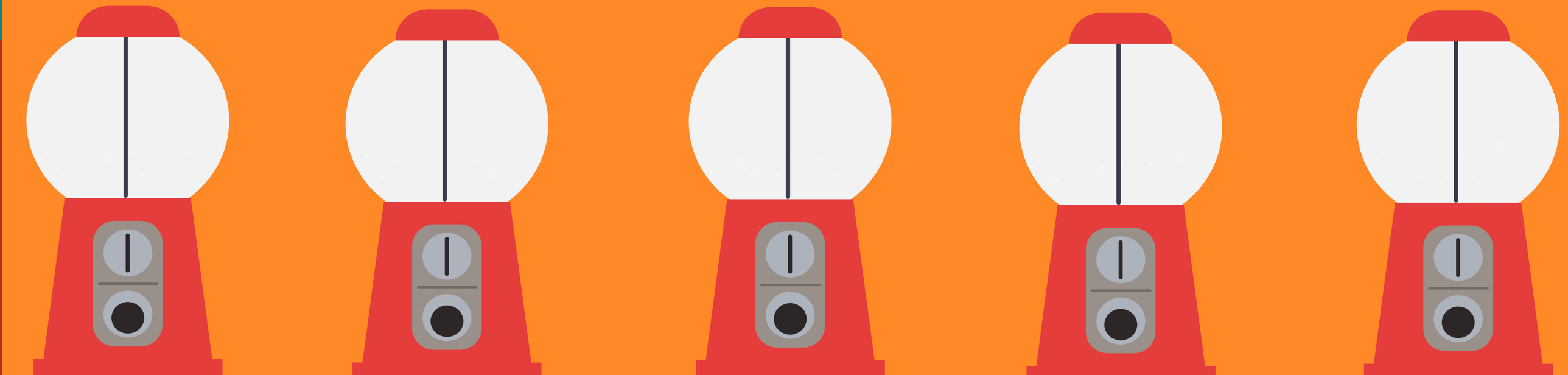
Jelly Belly

MACHINE



MANUFACTURER'S HISTORY

Construction: Wood
Manufacturer: Pulver Chemical Company
Function: When a coin was inserted, the figure rotated, picked up an item, and dispensed it.

Construction: Encased in embossed cast iron
Manufacturer: The One Cent Standard Gum Machine Works
Function: When a coin was inserted, the figure rotated, picked up an item, and dispensed it.

Precedent material

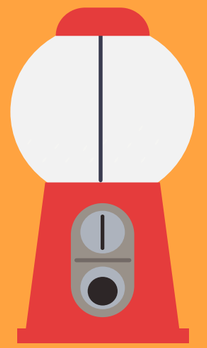
Product range

While many of the machines used this simple approach, some newer models elected to use electricity to control more elaborate forms of gumball transport, such as lifts, pulleys, ramps, and drops.

It only work with standard Jelly Belly jelly beans Other candies may get stuck in the machine and/or cause damage.

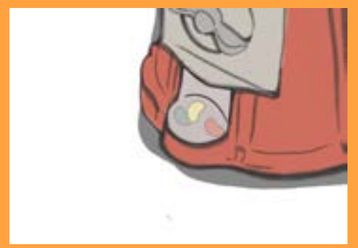
What material technology have significantly help the production of the product

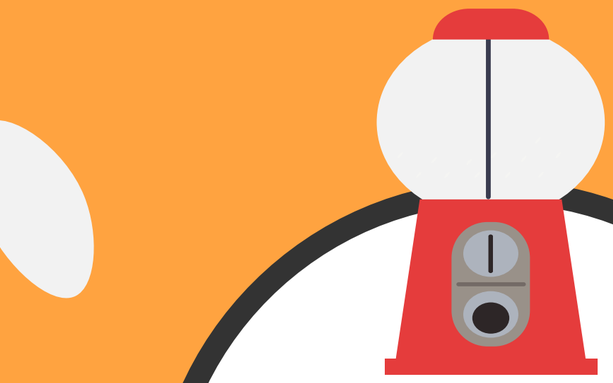
Manufacture (material) method:
Glass: Blow molding
Metal: Investment casting
Snap-fit design
Paint: Safe non-toxic paint surface (red colour)
Plastic: injection molding
Additive (grey colour / smooth surface)



How users interact with the parts

FILLING THE GLOBE





WHY IT EXIST?

Curiosity Toy Rise profit
Bring up new production line
Physical advertising Container
Trendy Collaboration
Decorator Souvenir

LIFE TIME

10 years

REQUIRE

Jelly Belly candy
coins (not necessary)
comes with package

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Design

Outsourcing

Manufacture

China

Process

Assemble

Packaging

Sell/promote

MARKET

Add Belly Jelly bean

Ship back to US

HDPE, Polypropylene (PP) 1

Stainless steel 2

Aluminium Alloys 3

Recycle

1 easy to disassemble, manufuture chop into fragments and applied to other product.

2 87% stainless steel can be reused; Stainless steel can be recycled infinitely - and it suffers no quality degradation during reprocessing.

3 bauxite mining, alumina production, primary aluminium production, semi-fabrication, product manufacture, use phase, recycling, semi-fabrication, product manufacture, use phase, recycling...

Bill of material

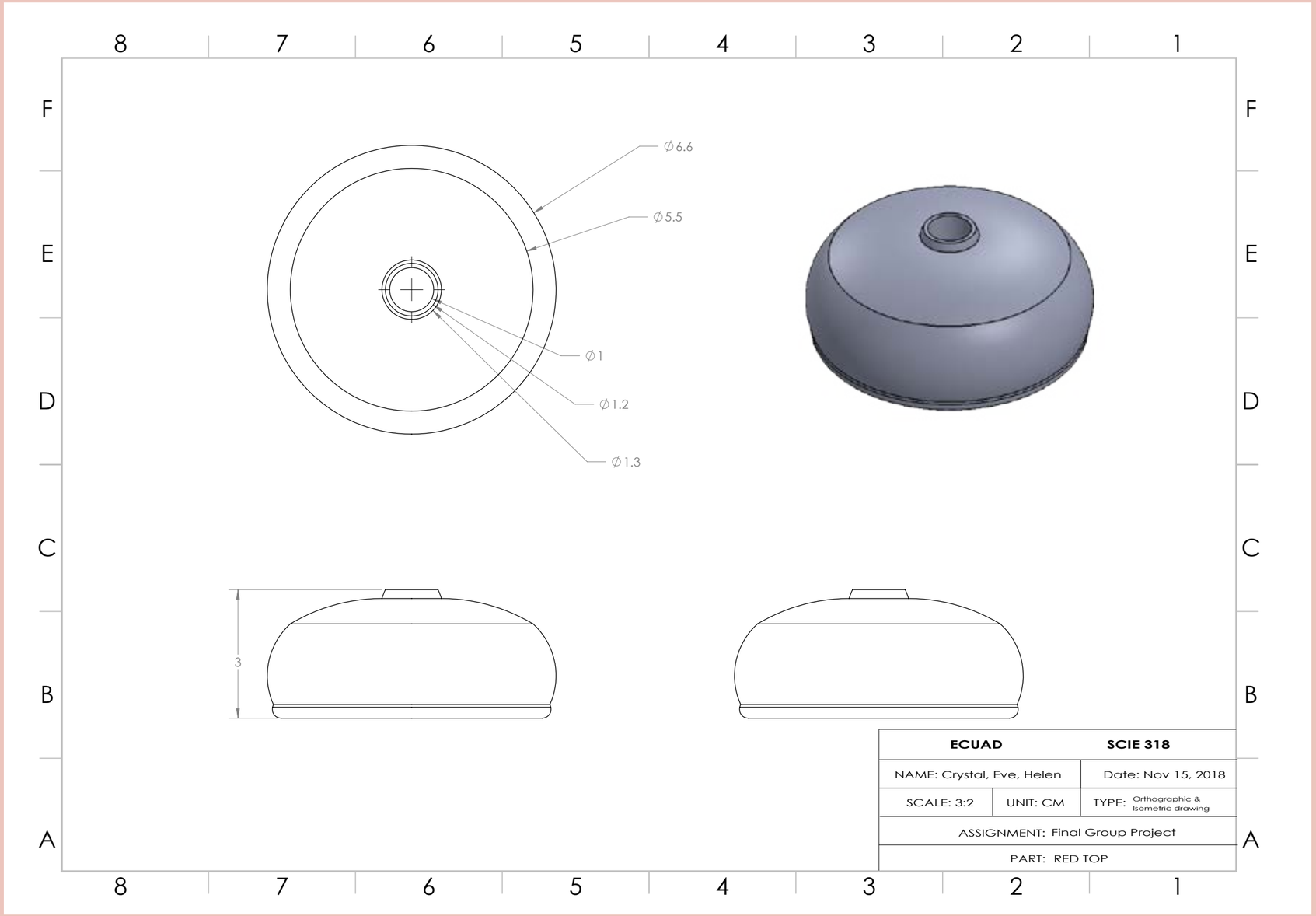
Part Name	Description	Quantity	Material	Weight Unit /lb.	OKALA impact factor points unit /lb.
Materials					
Clear Plastic Ring	The ring place between glass globe and brush plate	1	Polypropylene (PP)	0.0061	PP, Secondary 1.9
Spider Retaining Ring	A fastener that hold the “red top”	1	Polypropylene (PP)	0.1014	PP, Secondary 1.9
Metal Round Part	Attached to the “Plastic round” in order to strength	1	Stainless steel	0.0115	13
Metal Bolt	Fastener for the “red top”	1	Stainless steel	0.0073	13
Red top	The cap of the candy container	1	Aluminum Alloy	0.1641	4.5
Glass top	The part holding candy	1	glass	0.2821	0.56
Plastic Round	The wheel that triggers	1	Polypropylene	0.1047	PP, Secondary

	rotate mechanism with in the machine		(PP)		1.9
Metal Cat Part	A fastener	1	Stainless Steel	0.0054	13
Metal Z Part	A mechanical support located within the body part	1	Stainless Steel	0.0054	13
Metal Curve Part	A mechanical part	1	Stainless Steel	0.0032	13
Plastic Small Top	The part to stop the candy falling out	1	Polypropylene (PP)	0.0043	PP, Secondary 1.9
Mechanism Gear	•Coin mechanism • Rotating gear in transmitting force	1	Polypropylene (PP)	0.0024	PP, Secondary 1.9
Square Part	• Coin mechanism • attach the the "mechanism front" to the "body"	1	Polypropylene (PP)	0.0047	PP, Secondary 1.9
Mechanism Front	• Coin mechanism • One of the outside body part	1	Stainless Steel	1.1697	13
Metal T part	• Coin mechanism • The handle that triggers the coin machine	1	Aluminum Alloy	0.0185	4.5
Metal Half Round	• Coin mechanism • The connection between "mechanism front" and "Body"	1	Aluminum Alloy	0.0407	4.5

Body	• The main machine body part	1	Aluminum Alloy	1.4418	4.5
Brush Plate	• The part connected with “clear platices ring” and “Plastic Round”	1	Polypropylene (PP)	0.0167	PP, Secondary 1.9
Nut (1)	• A nut with 0.3cm diameter and 0.3cm length	1	Stainless Steel	0.0007	13
Nut (2)	• A nut with 0.14cm diameter and 0.15 length	1	Stainless Steel	0.0007	13
Rod	• A rob with 0.6cm length	2	Stainless Steel	0.00024	13
Base	• The base of the entire machine, and connect to body	1	Aluminum Alloy	0.1741	4.5

Manufacturing			
Injection mold PP	N/A		4.3
Blow molding	N/A		0.68
Steel Extrusion	N/A		1.1
Transport			
Airplane, interc.	Between continents	N/A	0.18 /p.-mi
Disposal			
Landfill PP	N/A		0.26
Landfill Stainless Steels	N/A		0.51
Landfill Aluminium	N/A		39
Landfill Glass	N/A		

Disassembled parts (orthographic / isometric)



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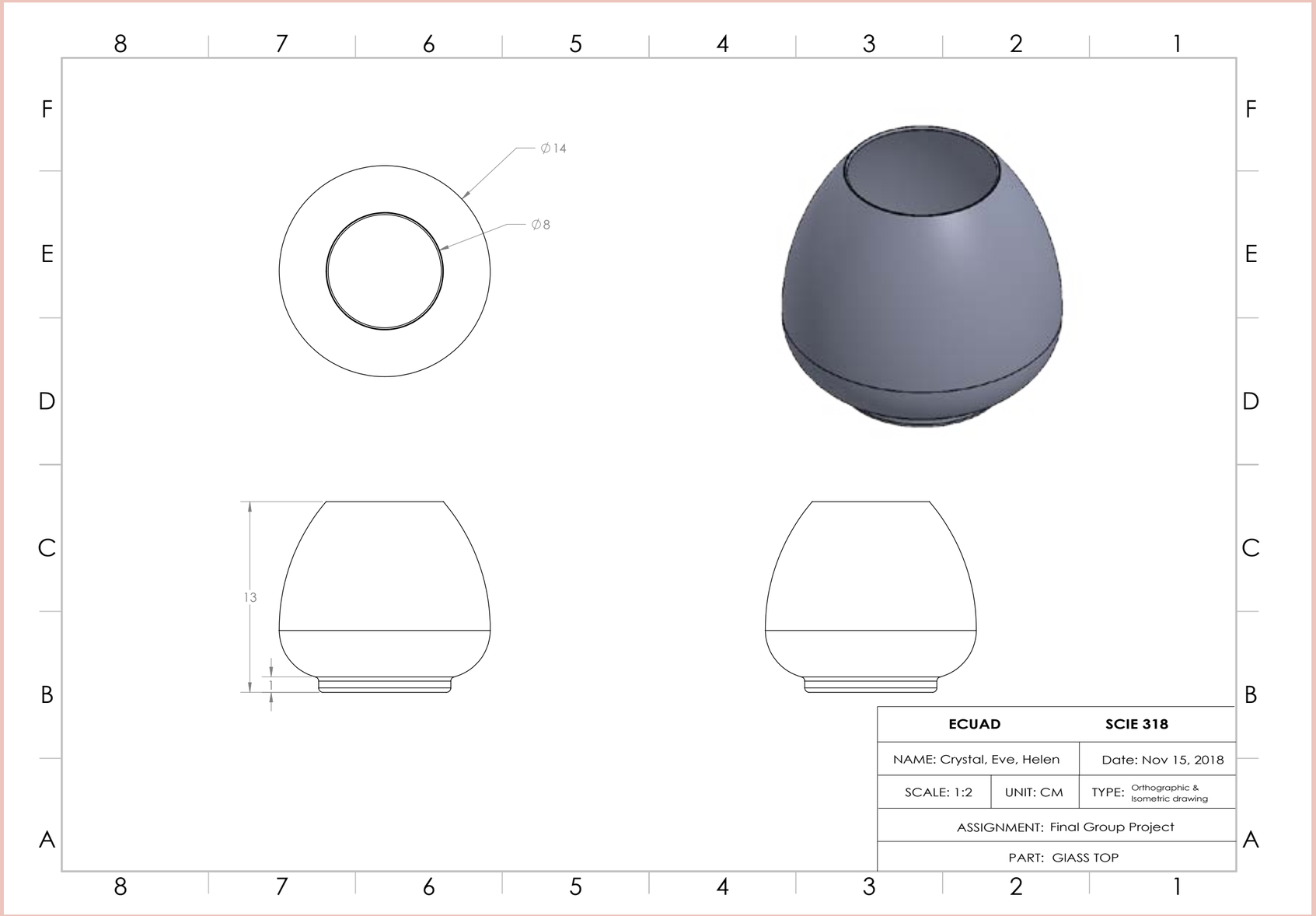

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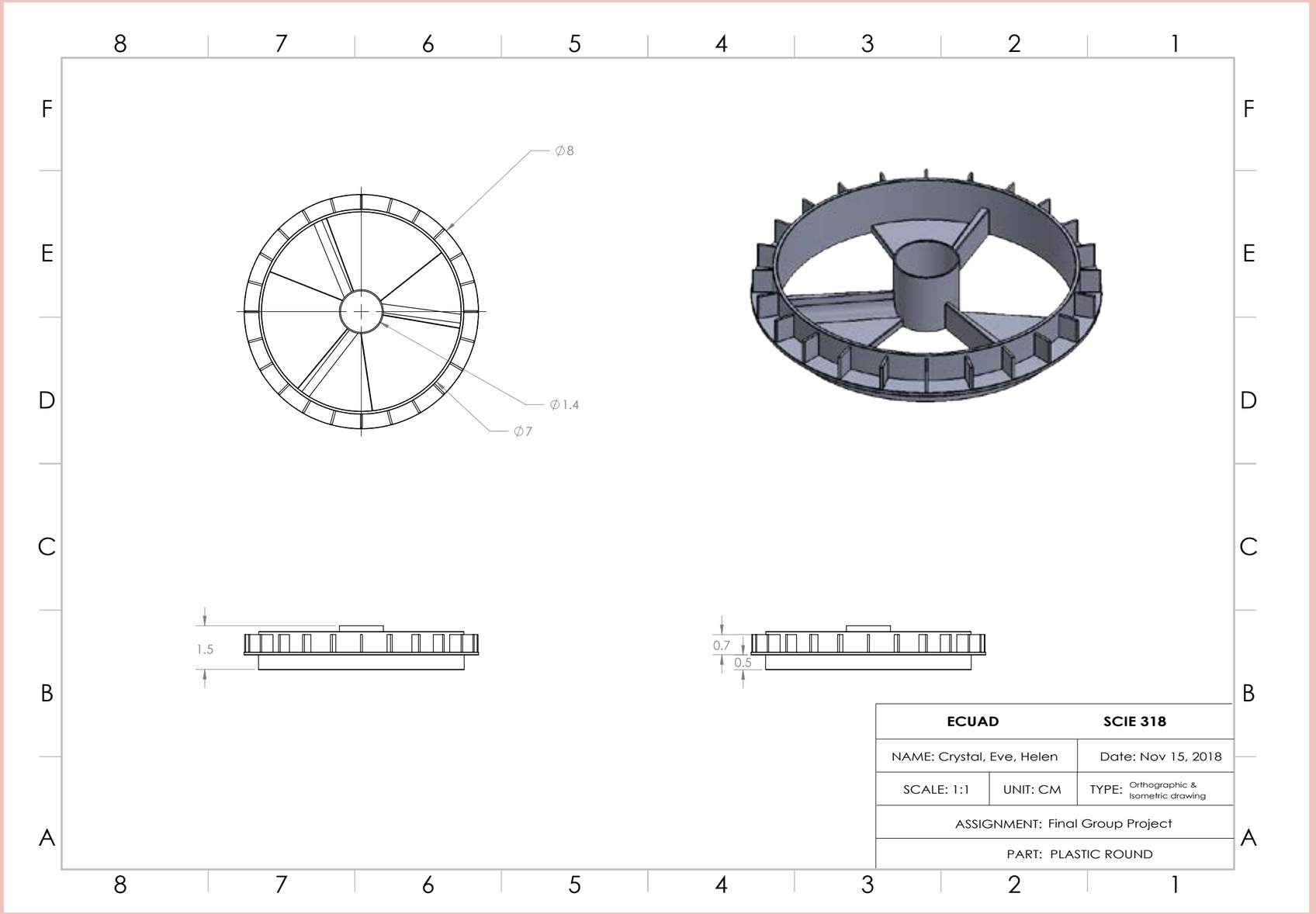

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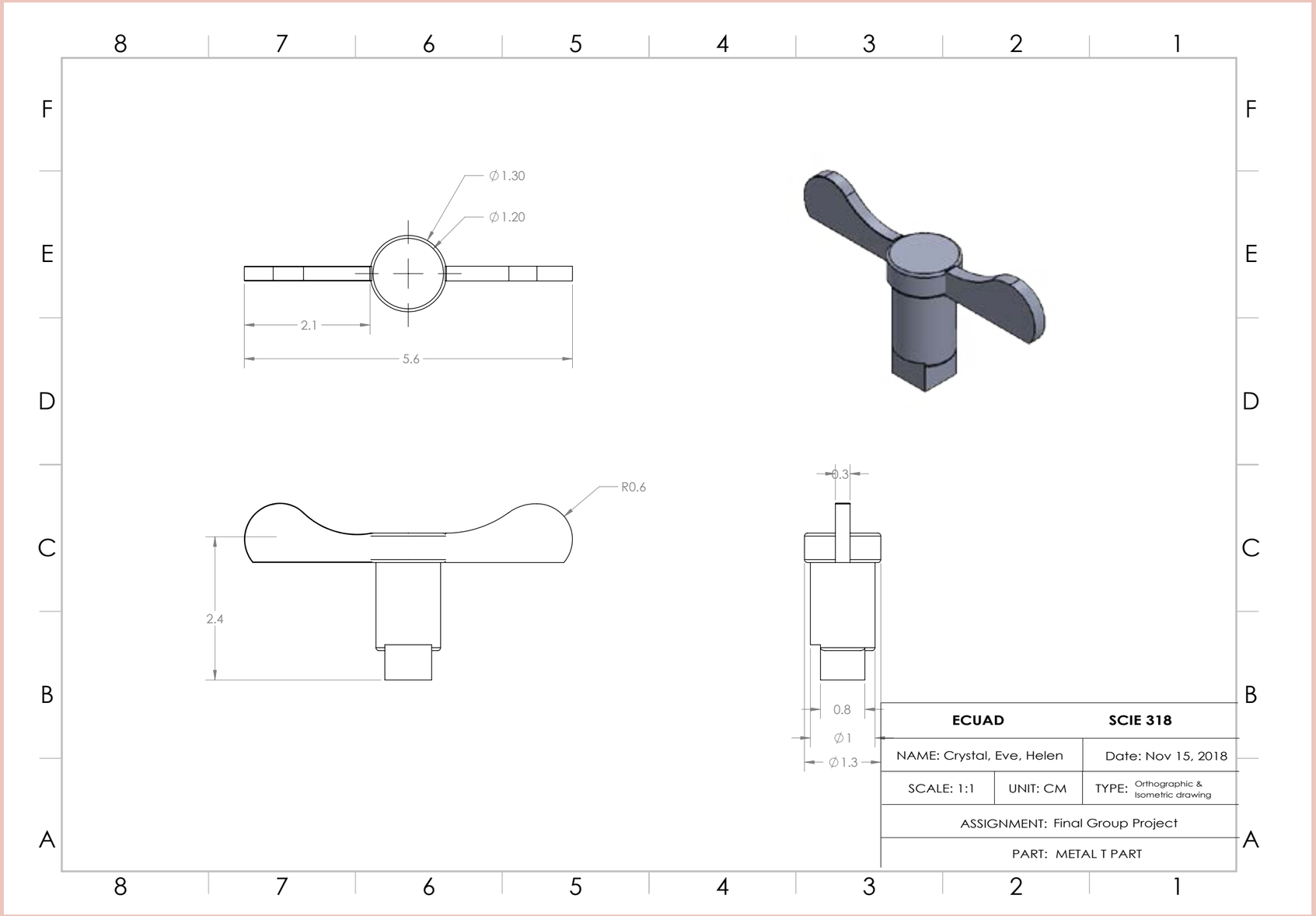

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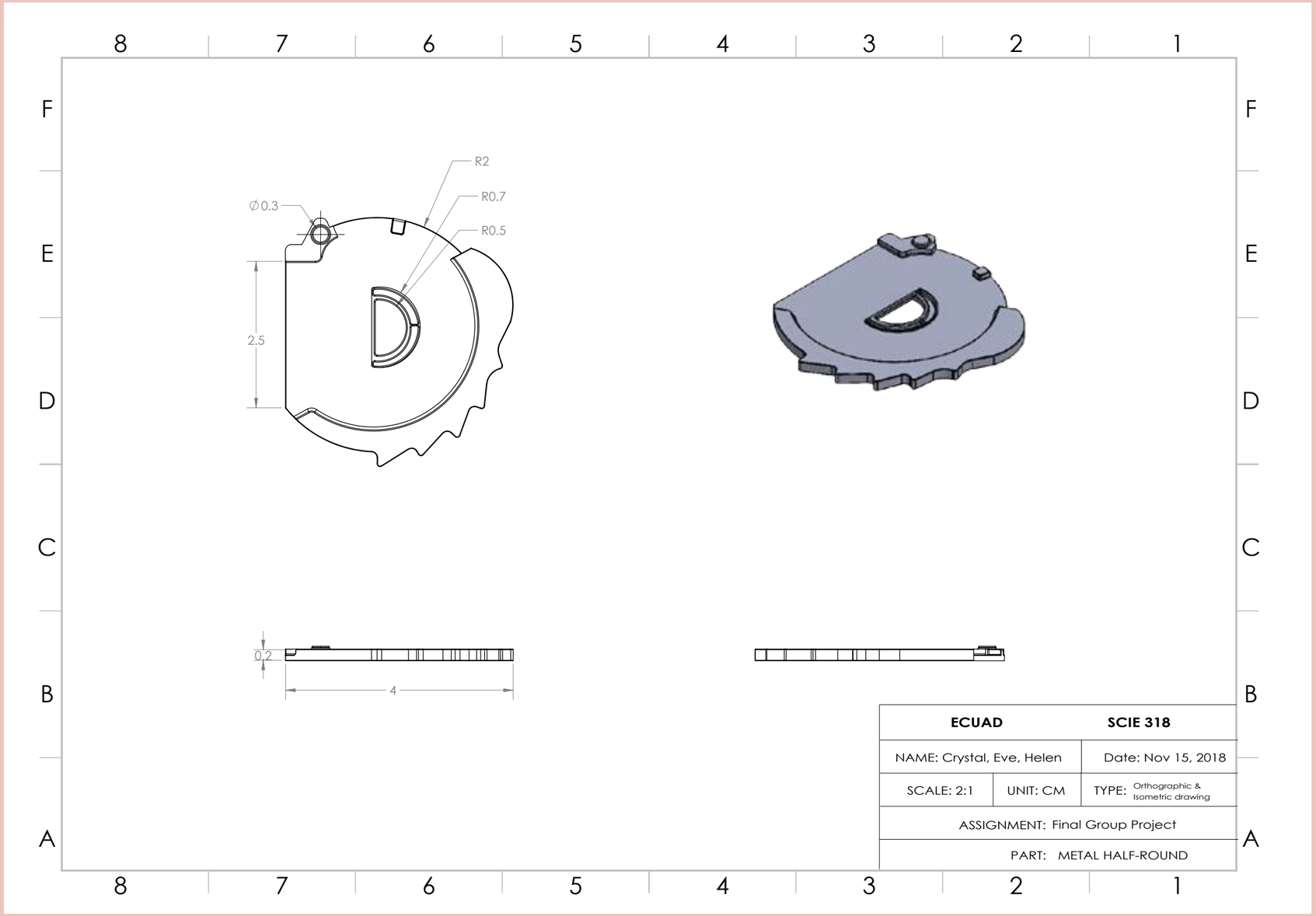

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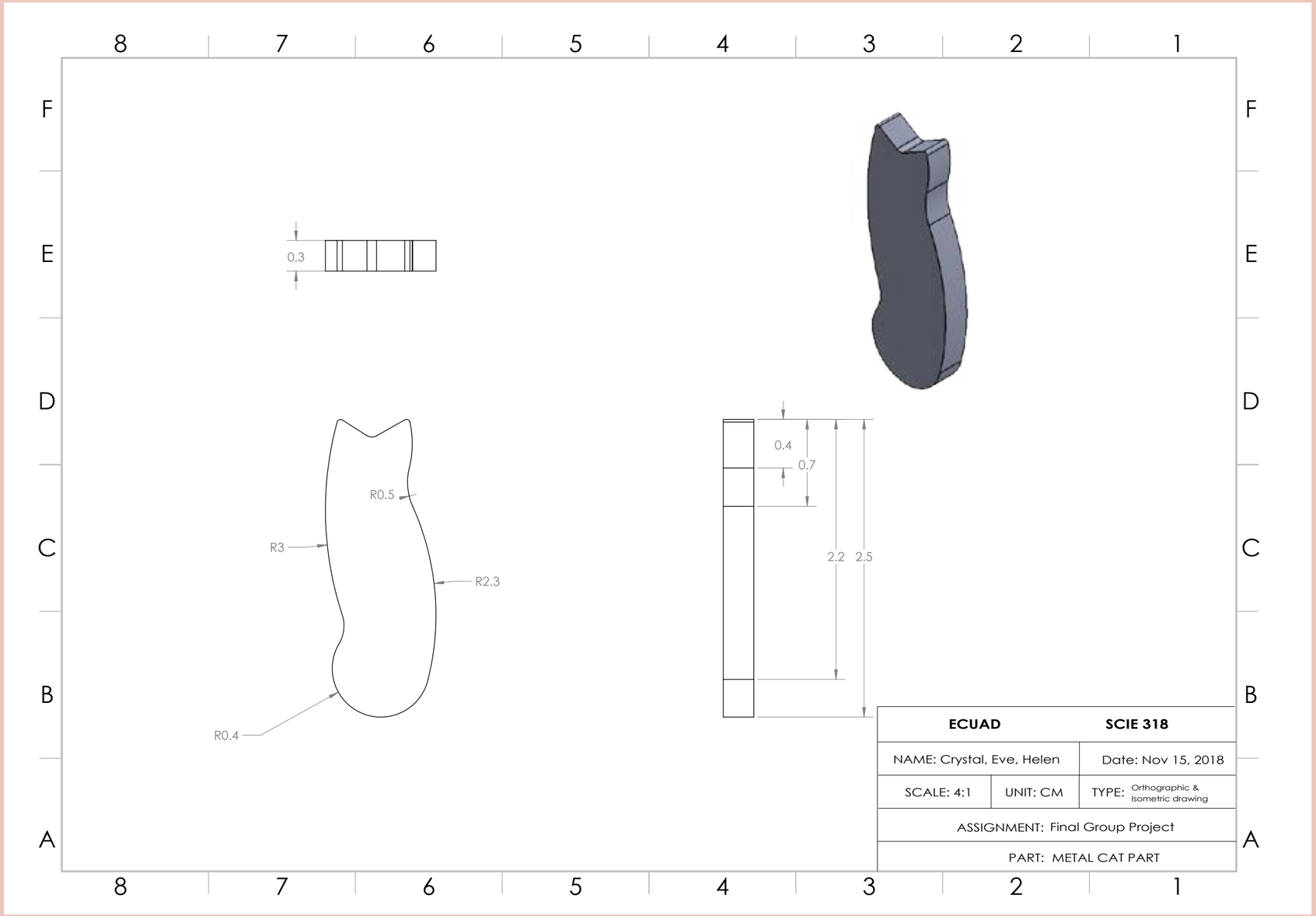

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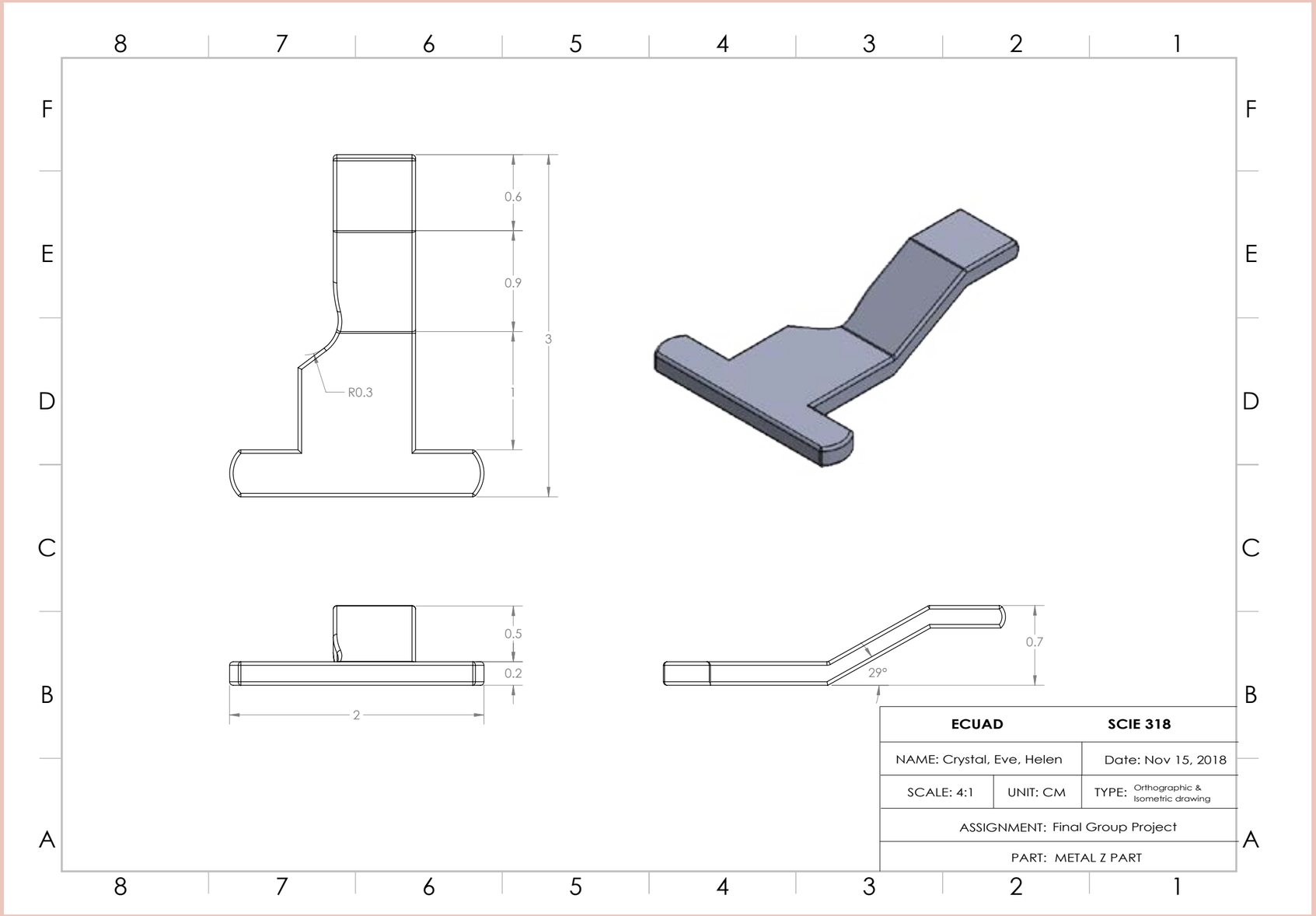

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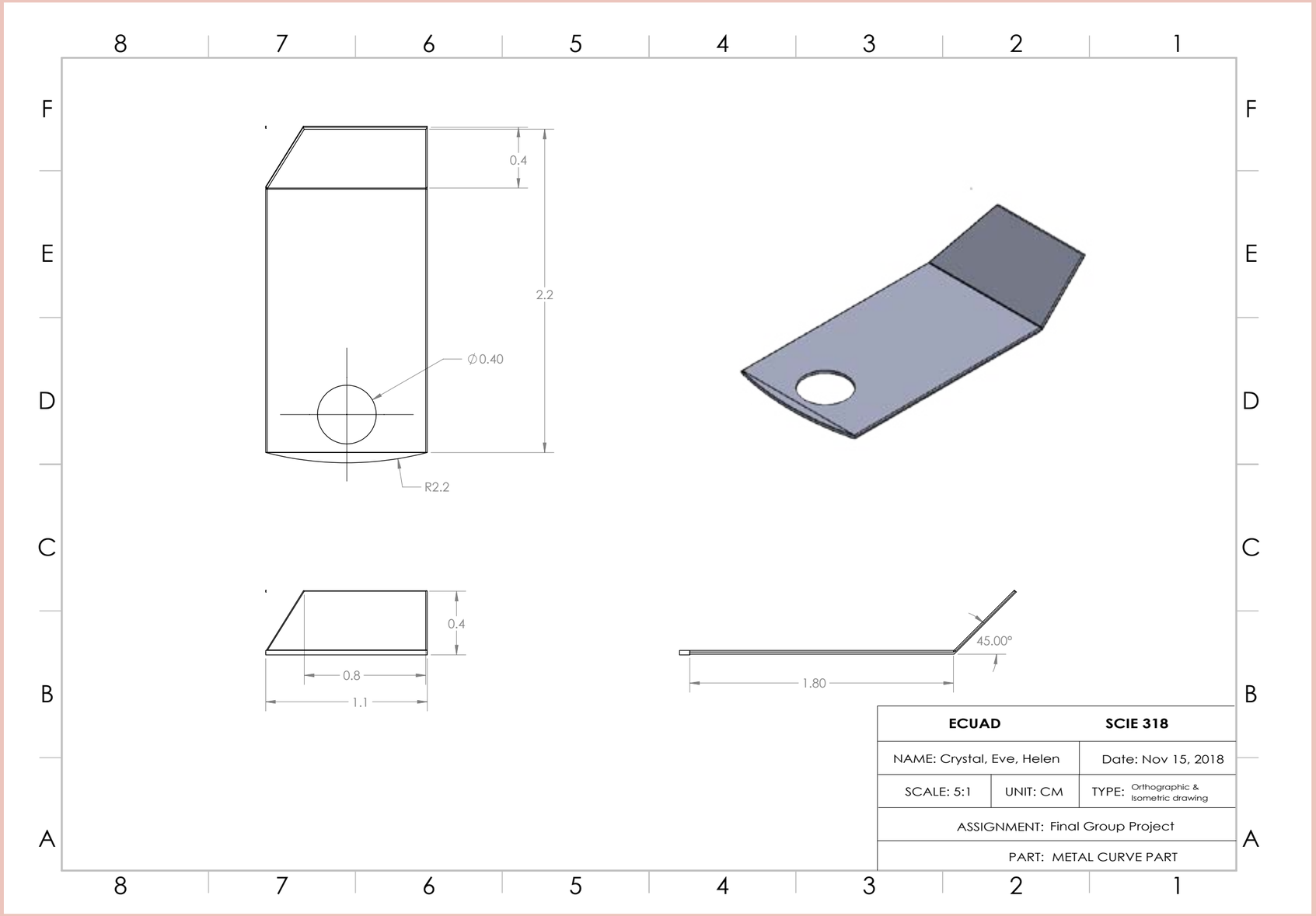

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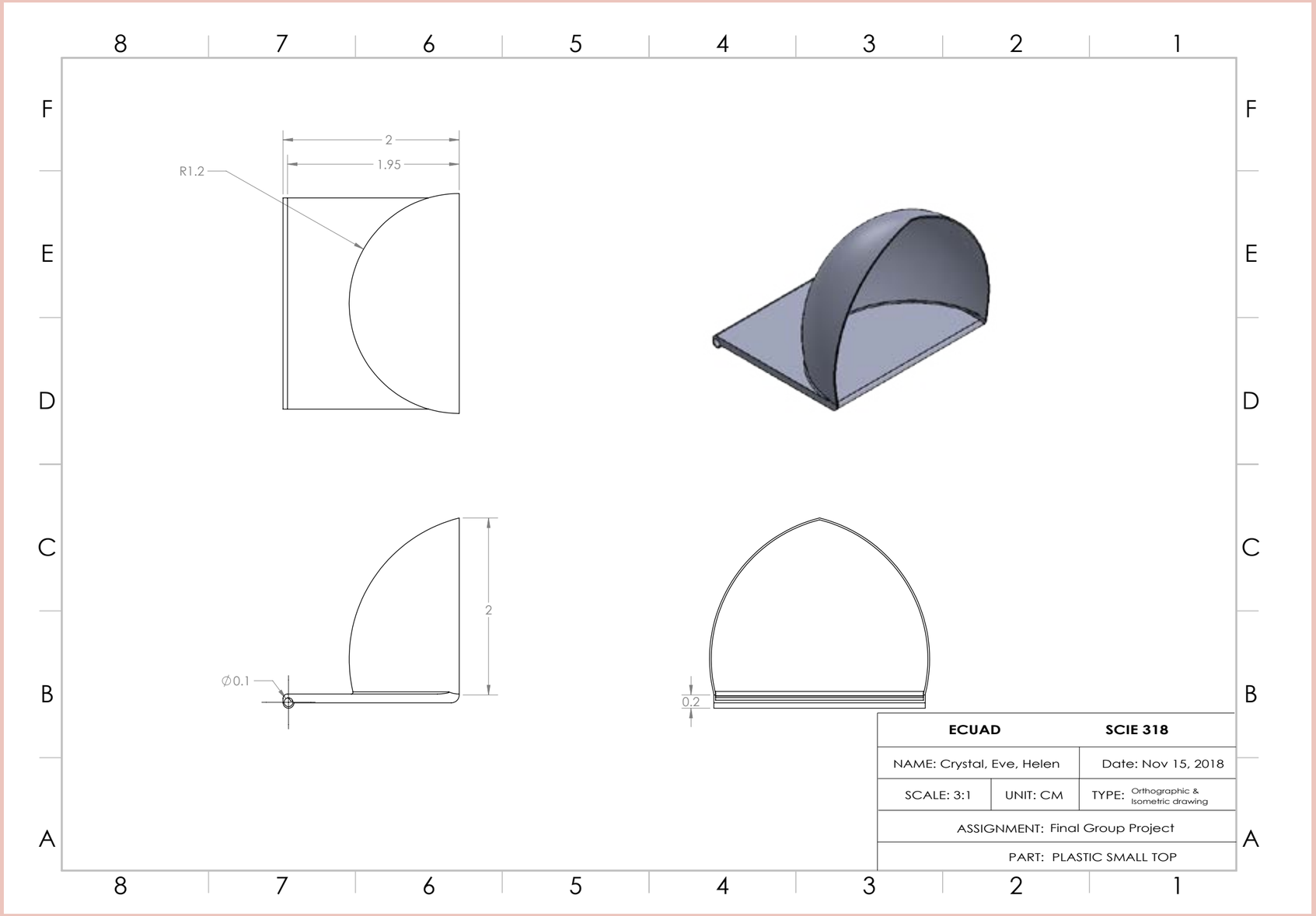

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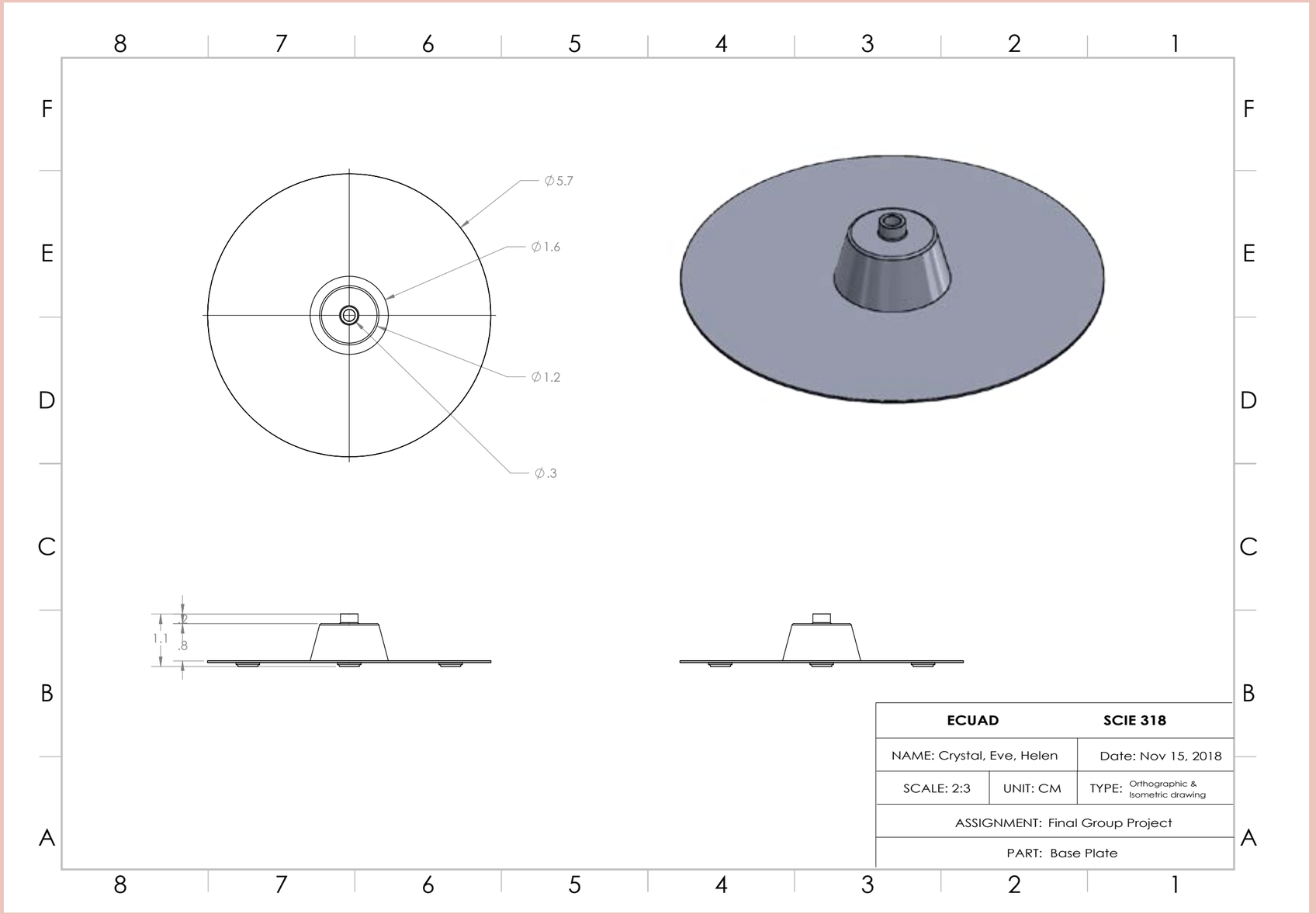

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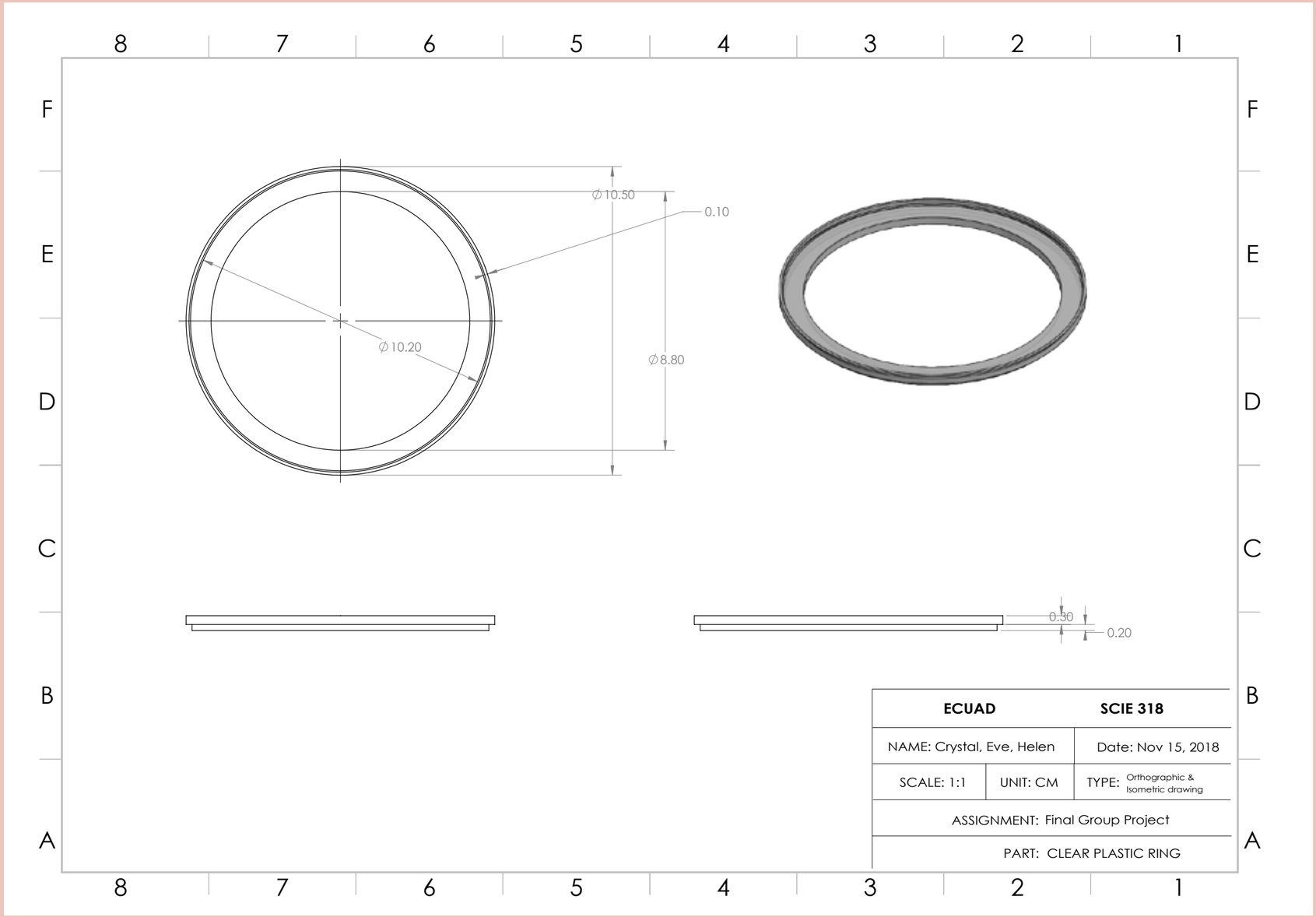

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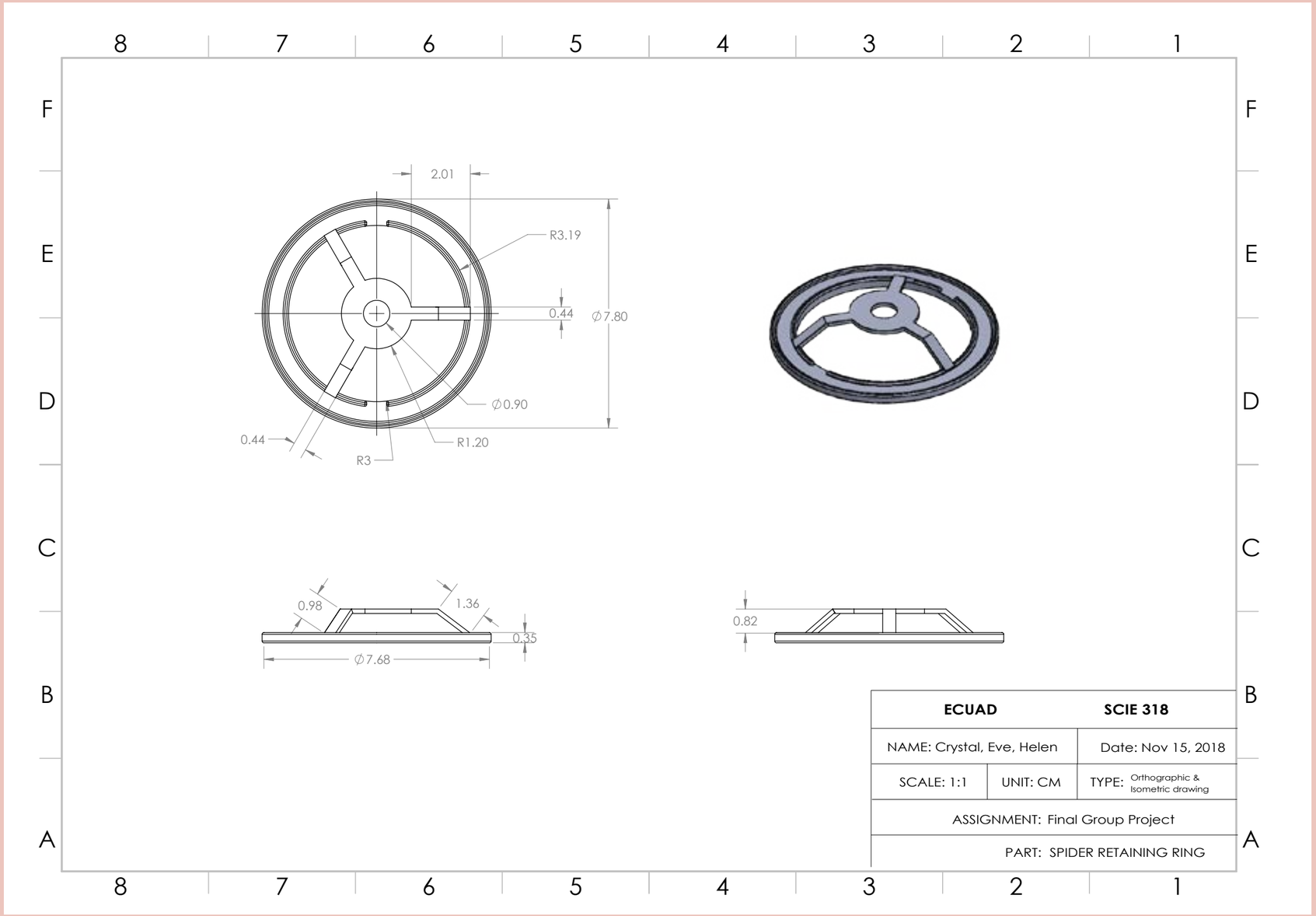

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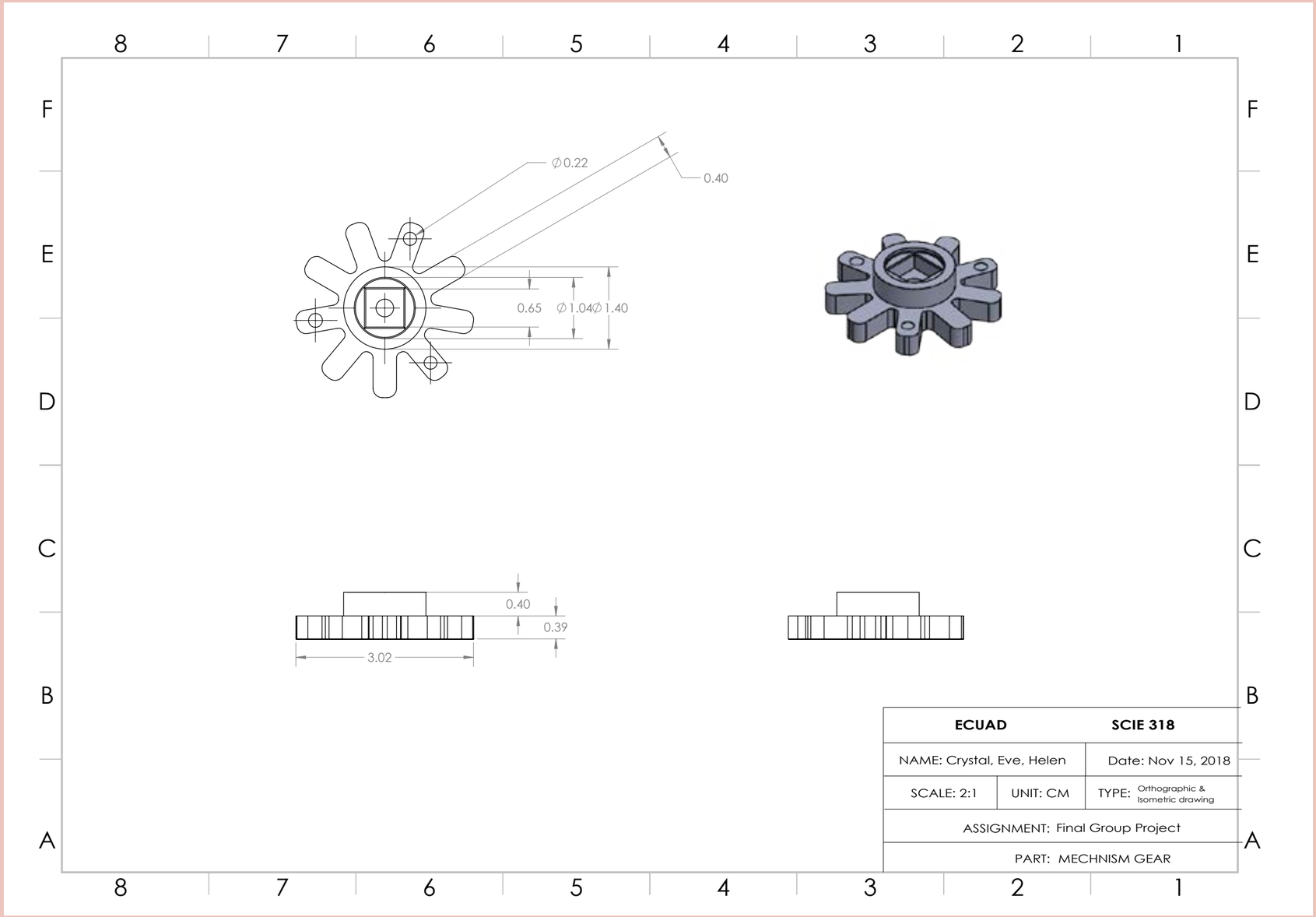

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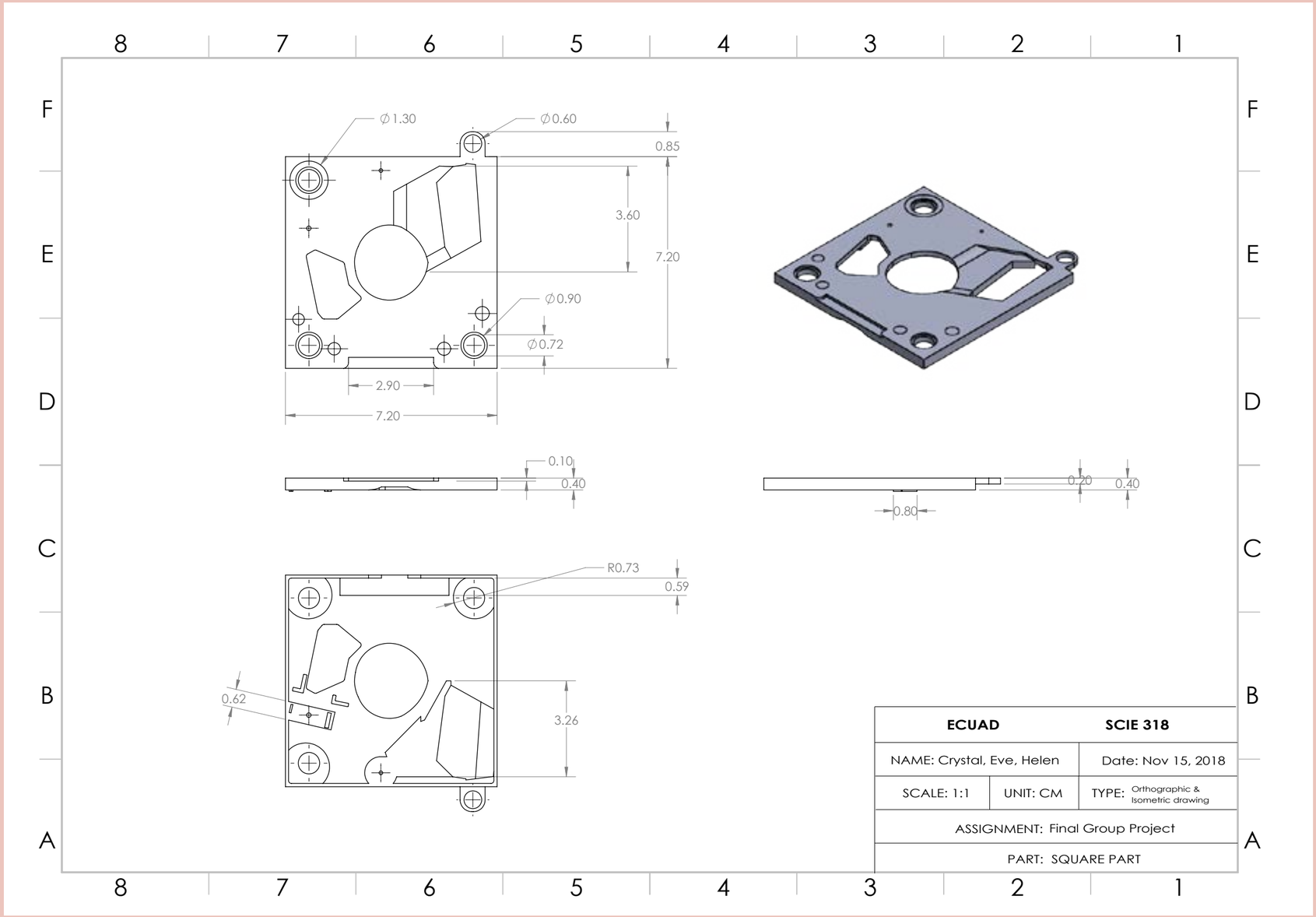

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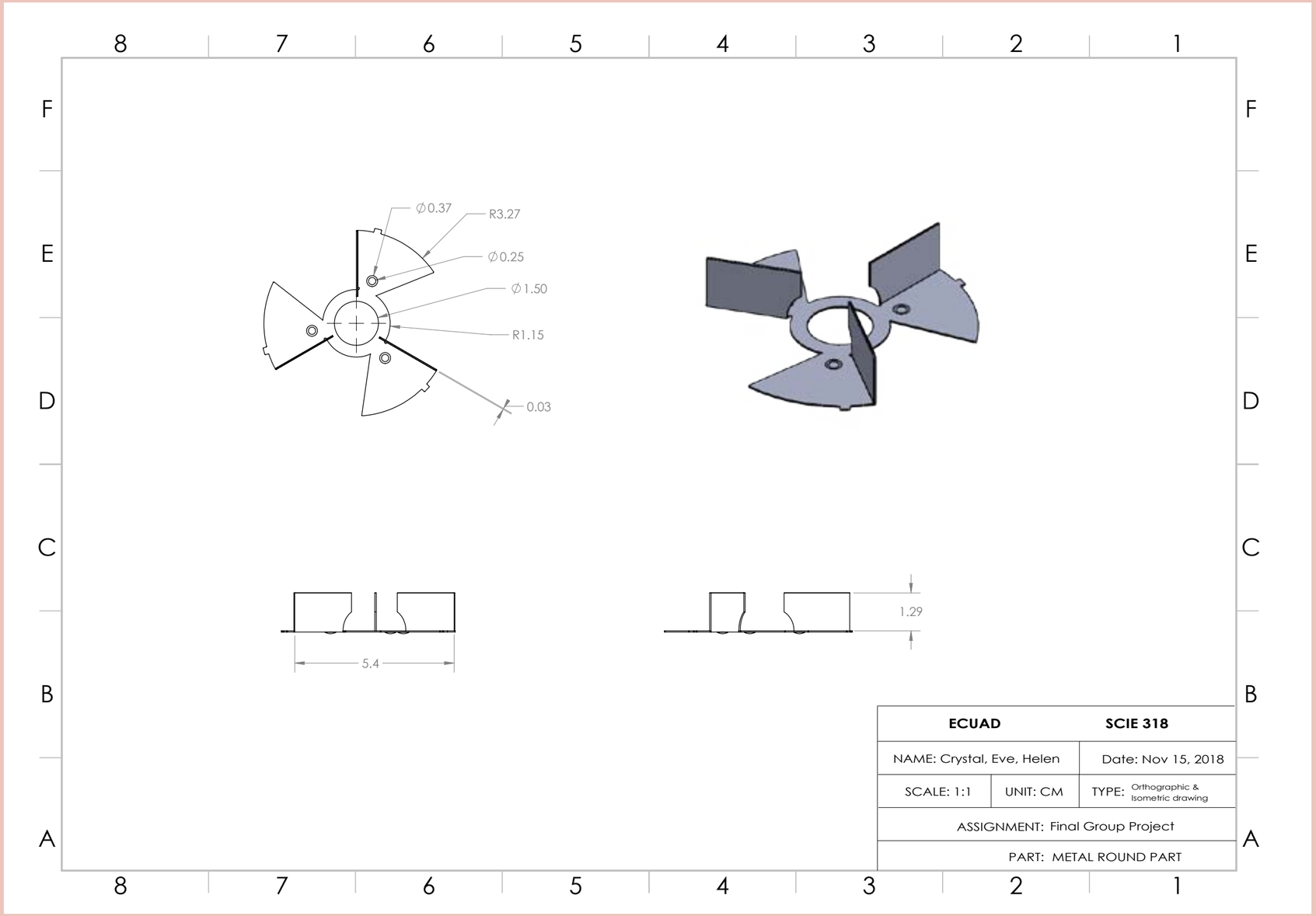

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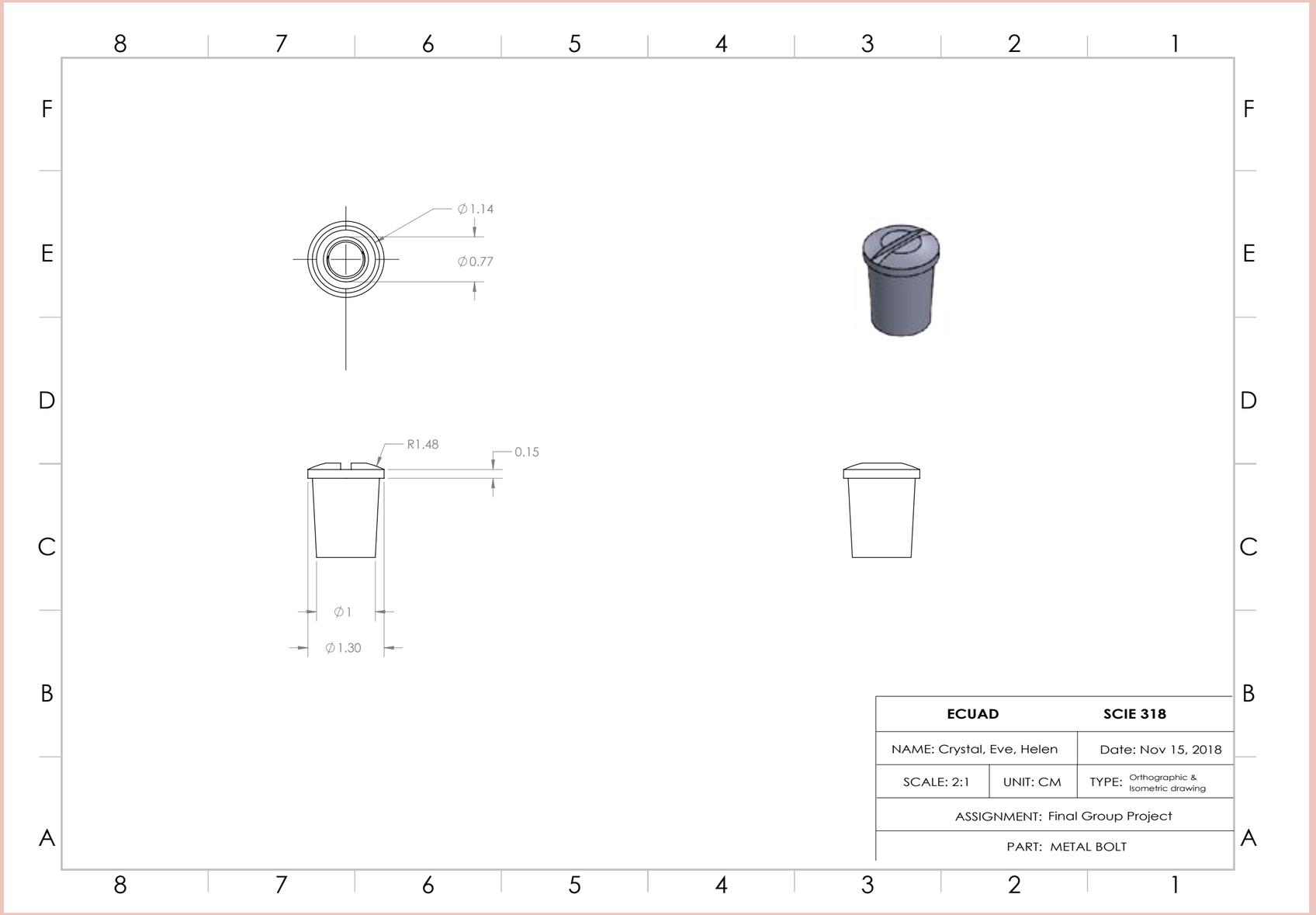

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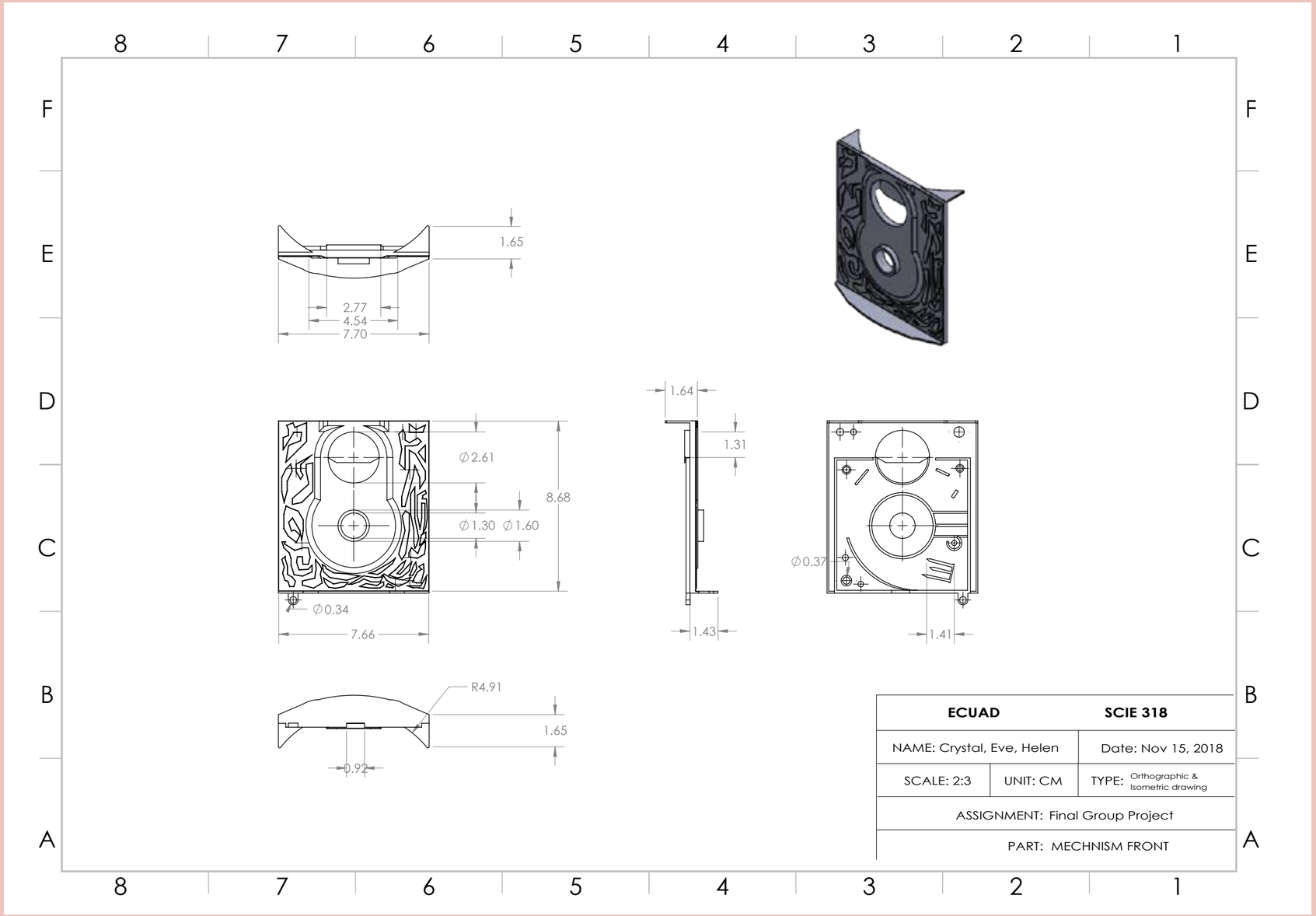

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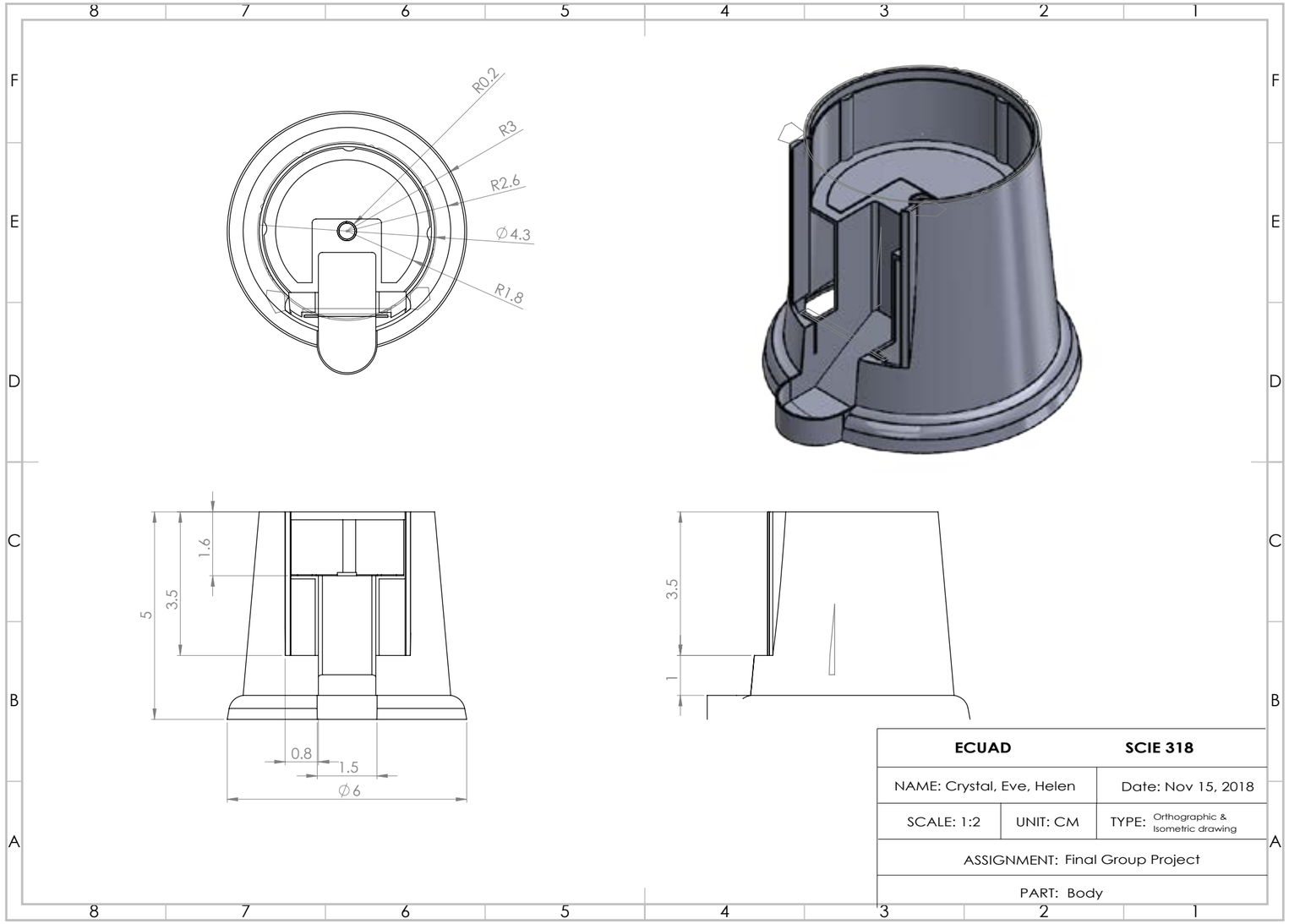

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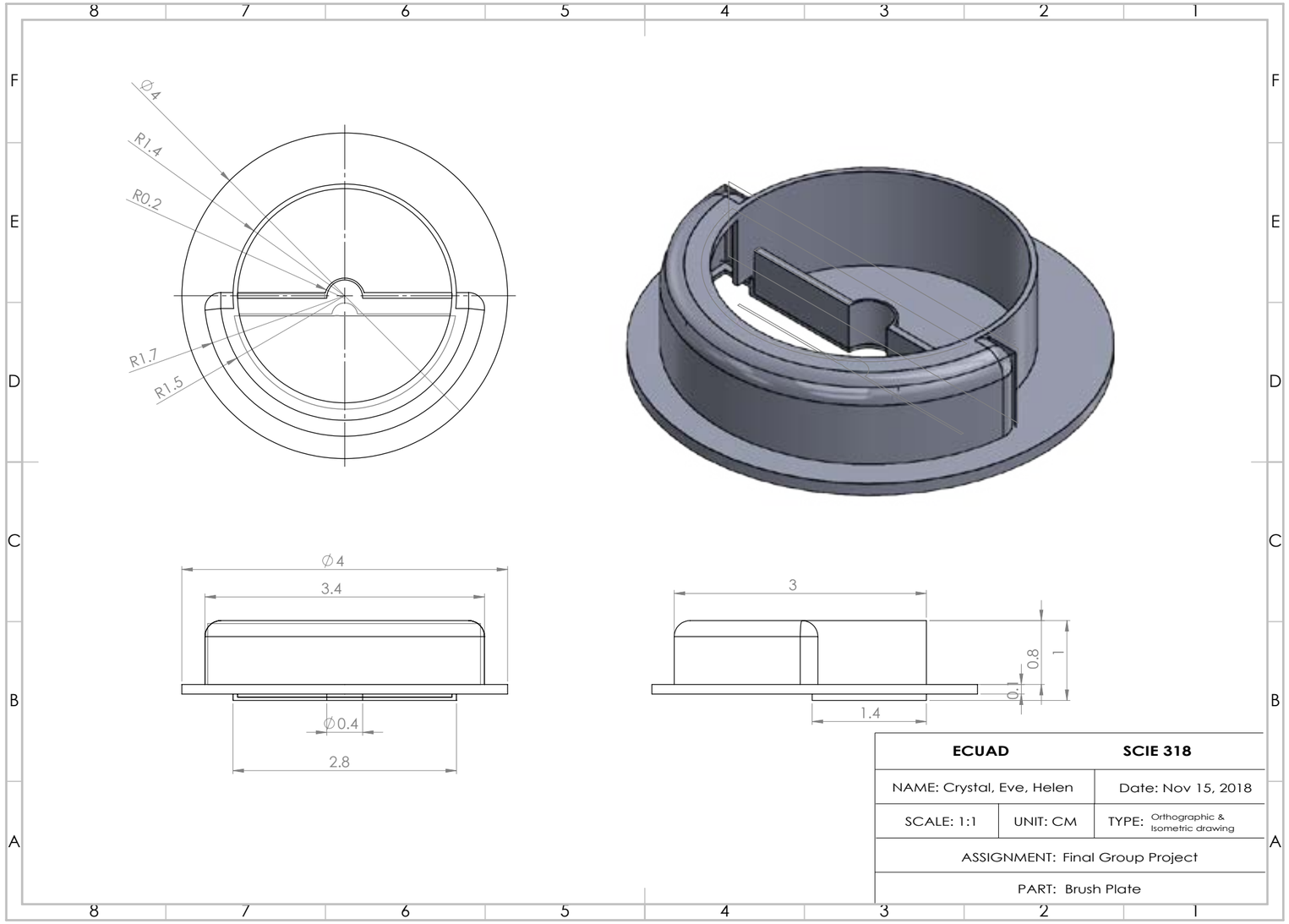

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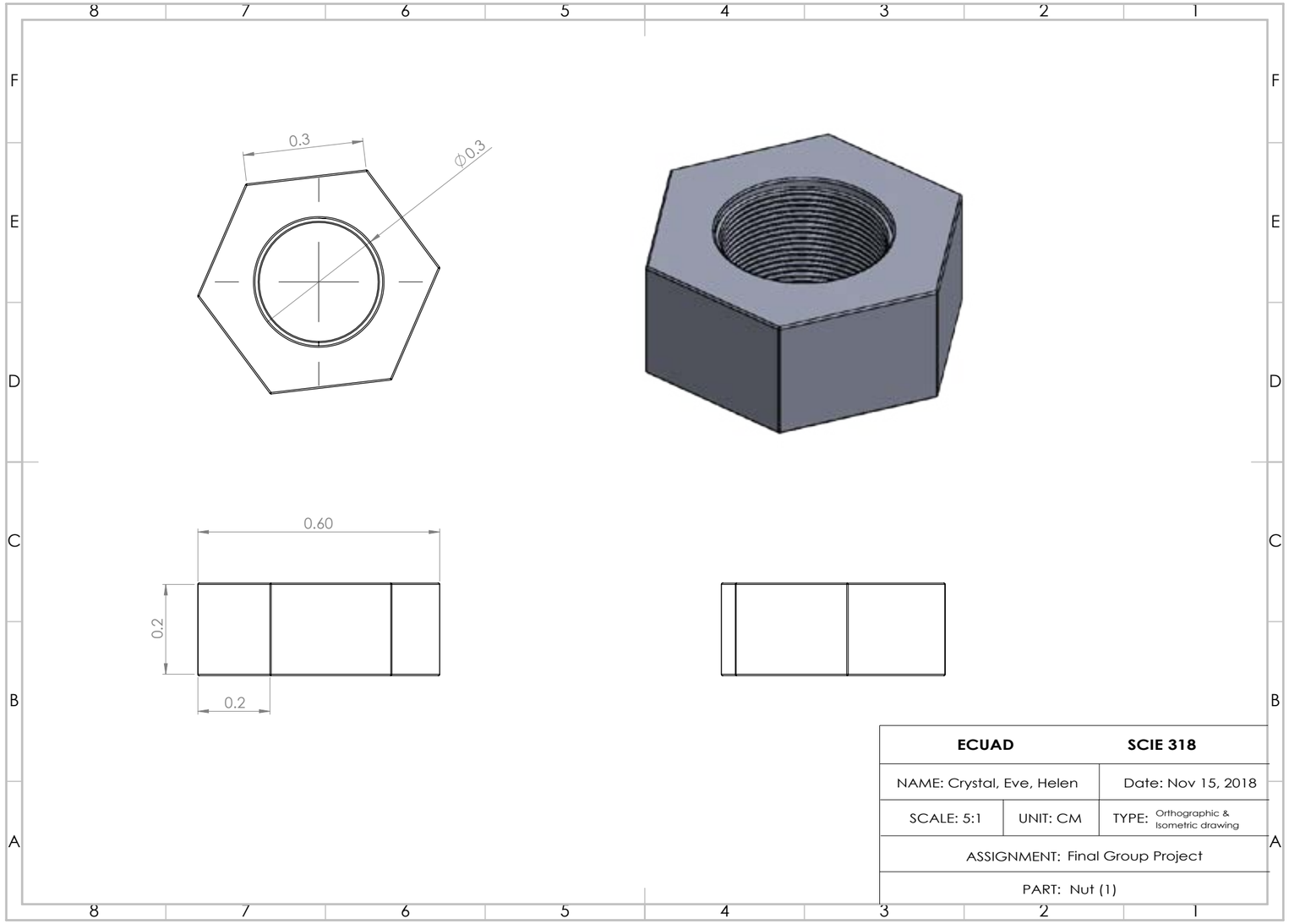

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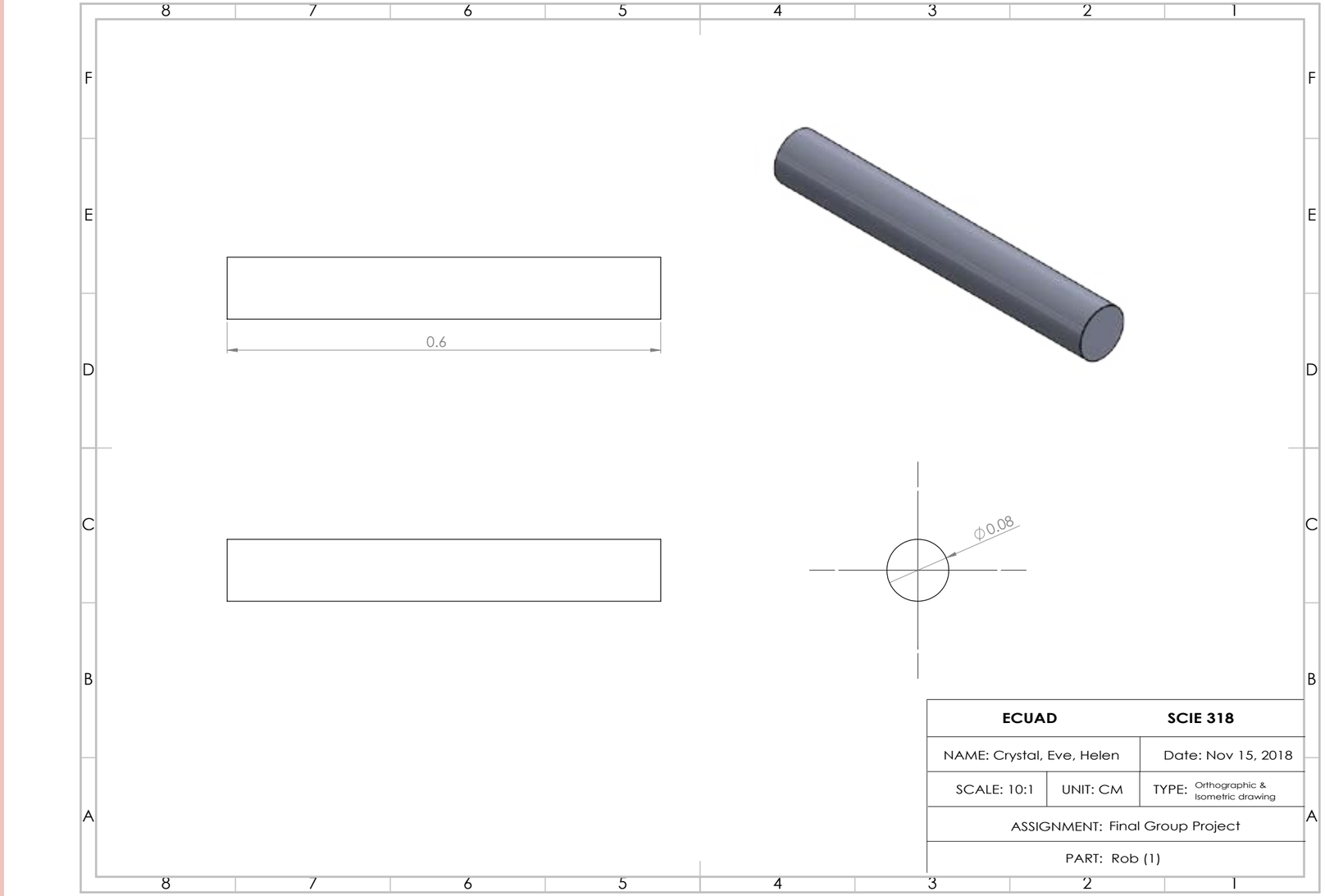

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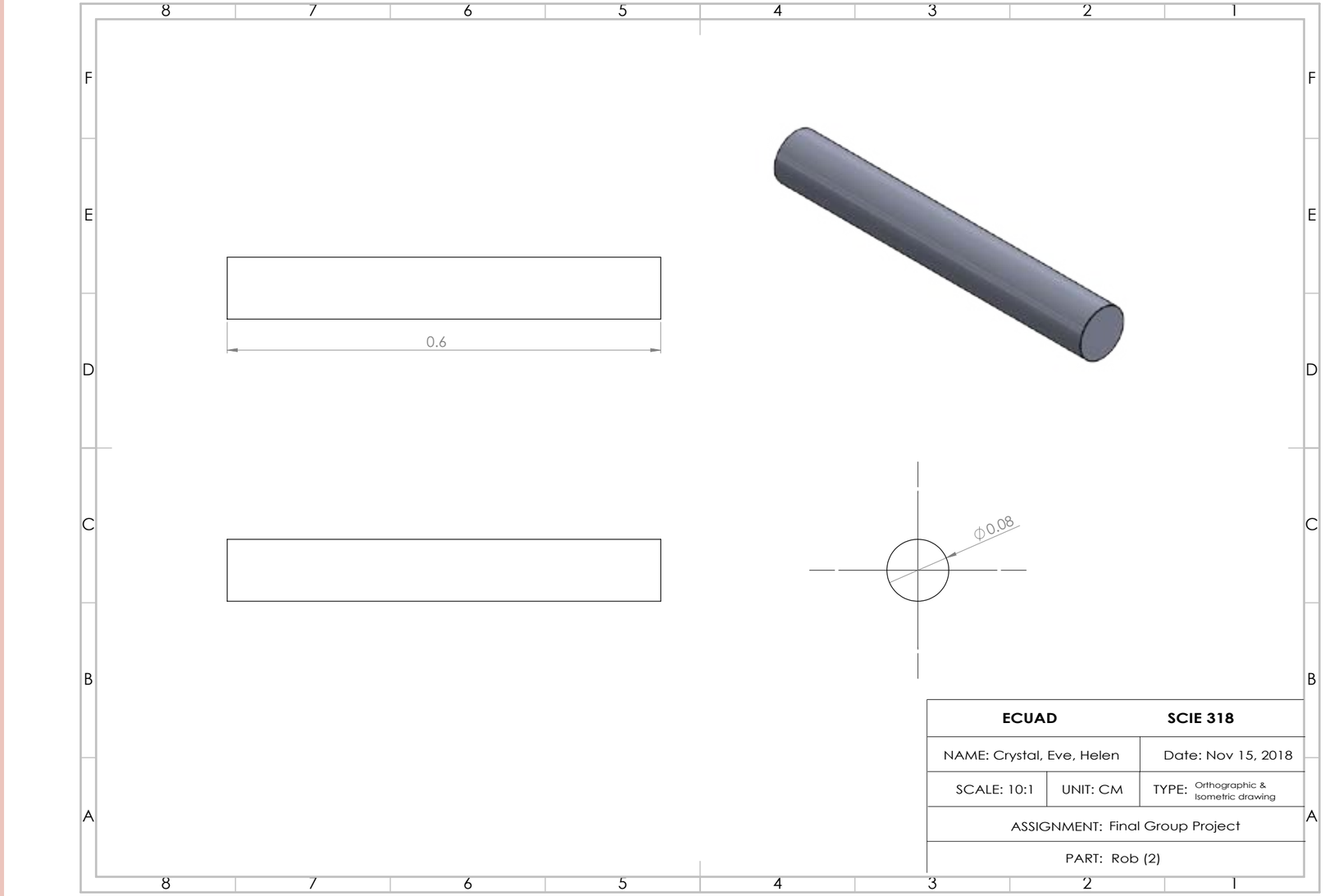

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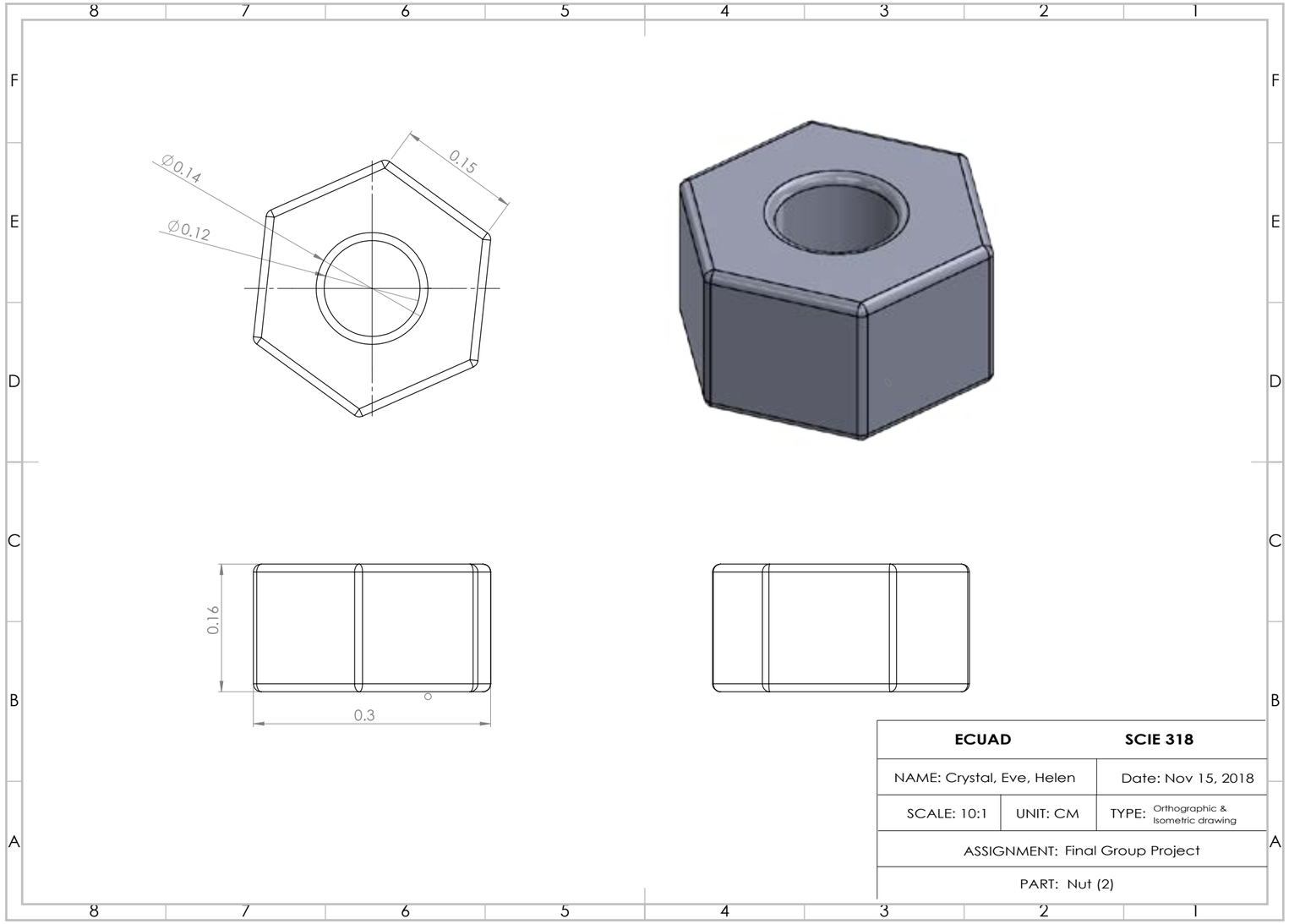
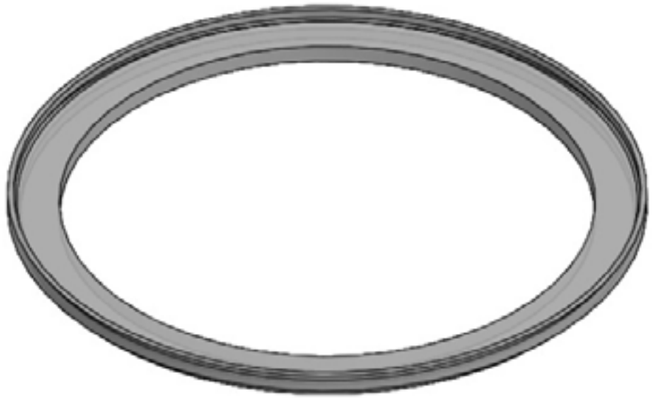


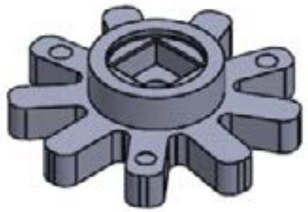
Manufacturing Process

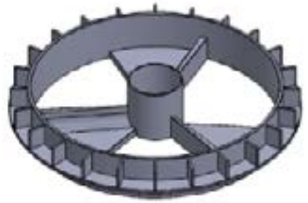
Clear plastic Ring

material: Plastic; PP
production method: 1. extrusion 2. Cut machine
Manufacture process:
1. The plastic material enters and drops on to the rotating screw
2. The heating system melts the plastic and will group through a scr pack
3. Then it will go to the pipe die and be formed into long extrusion
4. The extraction will be cut into pieces by going through cut machine



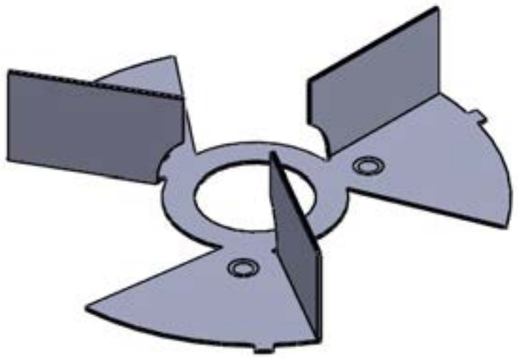
Mechanism Gear,
Spider retaining Ring
Square part,
Brush plate,
Plastic Round



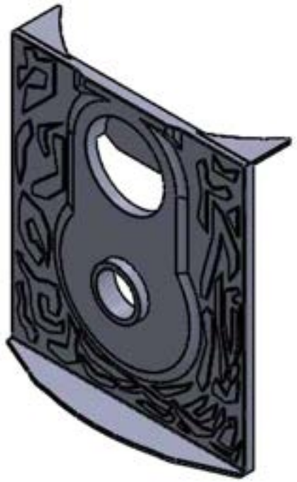


material: Plastic; PP
Production method: Injection molded
Manufacture process:
1. PP enters the injection barrel
2. Driven forward by the rotation of the screw
3. The plastic melt as the turning screw drags it towards the nozzle end
4. The molten plastic is sent through the nozzle and go to the injection mold (die)
5. It will be cool down and the parts will be formed

Metal Round Part



material: metal; stainless steel
production method: injection molded
manufacture process:
1. The metal in liquid stage will be poured into injection moldin
2. The liquid then injected into a mold of the part
3. It will be cooled down and hardens and then remove from the mold

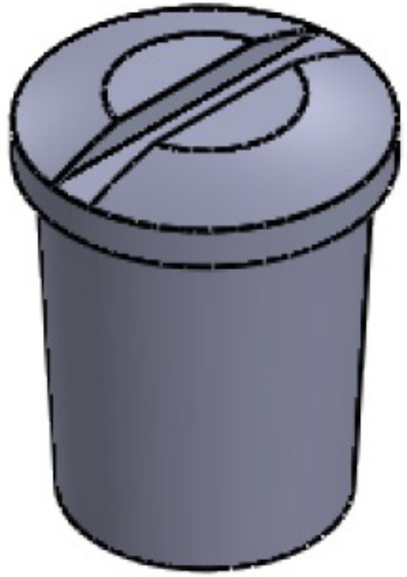


Mechanism Front

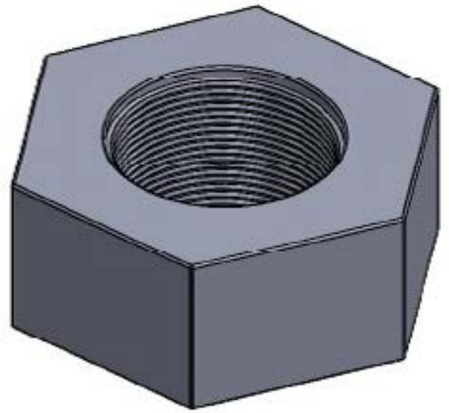
material: metal; stainless steel
production method: die casting
Manufacture process:
1. Preparing a two parts mold
2. Injecting the liquid metal into the mold
3. It will be cooled down and be removed from the mold

Metal Bolt

material: metal; stainless steel
production method: cold forging method: 1. die casting 2. High pressure roller 3. tool: Pointer
Manufacture process:
1. Use steel wire rod
2. 30 hours in a furnace soften it enough to be worked
3. Goes into a bath of sulfuric acid to remove rust particles
4. Rinsed in water then coated with phosphate (prevent rusting + lubricate)
5. Wire rod will be cut in to pieces and each piece will go through a series die that make the head round and leave the gap for screw driver.
6. The bottom of the bolt will be shaped in the chamfer by put into pointer.
7. To form the thread pattern, the bolt will be forced into roller
8. Go into oven for 1 hour and a rapid cooling stage to strengthen and remove the brittleness



Nut

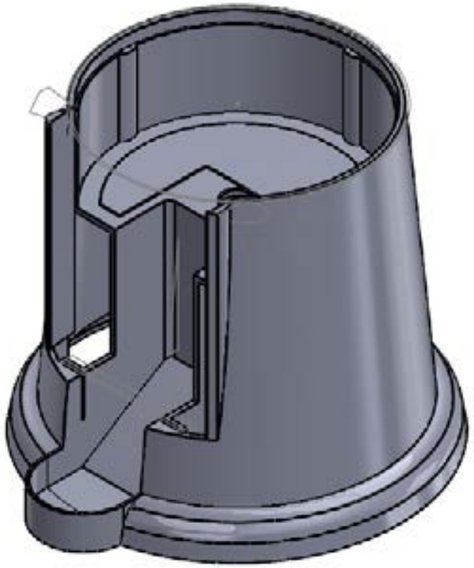


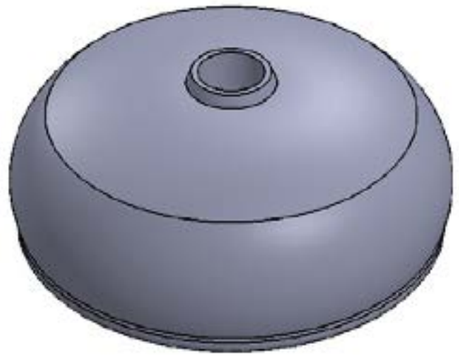
Material: metal; Stainless steel
Production method: cold forging method: 1. die casting 2. tool: Tapper
manufacture process:
1. Use steel wire rod
2. 30 hours in a furnace soften it enough to be worked
3. Goes into a bath of sulfuric acid to remove rust particles
4. Rinsed in water then coated with phosphate (prevent rusting + lubricate)
5. Wire rod will be cut in to pieces and each piece will go through a series die that make the piece into hexagon with hole.
6. Ap tool call a tapper will drive into holes and cut the thread inside

Red Top, Body

material: metal; Aluminum Alloy
production method: 1. Die casting 2. Metal coating
Manufacture process:
1. Use CAD to create the two parts, and prepare two halves of die.
2. Transfer molten metal into a chamber, where it can be injected into the die.
3. The molten metal that is injected into the die will begin to cool and solidify once it enters the die cavity.
4. After the cooling times has passed, the die halves can be opened and push the casting out of the die cavity.
5. During cooling, the material in the channels of the die will solidify attached to the casting.
6. Apply red metal coating.

Material Waste: during metal coating, paint might waste



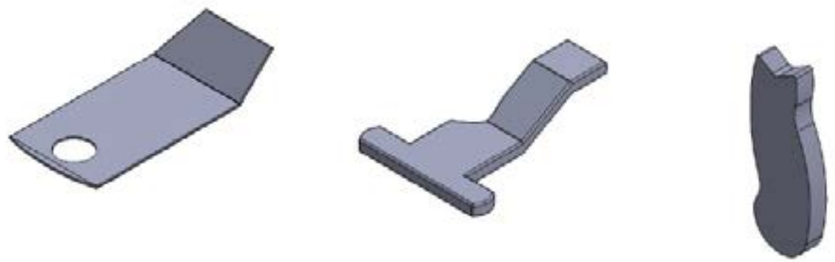


Glass top

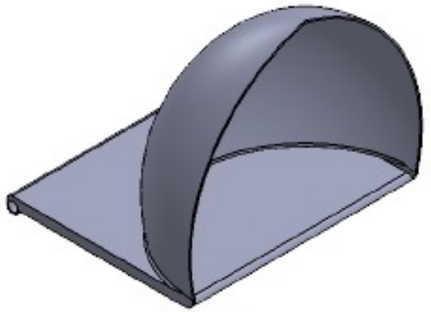
material: Glass
 production method: 1. Blow molding 2. Labelled
Manufacture process:
1. A gob of molten glass gathered onto the tube
2. Air blown into it through the tube
3. The shape is then lowered into a mold, and it has assumed the desired the shape.
4. Allows the mod to be moved and reused
5. Apply the label on the surface

Metal Z Part, Metal Curve Part, Metal Cat part

material: metal; Stainless steel
production method: 1.Metal Cutting 2. Metal Bending
Manufacture process:
1.Prepare metal sheet, and press to be particular shape (or use CNC)
2. Punch hole if necessary (only for Metal Curve Part)
3. Use metal press bending machine to bend the particular features
Material Waste: during metal cutting process



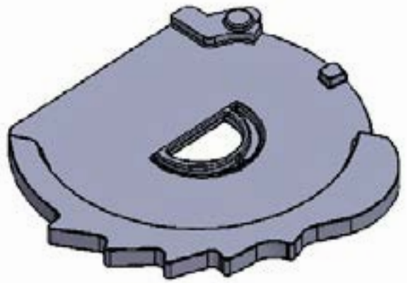
Plastic Small Top



material: Plastic; PP
Production method: Compression Molding
Manufacture process:
1. Prepared mold to form or mold
2. Placed the preform into the cavity of the a heated mold
3. Applied the heat and pressure in a compression molding press
4. Removed the part through the manufacturing operation, like deflashing and postcuring.

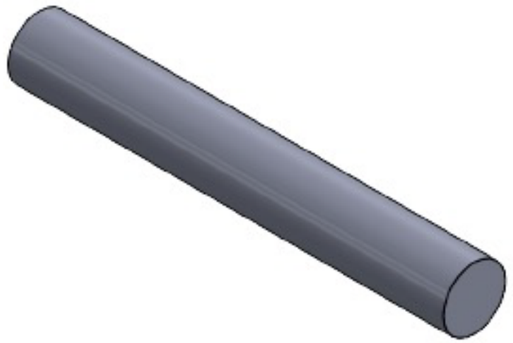
Metal T part, Metal Half Round

material: metal; Aluminum Alloy
 production method: 1. Die casting
Manufacture process:
1. Create the parts by CAD, and prepare two halves of die.
2. Apply molten metal into a chamber, where it can be injected into the die.
3. The molten metal that is injected into the die will begin to cool and solidify once it enters the die cavity.
4. After the cooling, the die halves can be opened and push the casting out of the die cavity.
5. During cooling, the material in the channels of the die will solidify attached to the casting.

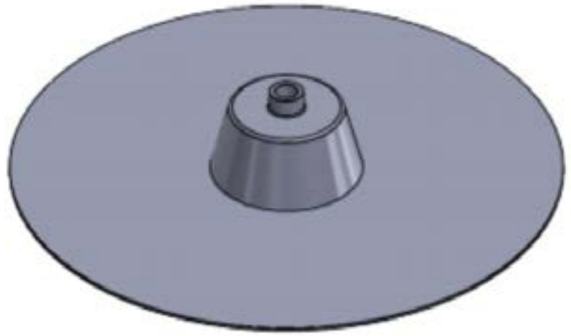


Rod

material: metal; stainless steel
production method: 1. Extrusion Molding 2.Threading
Manufacture process:
1. Extrusion mold the steel rod
2. Use chop saw to cut certain length of bar
3. Use threading machine to create threading on the front and back



Base



material: metal; Aluminum Alloy
production method: 1. Die casting 2.Zinc coating
Manufacture process:
1. Use CAD to create the mold, and prepare two halves of die.
2. Transfer molten metal into a chamber, where it can be injected into the die.
3. The molten metal that is injected into the die will begin to cool and solidify once it enters the die cavity.
4. After the cooling, the die halves can be opened and push the casting out of the die cavity.
5. During cooling, the material in the channels of the die will solidify attached to the casting.
6. Removed the part through the manufacturing operation, like deflashing and postcuring.
7. Apply Zinc coating, and surface pattern.
8. Apply tiny soft mat on the bottom to avoid slipping.

OKALA

Designers		Date	Nov 24, 2018		
Jelly Belly Candy Company		Product Lifetime	40 hours/year x 8 years = 320 hours		
Product Concept Name	Belly Jelly Bean Machine	System Boundaries		Functional Units	impact/hour
BILL-OF-MATERIALS	AMOUNT	UNIT X	OKALA FACTOR	UNIT =	OKALA IMPACT POINTS
Materials					
Clear Plastic Ring	0.0061	lb	1.9	/lb	0.012
Spider Retaining Ring	0.1014	lb	1.9	/lb	0.193
Metal Round Part	0.0115	lb	13	/lb	0.150

Metal Bolt	0.0073	lb	13	/lb	0.095
Red top	0.1641	lb	4.5	/lb	0.738
Glass top	0.2821	lb	0.56	/lb	0.158
Plastic Round	0.1047	lb	1.9	/lb	0.199
Metal Cat Part	0.0054	lb	13	/lb	0.070
plastic Z Part	0.0054	lb	13	/lb	0.070
Metal Curve Part	0.0032	lb	13	/lb	0.042
Plastic Small Top	0.0043	lb	1.9	/lb	0.008
Mechanism Gear	0.0024	lb	1.9	/lb	0.005
Square Part	0.0047	lb	1.9	/lb	0.009
Mechanism Front	1.1697	lb	13	/lb	15.206
Metal T part	0.0185	lb	4.5	/lb	0.082
Metal Half Round	0.0407	lb	4.5	/lb	0.183
Body	1.4418	lb	4.5	/lb	6.488

Brush Plate	0.0167	lb	1.9	/lb	0.317
Nut (1)	0.0007	lb	13	/lb	0.009
Nut (2)	0.0007	lb	13	/lb	0.009
Rod	0.00024	lb	13	/lb	0.003
Base	0.1741	lb	4.5	/lb	0.783
Manufacturing					
Injection mold PP	0.240	lb	4.3	/lb	1.032
Blow molding	0.281	lb	0.68	/lb	0.191
Steel Extrusion	1.20		1.1	/lb	1.320
Transport					
Airplane, interc.	3.566	/p.-mi	0.18	/p.-mi	0.641
Disposal					

Landfill PP	0.240	lb	0.26	/lb.	0.062
Landfill Stainless Steels	1.204	lb	0.51	/lb.	0.614
Landfill Aluminum	1.839	lb	39	/lb	71.721
Landfill Glass	0.2821	lb	N/A	/lb	N/A
				Total impact/lifetime:	100.41

Impacts/product lifetime / lifetime hours = impact/hour

100.41 / 320 = 0.31

Sustainable Redesign

Inspiration

“ Coca-Cola Invents 16 Bottle Caps To Give Second Lives To Empty Bottles”

Extented lifetime

Reused/refunction

second-life

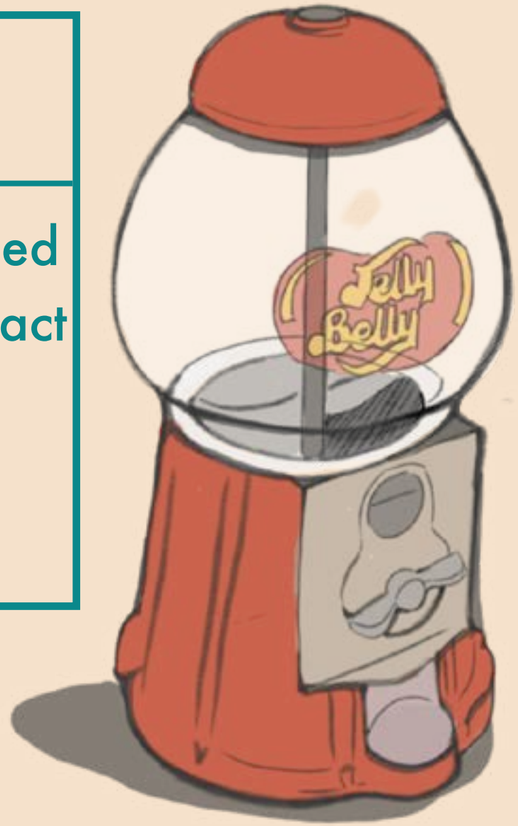
Sustainable Redesign

Introduction

What need to be improved?

- hard to be recyled
- High Okala impact
- Short life time

shore service time/
duration of use



Before

Flat Cap

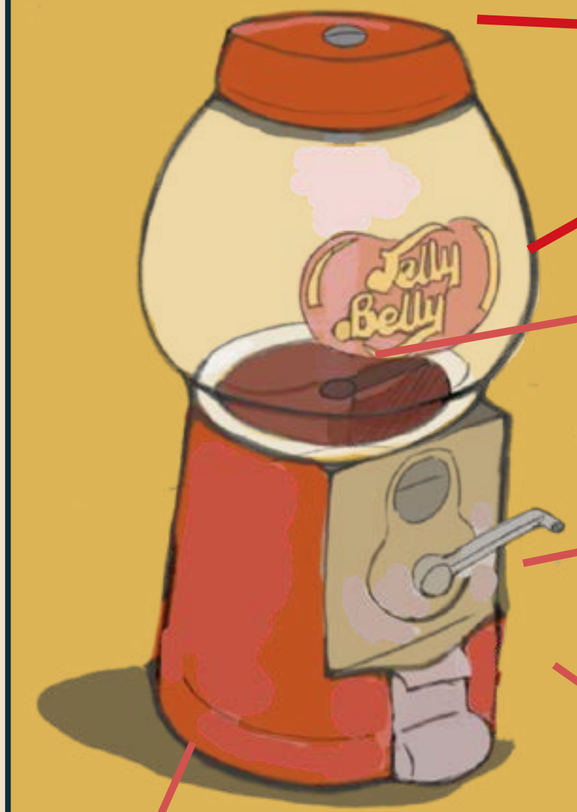
main material change:
- HDPE

Rod removed

Ergonomic handle

More sustainable material choose

less material use



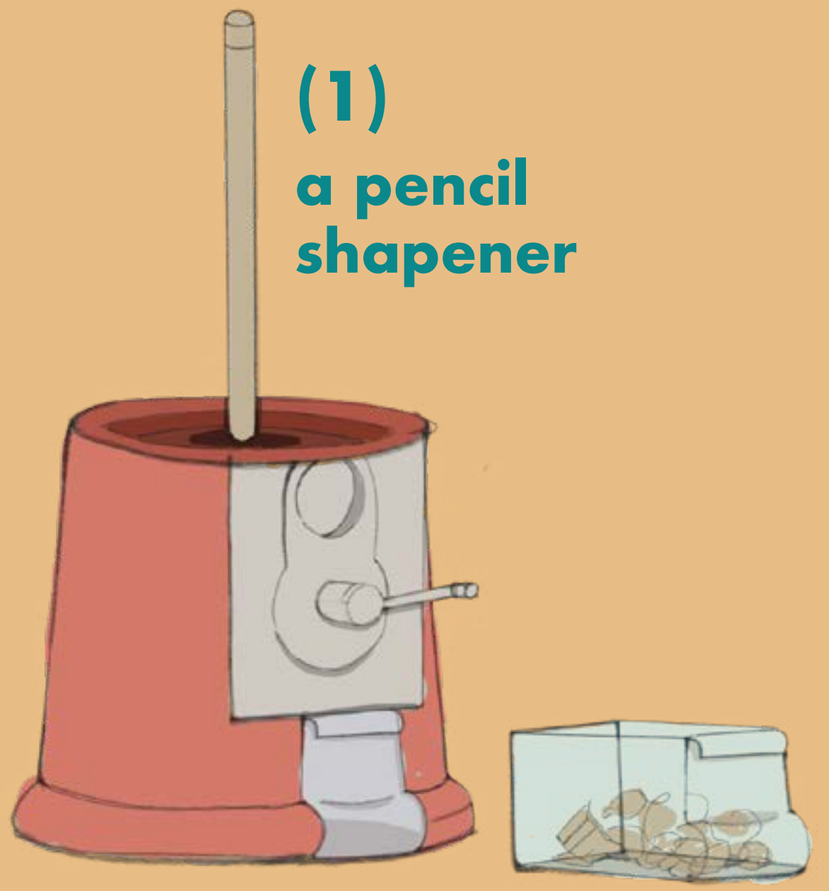
After

Sustainable Redesign

Introduction

- The new design will be designed for disassembly.

- It can be disassembled into a stationary set which includes **(1)**a pencil shapener and a **(2)**pen container.



(1)
a pencil shapener

(2)
a pen container

Sustainable Redesign

How to disassemble?

Steps:

1. *Rotate the red cap*
2. *Rotate the metal bolt*
3. *Take both of them off*

Sustainable Redesign

How to disassemble?

Steps:

1. *Turn the red cap up side down*
2. *Rotate and connect to the body*
3. *You get a pen container*

Recycling aspect

The whole cotaniner will be made by the same kind of recycable plastic.

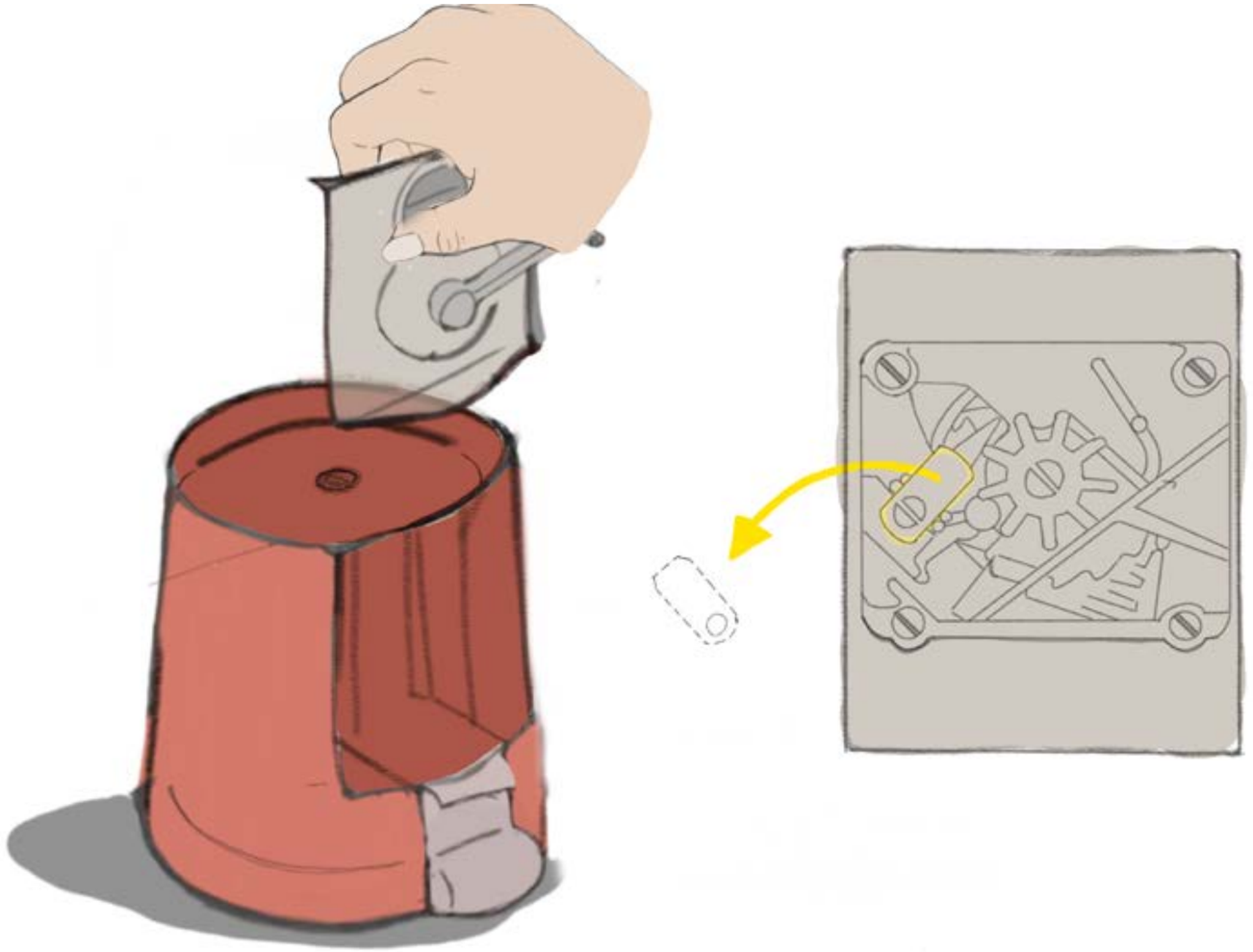
Sustainable Redesign

How to disassemble?

Steps:

1. Pull the grey metal out from the body

2. Look for the yellow part and take it off (gold stopper)



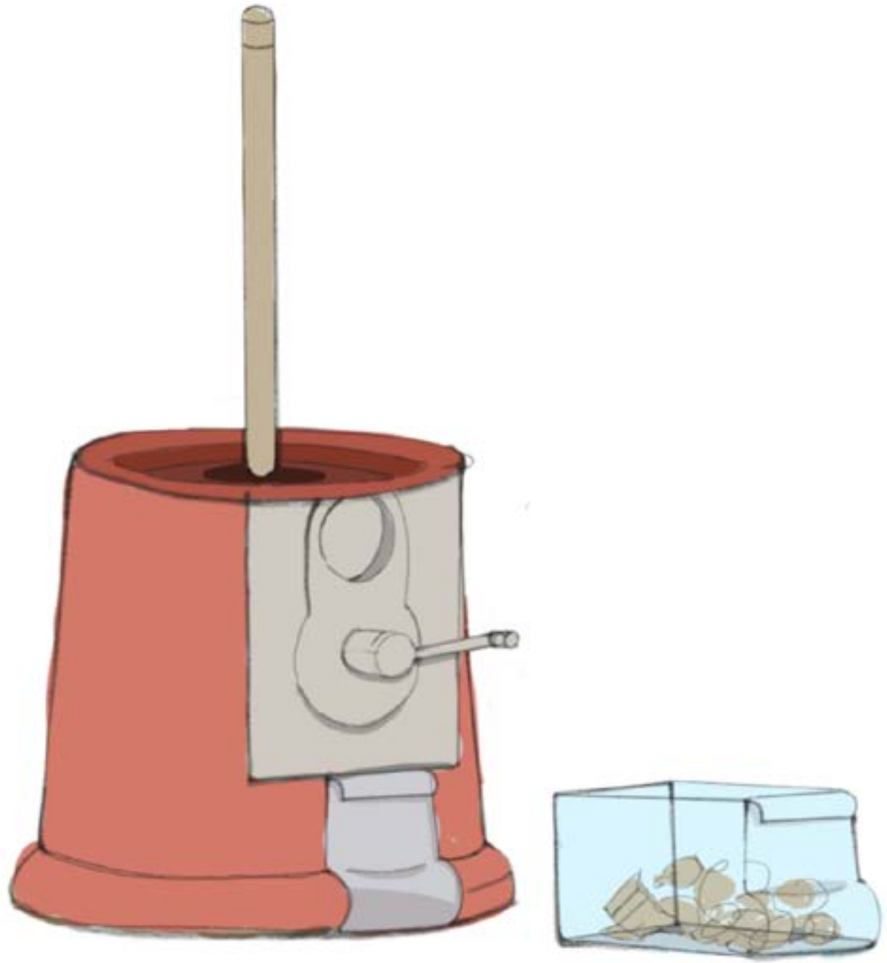
Sustainable Redesign

How to disassemble?

Steps:

1. Put the grey part back

2. You got a pencil shapener



Sustainable Redesign

How does it work?

Sharpener Mechanism

|

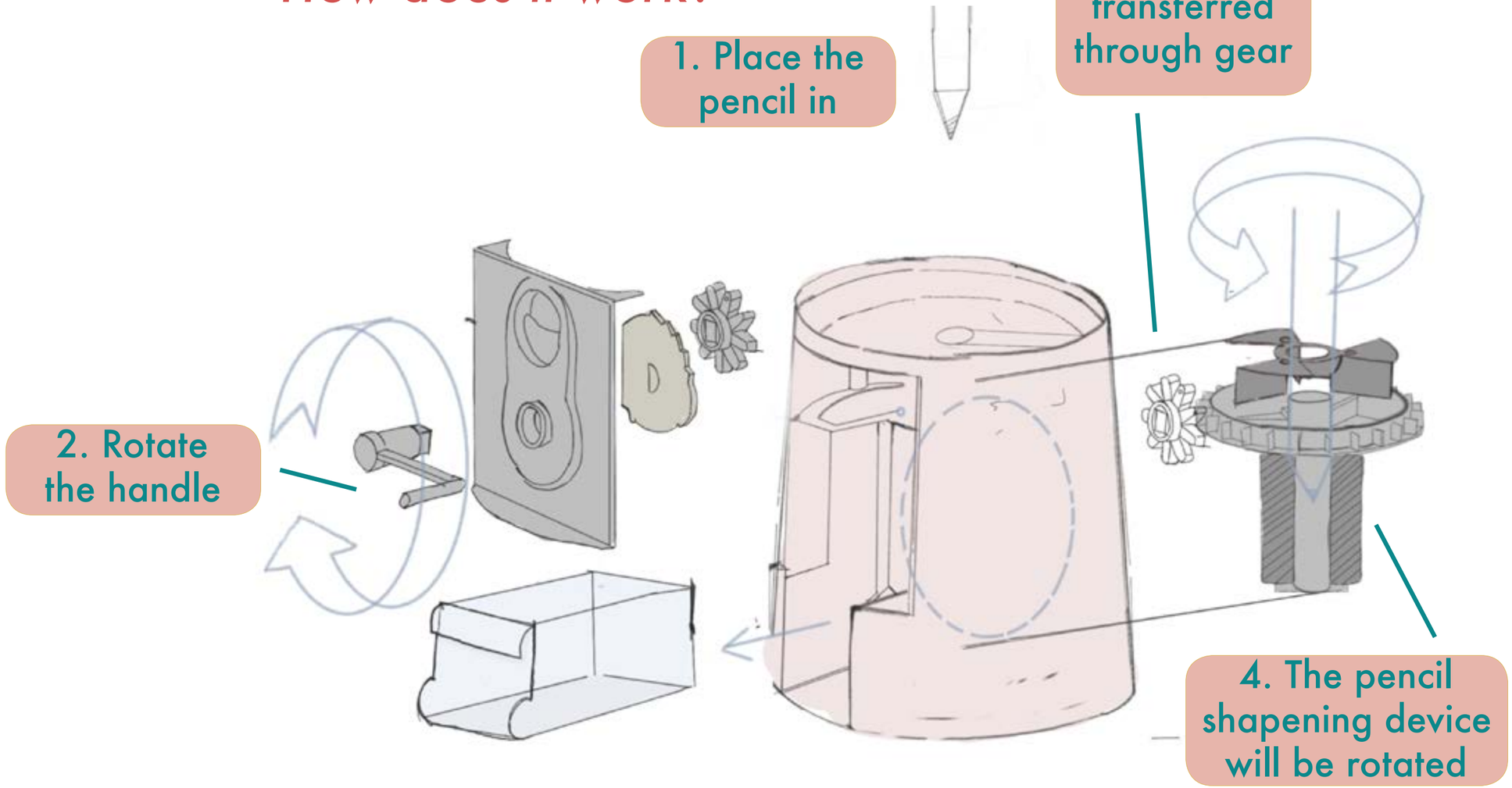
Flow chart

1. Place the pencil in

2. Rotate the handle

3. The force will be transferred through gear

4. The pencil shapening device will be rotated



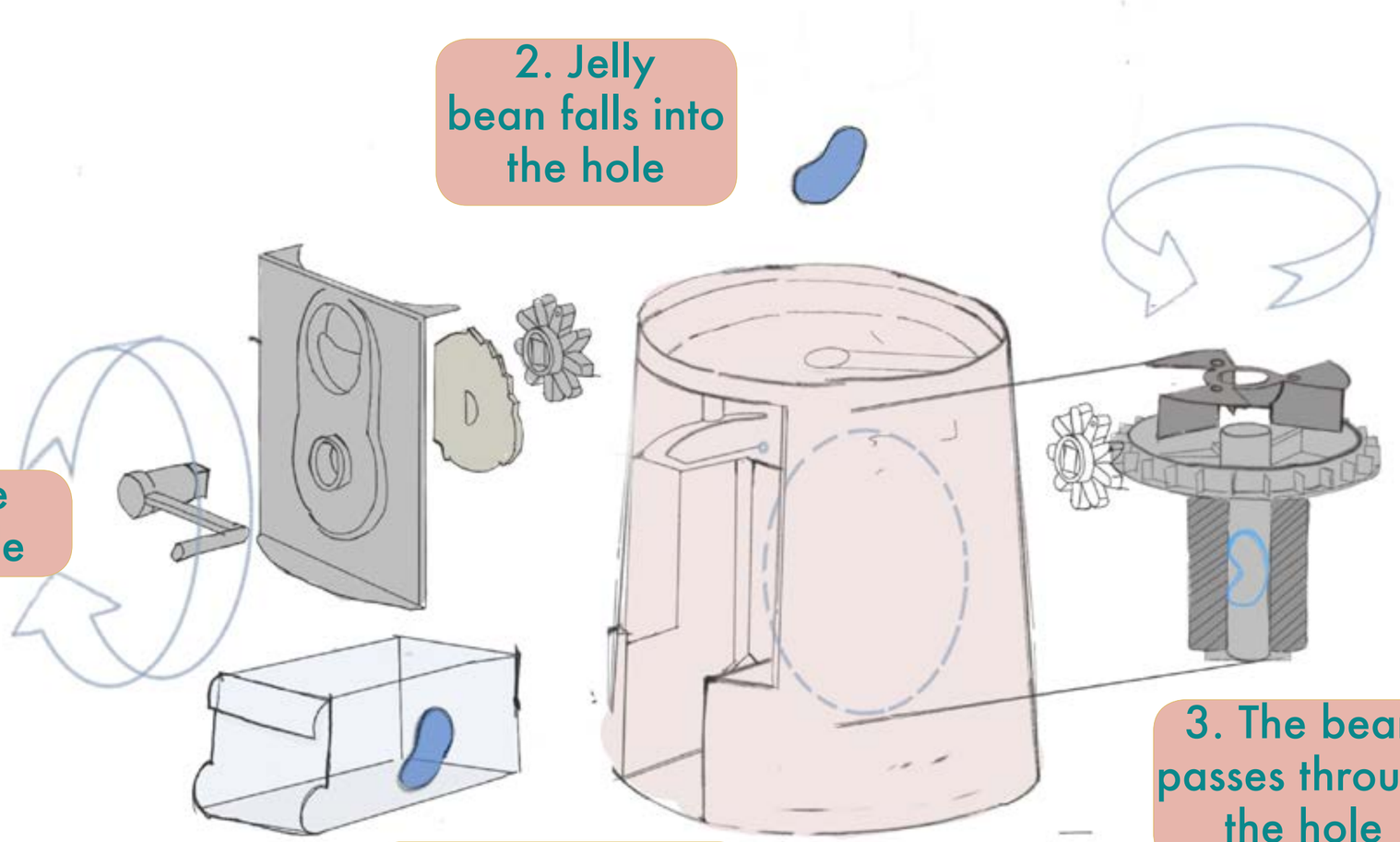
Sustainable Redesign

How does it work?

Jelly Bean Mechanism

|

Flow chart



Sustainable Redesign

Why is it better?

The target: Children

- *reasonable for the target user to use afterward.*
- *Easier / a new way to promote as we added a learning purpose*

Longer lifetime

- *Get engage again with the product*
- *much longer service time and duration of use will be created*

Easiler to recycle

- *The Pen container part will be all made of one specific type of recyclable plastic*
- *you can throw it straightly to the recyclable plastic bin*

New Design

Bill of material

Highlight: Design we had changed

Part Name	Description	Quantity	Material	Weight Unit /lb.	OKALA impact factor points unit /lb.
Materials					
Clear Plastic Ring	The ring place between glass globe and brush plate	1	Polypropylene (PP)	0.0061	PP, Secondary 1.9
Spider Retaining Ring	A fastener that hold the "red top"	1	Polypropylene (PP)	0.1014	PP, Secondary 1.9

Metal Round Part	Attached to the "Plastic round" in order to strength	1	Stainless steel	0.0115	13
Metal Bolt	Fastener for the "red top" Changed material to HDPE, to unify the material in entire part	1	HDPE, secondary	0.005	1.2
Red top	1. The cap of the candy container; redesign the flat cap that reducing the weight 2.Changed material to HDPE	1	HDPE,secondary	0.05	1.2
Glass top	The part holding candy Changed material glass to HDPE, for easier recycle and reduce the weight	1	HDPE,secondary	0.100	1.2

Plastic Round	The wheel that triggers rotate mechanism with in the machine	1	Polypropylene (PP)	0.1047	PP, Secondary 1.9
Metal Cat Part	A fastener	1	Stainless Steel	0.0054	13
Metal Z Part	A mechanical support located within the body part	1	Stainless Steel	0.0054	13
Metal Curve Part	A mechanical part	1	Stainless Steel	0.0032	13
Plastic Small Top	The part to stop the candy falling out	1	Polypropylene (PP)	0.0043	PP, Secondary 1.9
Mechanism Gear	•Coin mechanism • Rotating gear in transmitting force	1	Polypropylene (PP)	0.0024	PP, Secondary 1.9
Square Part	• Coin mechanism • attach the the "mechanism front" to the "body"	1	Polypropylene (PP)	0.0047	PP, Secondary 1.9

Mechanism Front	• Coin mechanism • One of the outside body part	1	Stainless Steel	1.1697	13
Metal T part	• Coin mechanism • The handle that triggers the coin machine • Redesign the handle, for reducing the weight, and more ergonomic.	1	Aluminum Alloy	0.005	4.5
Metal Half Round	• Coin mechanism • The connection between “mechanism front” and “Body”	1	Aluminum Alloy	0.0407	4.5

Body	• The main machine body part • Redesign the body, reduce unnecessary features, and cut down material use.	1	Aluminum Alloy	0.500	4.5
Brush Plate	• The part connected with "clear platices ring" and "Plastic Round"	1	Polypropylene (PP)	0.0167	PP, Secondary 1.9
Nut (1)	• A nut with 0.3cm diameter and 0.3cm length	1	Stainless Steel	0.0007	13
Nut (2)	• A nut with 0.14cm diameter and 0.15 length	1	Stainless Steel	0.0007	13
Rod	• A rob with 0.6cm length	2	Stainless Steel	0.00024	13
Base	• The base of the entire machine, and connect to body	1	Aluminum Alloy	0.1741	4.5
Sharper	Inner part for new design pencil sharpener	1	Aluminum Alloy	0.015	4.5
Manufacturing					

Injection mold PP	N/A		4.3
~~Blow molding~~	~~N/A~~		~~0.68~~
Steel Extrusion	N/A		1.1
Transport			
Airplane, interc.	Between continents	N/A	0.18 /p.-mi
Disposal			
Landfill PP	N/A		0.26
Landfill Stainless Steels	N/A		0.51
Landfill Aluminium	N/A		39
~~Landfill Glass~~	~~N/A~~		

New Design OKALA

Designers		Date	Nov 25, 2018		
Jelly Belly Candy Company		Product Lifetime	65 hours/year x 15 years = 975 hours		
Product Concept Name	Belly Jelly Bean Machine	System Boundaries		Functional Units	impact/hour
BILL-OF-MATERIALS	AMOUNT	UNIT X	OKALA FACTOR	UNIT =	OKALA IMPACT POINTS
Materials					
Clear Plastic Ring	0.0061	lb	1.9	/lb	0.012
Spider Retaining Ring	0.1014	lb	1.9	/lb	0.193
Metal Round Part	0.0115	lb	13	/lb	0.15
Metal Bolt	0.005	lb	1.2	/lb	0.006
Red top	0.05	lb	4.5	/lb	0.225
Glass top	0.100	lb	0.56	/lb	0.056
Plastic Round	0.1047	lb	1.9	/lb	0.199
Metal Cat Part	0.0054	lb	13	/lb	0.070
Metal Z Part	0.0054	lb	13	/lb	0.070
Metal Curve Part	0.0032	lb	13	/lb	0.042

Plastic Small Top	0.0043	lb	1.9	/lb	0.008
Mechanism Gear	0.0024	lb	1.9	/lb	0.005
Square Part	0.0047	lb	1.9	/lb	0.009
Mechanism Front	1.1697	lb	13	/lb	15.206
Metal T part	0.005	lb	4.5	/lb	0.0225
Metal Half Round	0.0407	lb	4.5	/lb	0.183
Body	0.500	lb	4.5	/lb	2.25
Brush Plate	0.0167	lb	1.9	/lb	0.317
Nut (1)	0.0007	lb	13	/lb	0.009
Nut (2)	0.0007	lb	13	/lb	0.009
Rod	0.00024	lb	13	/lb	0.003
Base	0.1741	lb	4.5	/lb	0.783
Sharper	0.005	lb	4.5	/lb	0.022
Manufacturing					
Injection mold PP	0.2403	lb	4.3	/lb	1.033
~~Blow molding~~			~~0.68~~	~~/lb~~	
Steel Extrusion	1.197	lb	1.1	/lb	1.317

Transport					
Airplane, interc.	2.3	/p.-mi	0.18	/p.-mi	0.414
Disposal					
Landfill PP	0.2403	lb	0.26	/lb.	0.0624
Landfill Stainless Steels	1.197	lb	0.51	/lb.	0.610
Landfill Aluminum	0.725	lb	39	/lb	28.275
Landfill polyethylenes	0.155	lb	0.3	/lb	0.0465

				Total impact/lifetime:	51.607

Impacts/product lifetime / lifetime hours = impact/hour

51.607 / 975 = 0.053

Life Cycle of New Design

Design

Outsourcing

Manufacture

China

Process

Assemble

Packaging

Sell/promote

MARKET

Add Belly Jelly bean

Ship back to US

HDPE, Polypropylene (PP) 1

Stainless steel 2

Aluminium Alloys 3

Recycle

1 easy to disassemble, manufature shop into fragments and applied to other product

2 87% stainless steel can be reused. Stainless steel can be recycled infinitely - and it suffers no quality degradation during reprocessing.

3 bauxite mining, alumina production, primary aluminium production, semi-fabrication, product manufacture, use phase, recycling, semi-fabrication, product manufacture, use phase, recycling...