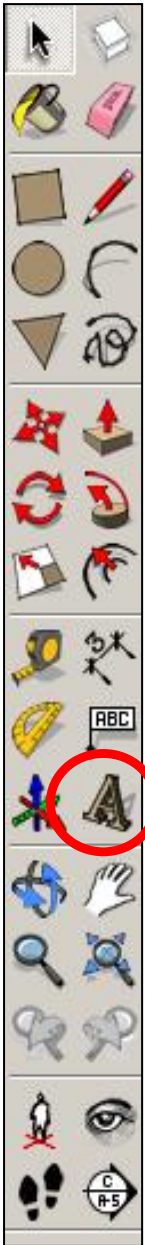
1. To put some simple graphics on the hairdryer body, first select the **3D Text**.

2. A pop-up box will appear. Type in the name you want to use for the hairdryer. Change the height to 20, make sure extrude has no tick next to it

Place 3D Text

Dysokenny

Font	Tahoma	Regular
Align	Left	Height	20.0mm
Form	☑ Filled	☐ Extruded	25.4mm

Place   Cancel
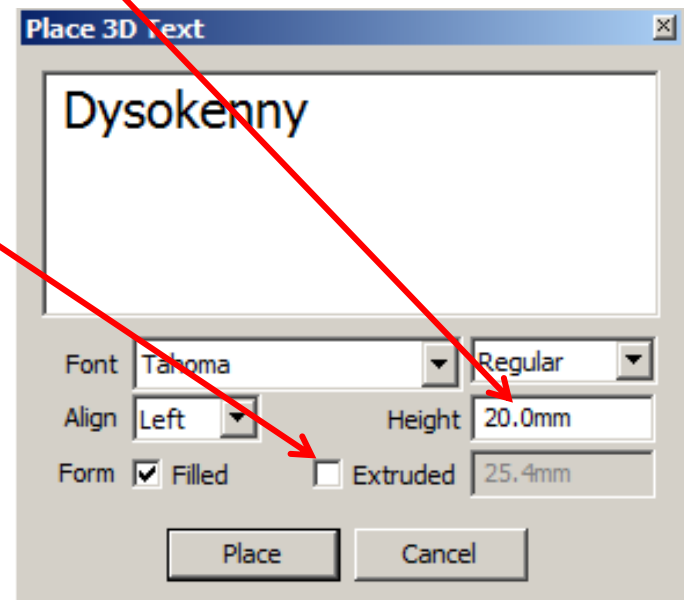
3. Using the *move tool* position the writing over the hairdryer body.

On Edge in Group
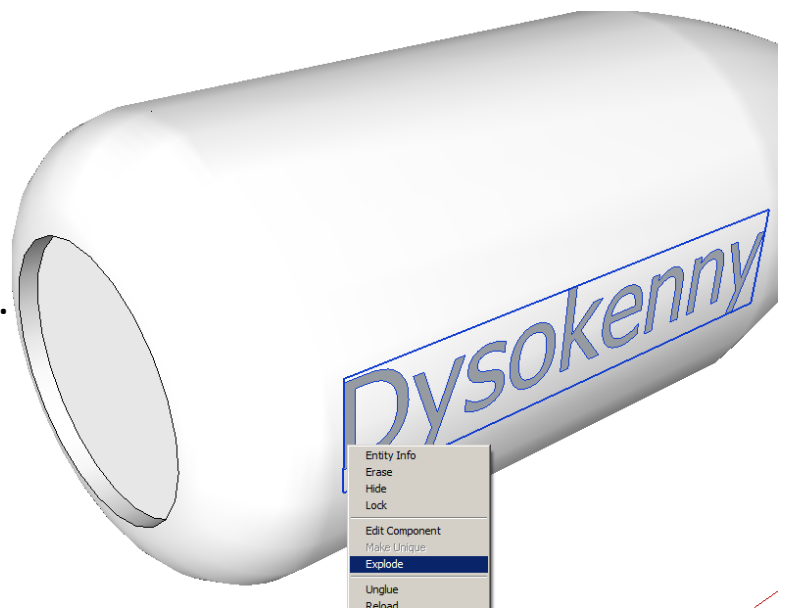
4. Using the *select tool* highlight the writing, right click and explode........

Entity Info
Erase
Hide
Lock

Edit Component
Make Unique
Explode

Unglue
Reload

5. Using the *push tool* extrude the letters into the main body of the hairdryer

6. Double click after the first letter has been extruded and it will extrude the remaining letters into the body

7. Using the *select tool* highlight the body, right click and explode........
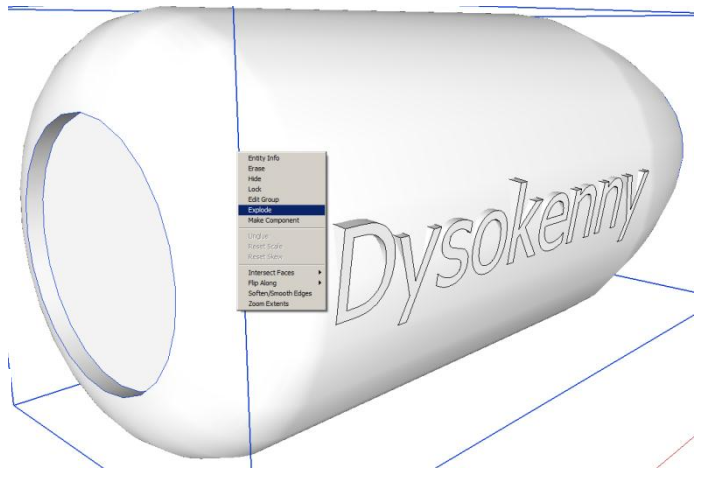
8. Using the *select tool* highlight the body and writing now they are un-grouped. Make sure both are highlighted. Right click and Intersect faces with model. This will attached the letters onto the main body
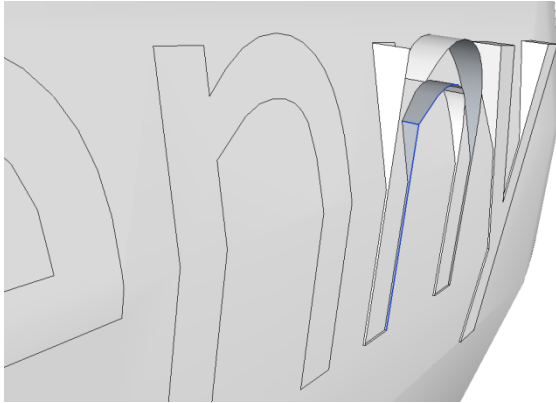
9. Using the ***eraser tool*** deleted the 3D part of the letters to leave the writing wrapped around the body
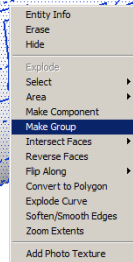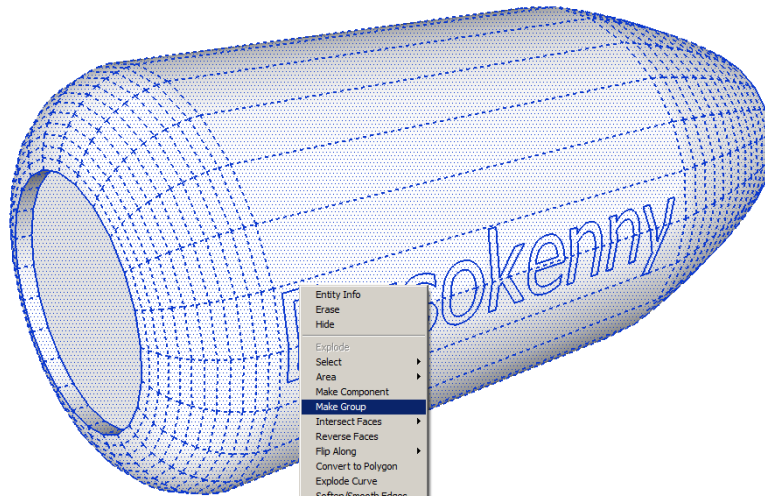
10. Using the ***select tool*** highlight the body and writing. Right click and make group

Dysokenny

On Red Axis
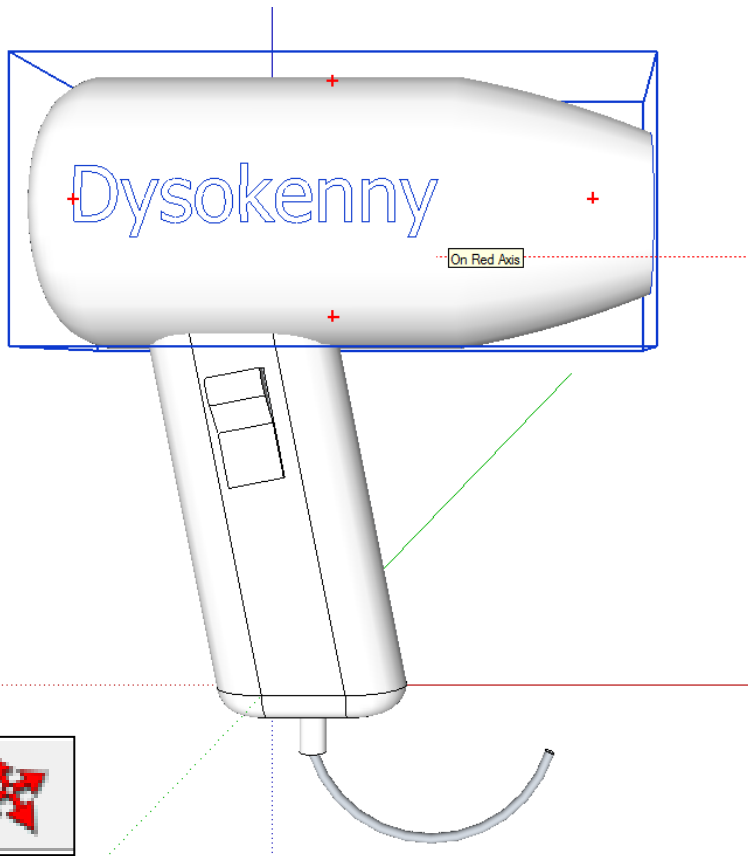
11. Using the *move tool* position the top body over the hairdryer handle. To assist click on the side view

12. Using the *move tool* check the position the top body over the hairdryer handle and move where necessary. To assist click on the front view
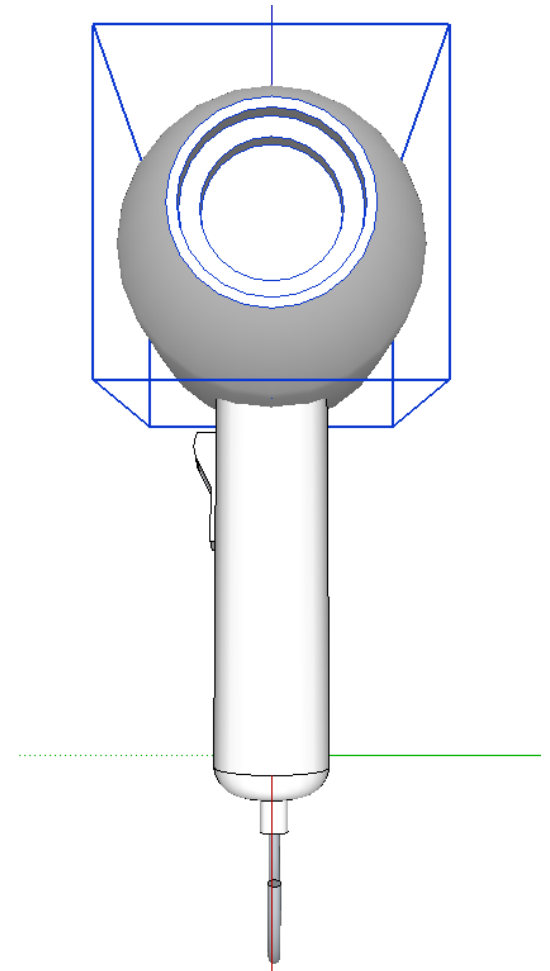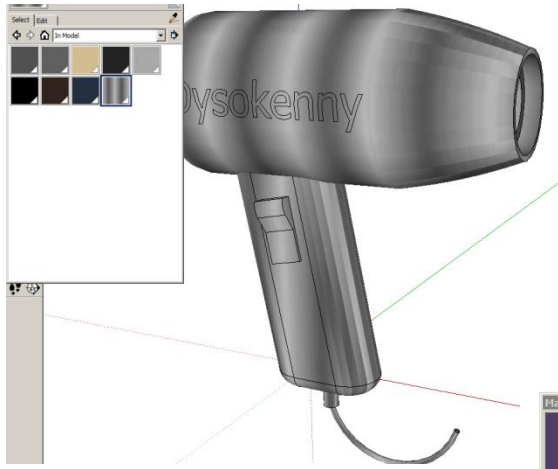
13. Using the *colour bucket* to render your design
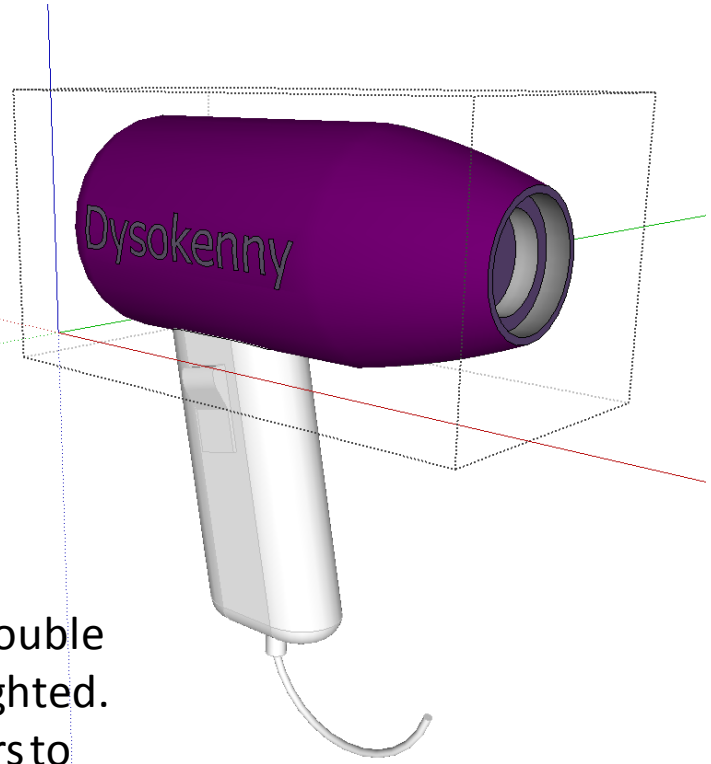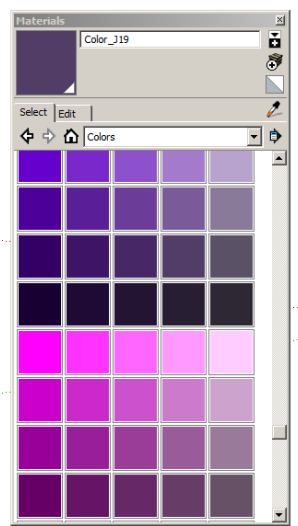
14. You will need to use the *select tool* to double click grouped objects so they are highlighted. You will be able to add individual colours to these parts such as the switch

Dysgbar

Name / Enw: _____   **Form / Dosbarth:** _____

You are a Product designer working for a firm that specializes in designing products. Clients often come in asking you to complete a range of design proposals to meet unique design briefs.

You are to complete a range of CAD tutorials before being given a brief to redesign a product that can be flat-packed (laser cut) or 3D printed.

Learning Objectives / *Nodau Dysgu*:
•You should be able to work through the design process and design and create and mobile TV Stand
•You will understand how analyse a design task to explore all possibilities when designing.
•You will be able to use 3D CAD to design your product and understand how your CAD drawing can be used to present real life visual drawings for potential clients before manufacture.
•You will be able to use rendering tools, animations to present your work.

CAD TUTORIALS
CAD Tutorial 8: Gameboy
Level of Difficulty
★★★★☆
Time
Approximately 60-80 minutes

Help and Guidance
You can find help at www.theDTresource.co.uk or www.designouttthebox.com. There you can find information on how to complete the activities in this folder.

Literacy and Numeracy
You are expected to **correct all spelling errors** and **incorrect punctuation** in your design folder. **Show all the calculations** that you carry out in your design folder.

Literacy Feedback and Targets to Improve my Design Portfolio Work	
SP	Spelling Error
P	*Incorrect Punctuation*
CAPS	Incorrect capital / lower case letter
N.P	*New paragraph*
UL	Headings need underlining

CAD Basics	Level Awarded
1. House	
2. Dimensions	
3. Editing	
4. Design Tools	

CAD Basics targets

Advanced Skills	Level Awarded
5. Mobile Phone	
6. IPod	
7. Hairdryer	
8. Gameboy	
9. Boat	
10. Camera	
11. Toy tank	
12. Water Bottle	
13. Components	
14. Aircraft Lamp	
15.Big ben Lamp	
16. Flat Packed Toy	
17. Working Drawing	

Advanced skills targets

Advanced skills targets

Advanced skills targets

er b
Vie
Component Edit ▶
Animation ▶

Extension

- Design an electric drill using CAD…………..