# S&C SYST1 June 2015 Model Answer

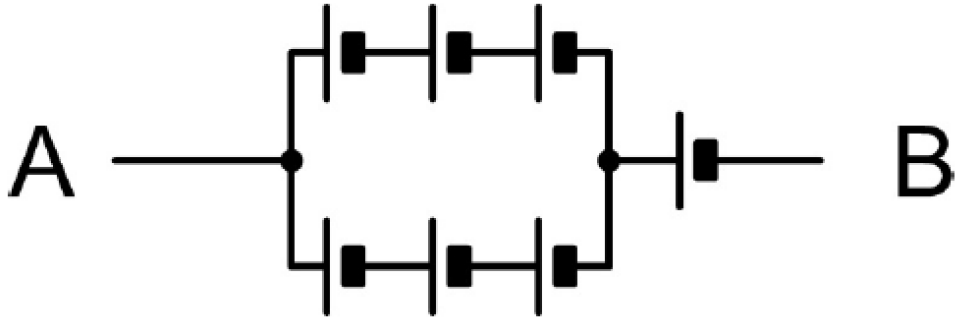
1ai)

Oil or Grease or Graphite or Air or Teflon or any other lubricant

1aii)

Resistor or Variable resistor or Potentiometer or Rheostat

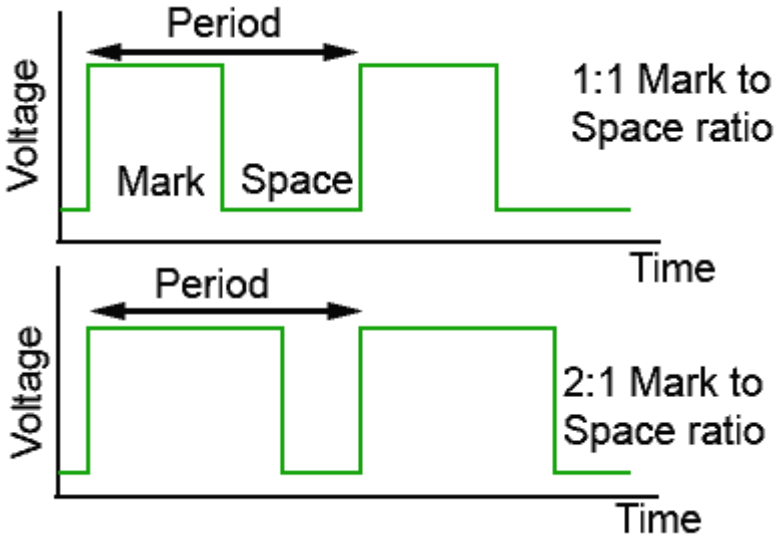
1b)




All Cells 2 Volts

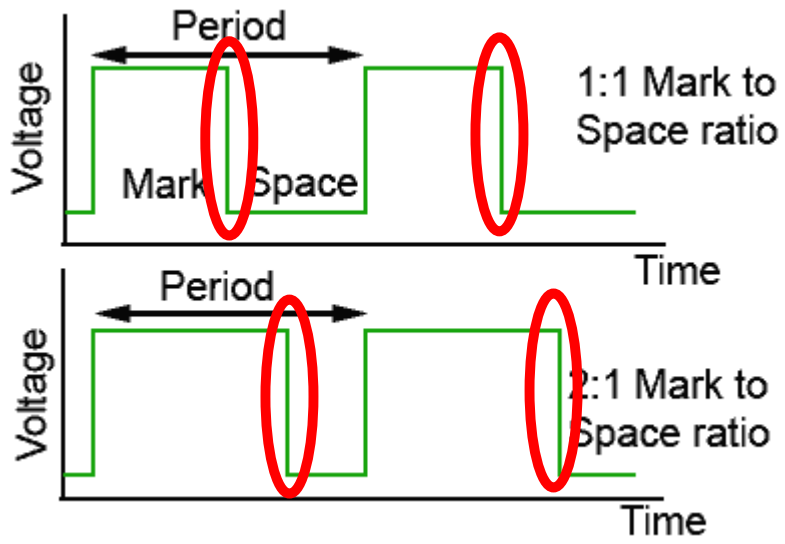
Working showing 6v for those in parallel + 2v in series
Total Potential difference between A and B = 8v

2a)

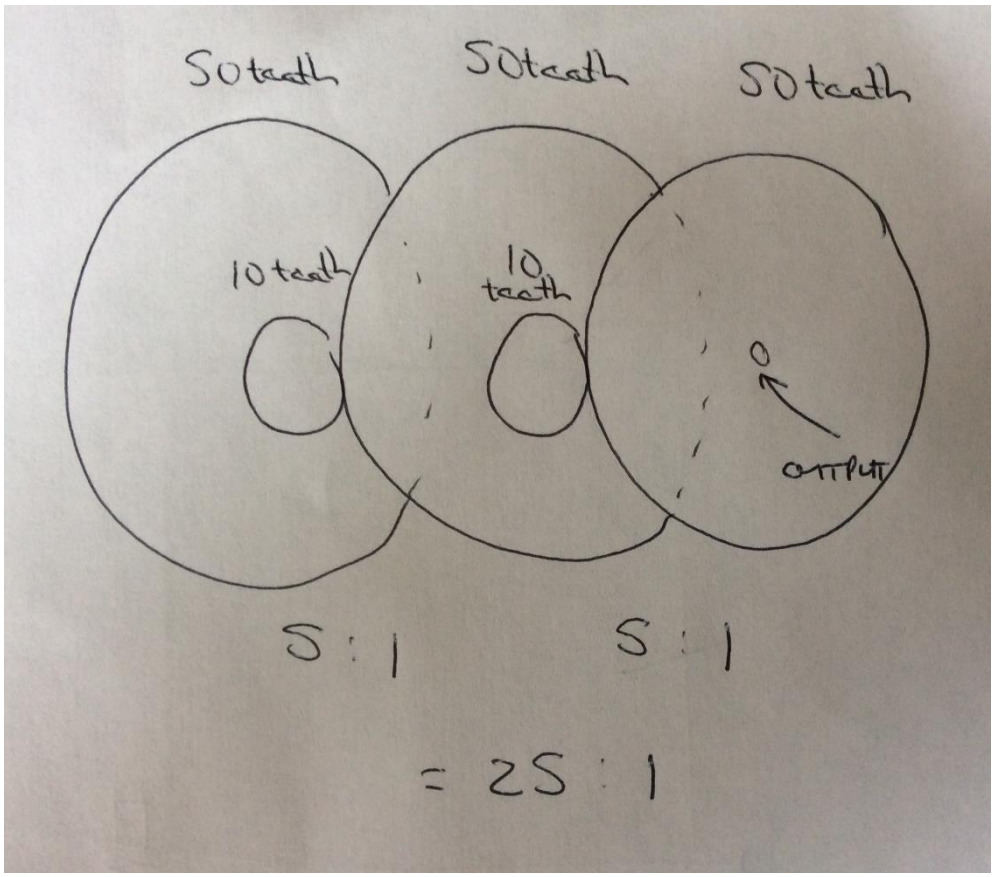


2b)

A pulse changing from positive, going negative.

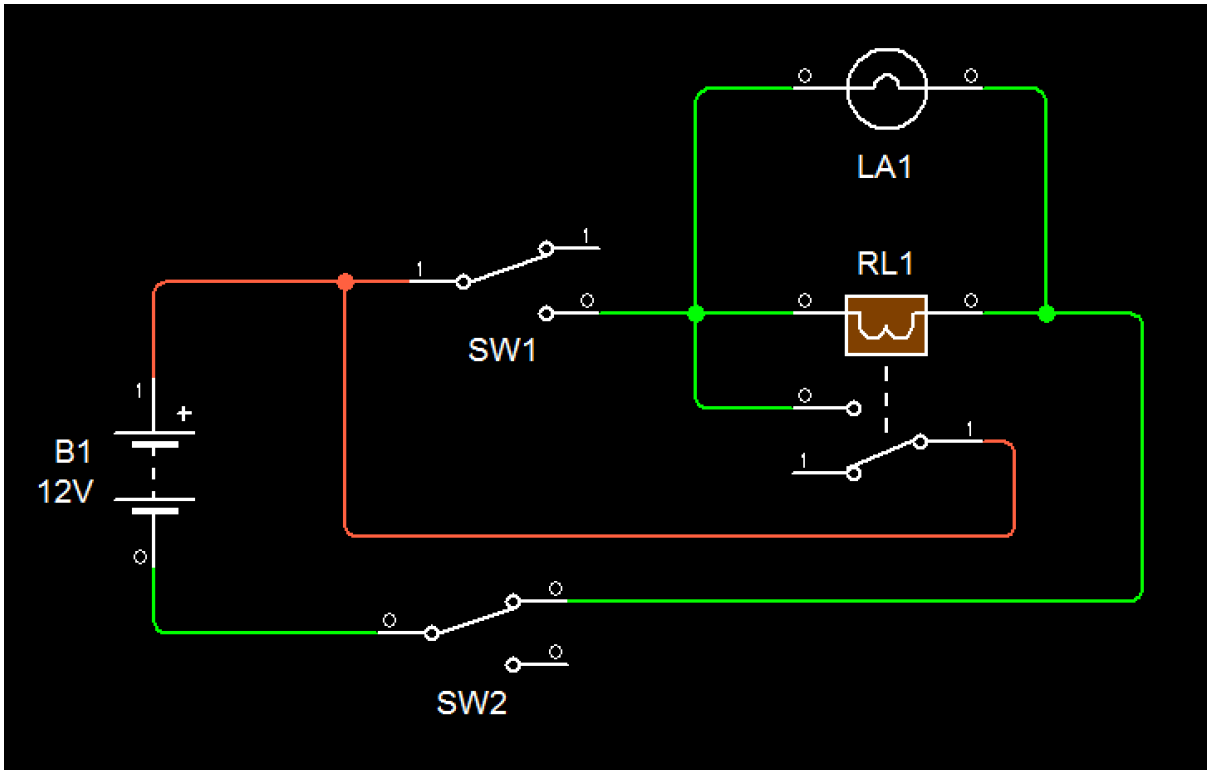



3)

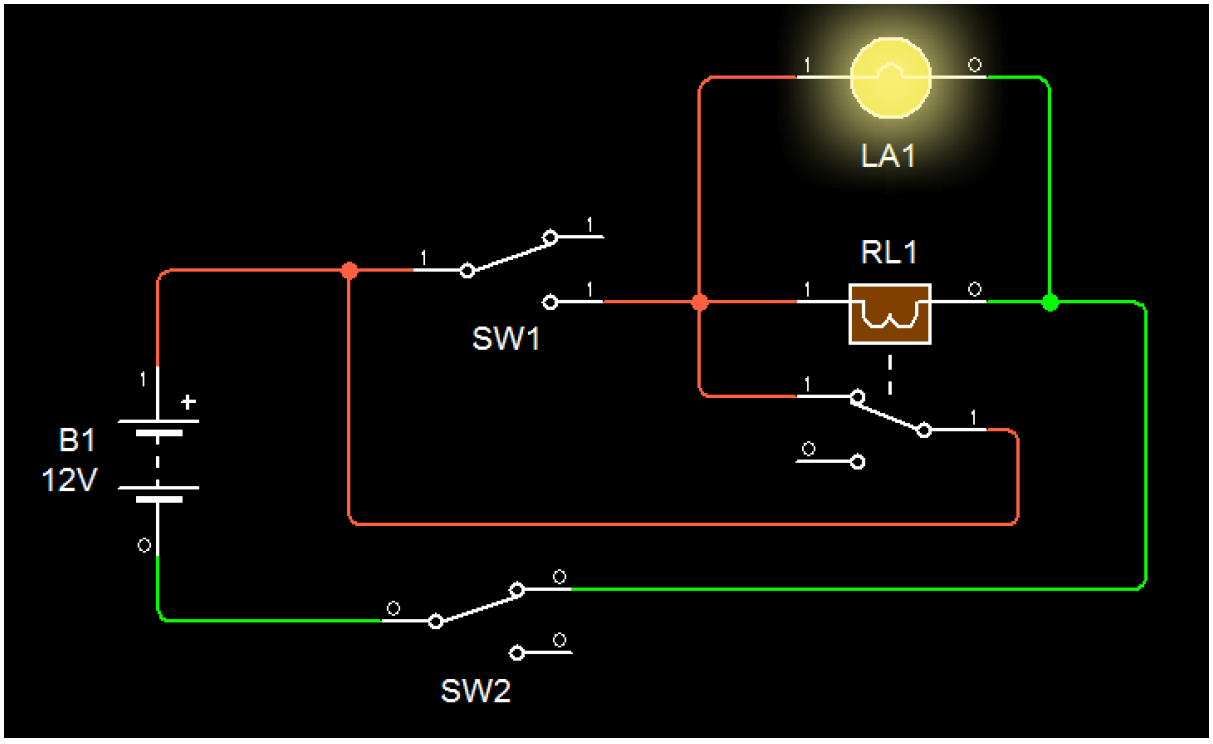


4a)

# OFF



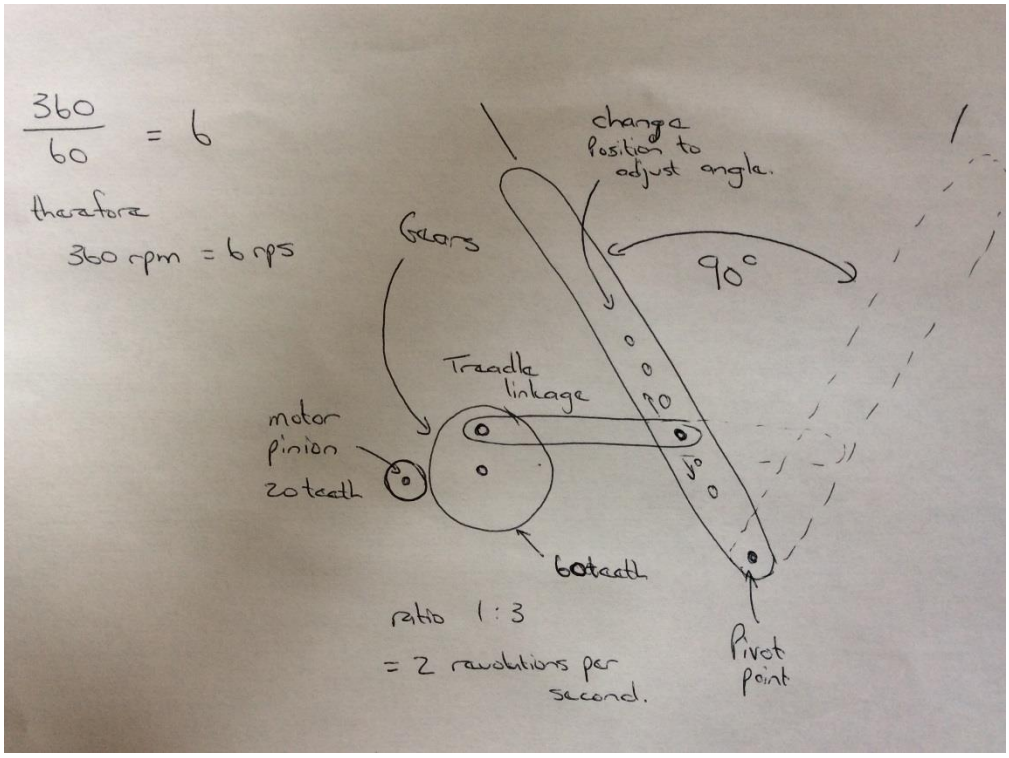

# ON



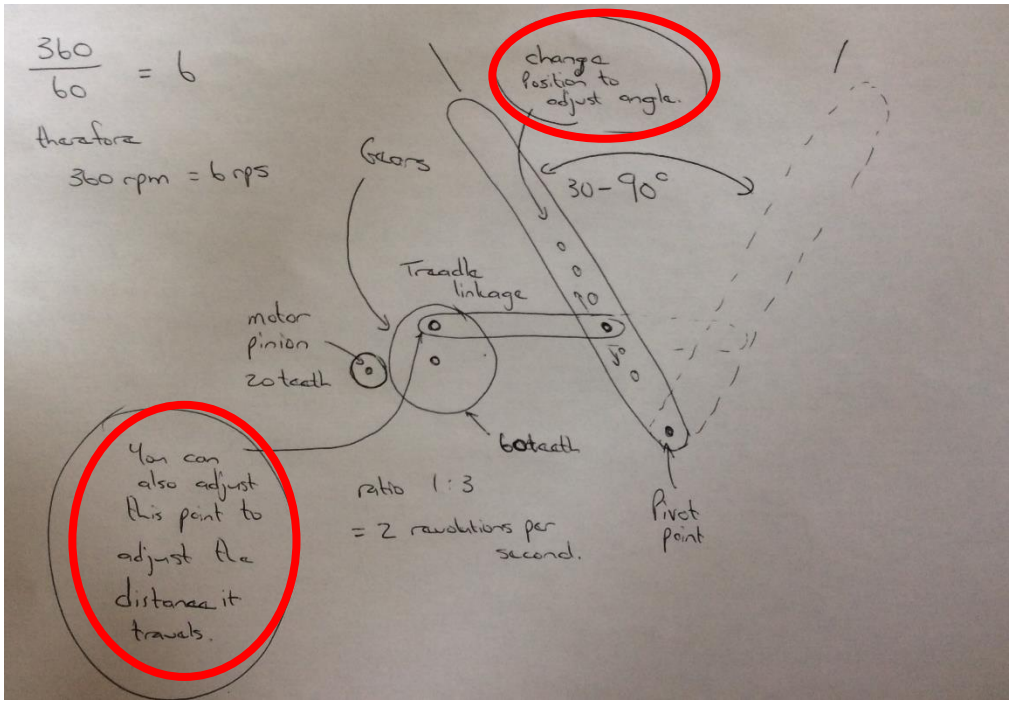
4b)

Reason 1: Overcoming friction causes energy loss.
Reason 2: Overcoming Momentum causes energy loss.

5ai)




5aii)

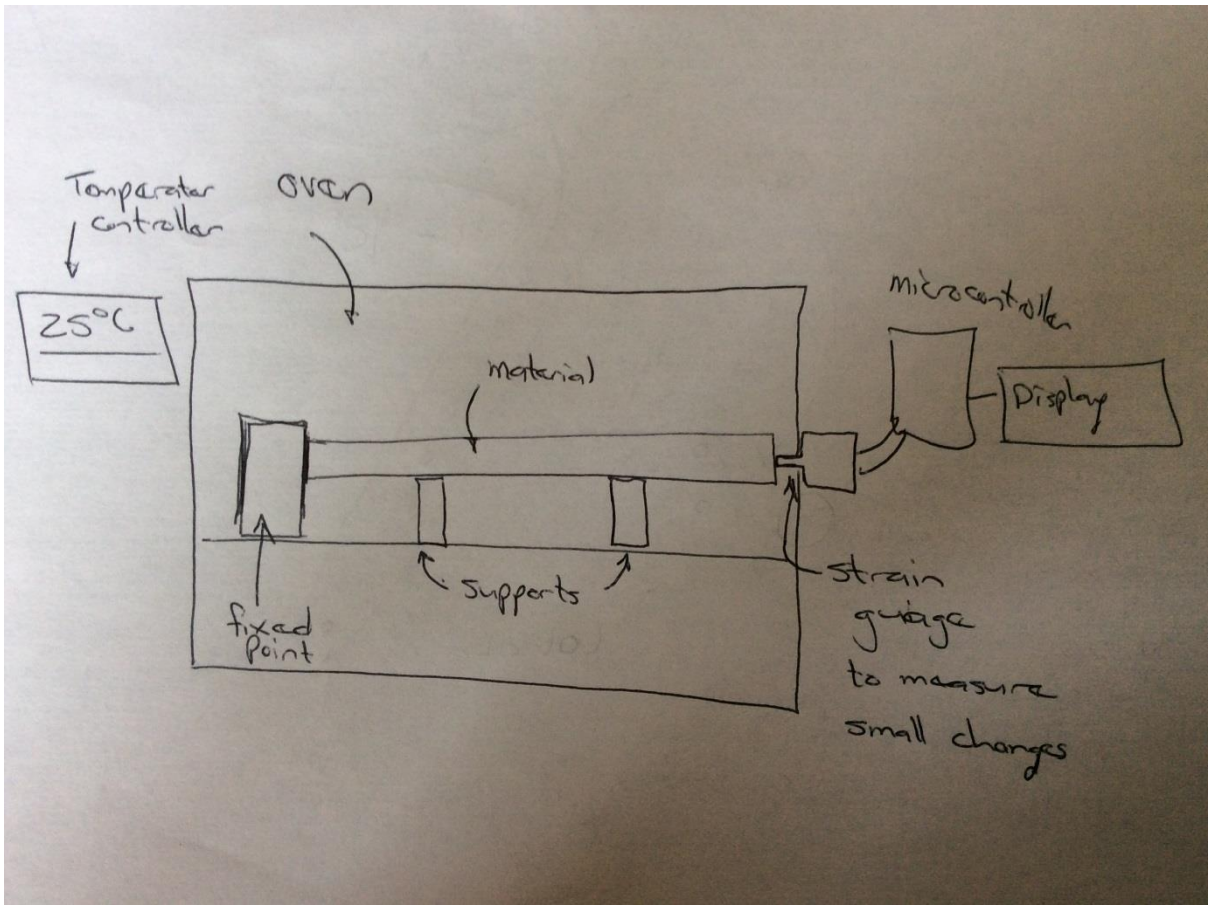


5b)

A range of different metals will need to be tested. As many as possible, but at least 10 to get a good average reading.

The materials will need to start in a controlled temperature environment, such as an oven at a specific temperature, for example 25 degrees Celsius. The materials will need to be cut to a specific length and the base temperature. For example 300mm at 25 degrees Celsius.

This would need to be carefully controlled to ensure the start point is accurate.

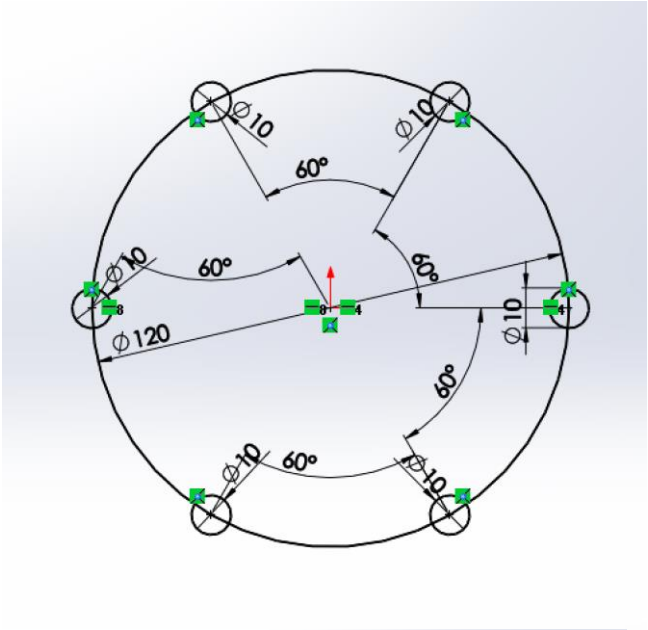


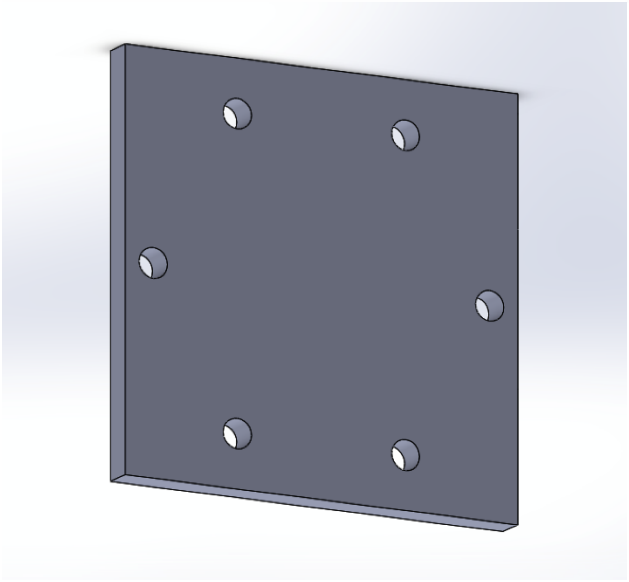

The test piece could be put in the oven and set up a 25 degrees. At the end of the material we could connect a strain gauge to measure very small movements which could be read by a microcontroller. The temperature controller can then be used to increase the temperature by 100 degrees to 125 degrees.

This data could then be analysed to see by how much each material expands per 100 degrees. This could be listed in a table as a guide.

6a)

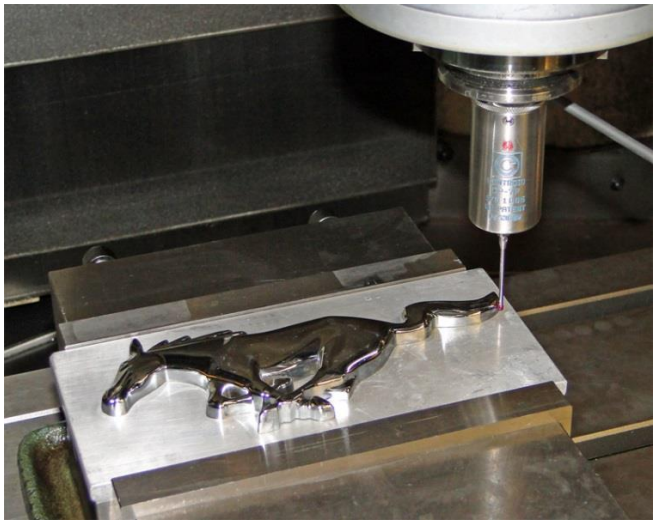
The parts could be designed using CAD software.



These parts that have been designed could then be electronically sent to a CNC milling machine (or any other CNC cutting machine with similar accuracies) which would cut the parts out extremely accurately.

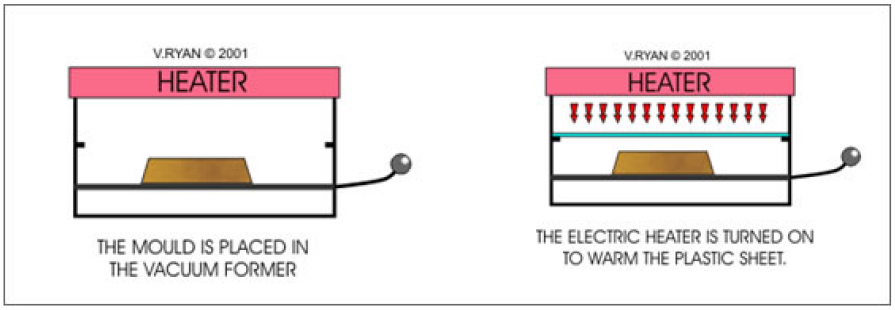
This could all also be achieved using steel rulers and drawing equipment to produce the accurate measurements and then cut out and drilled using standard machinery.

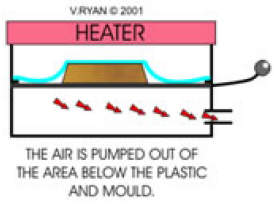


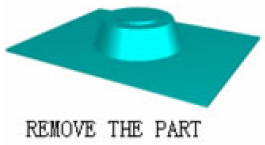
6b)

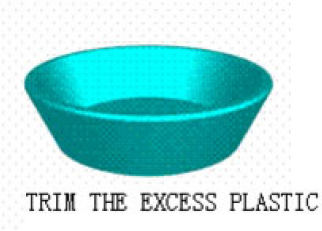
The process I would use to produce the cup would be vacuum forming.

1. First, make a former and place into the vacuum former.
2. Place a plastic sheet into the vacuum former and heat. .
3. Turn on the vacuum and pump out the air.
4. Remove the part and trim the excess plastic.



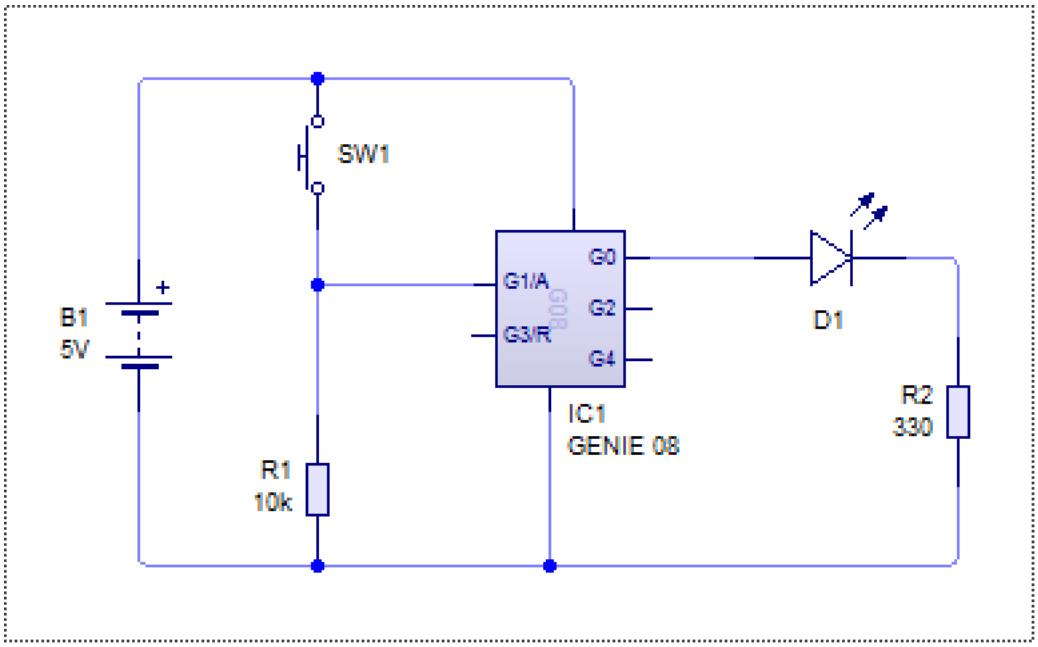



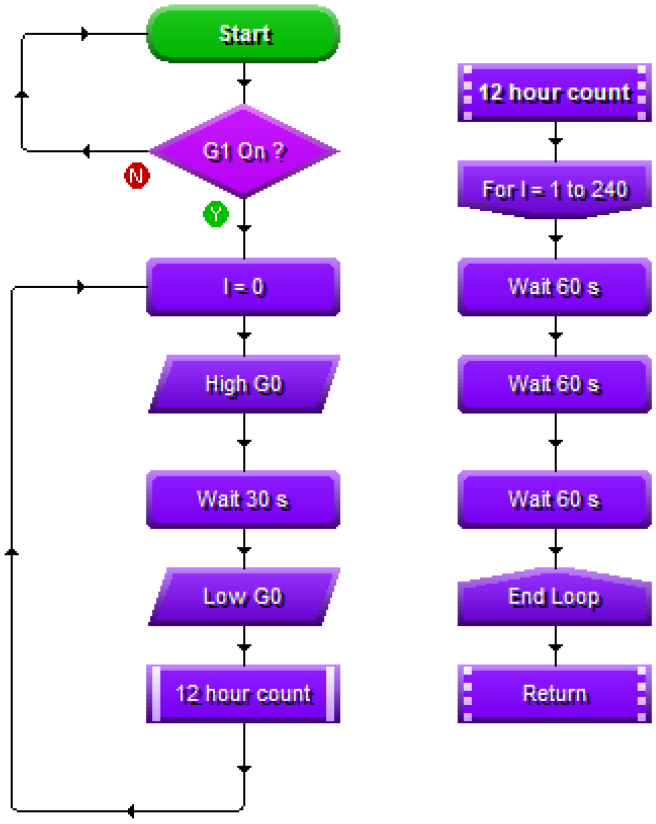




7ai)

Hygiene 1…Non Toxic, exclude bacteria, maintain food quality.
Hygiene 2…Easily cleaned.
Safety 1…Nothing to trap animal.
Safety 2…No sharp surfaces, Low voltage, no sudden movement, stable.

7aii)

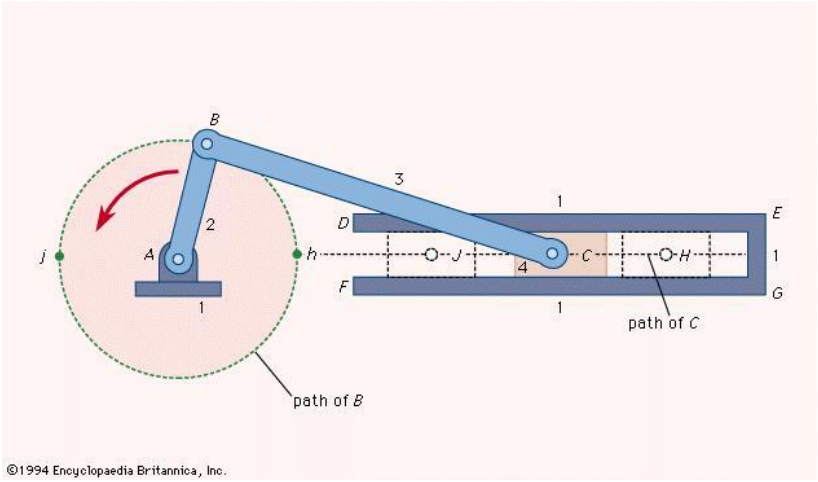

SW1
B1
5V
R1
10k
G1/A
G3/R
G0
G2
G4
IC1
GENIE 08
D1
R2
330

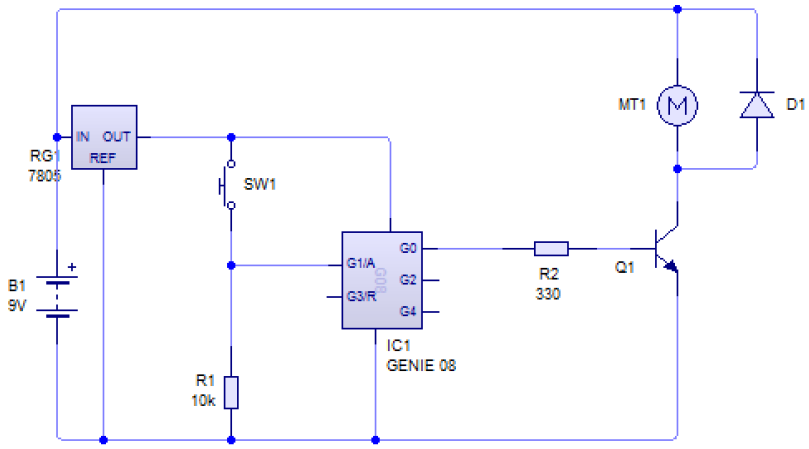

Start
G1 On ?
N
Y
I = 0
High G0
Wait 30 s
Low G0
12 hour count

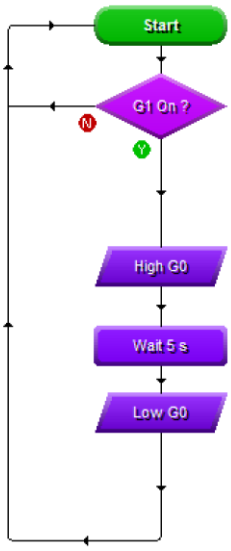

12 hour count
For I = 1 to 240
Wait 60 s
Wait 60 s
Wait 60 s
End Loop
Return

7bi)

A crank and slider mechanism can be used. The rotary motion will come from a dc motor which can be controller from a PIC.

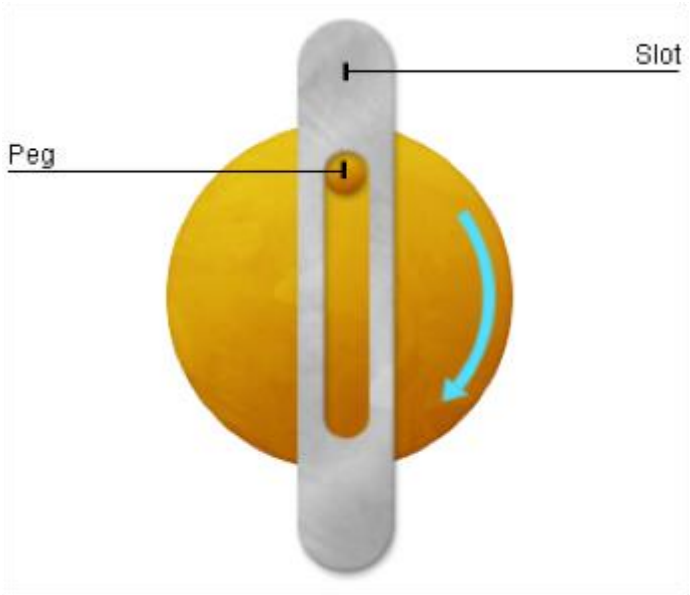


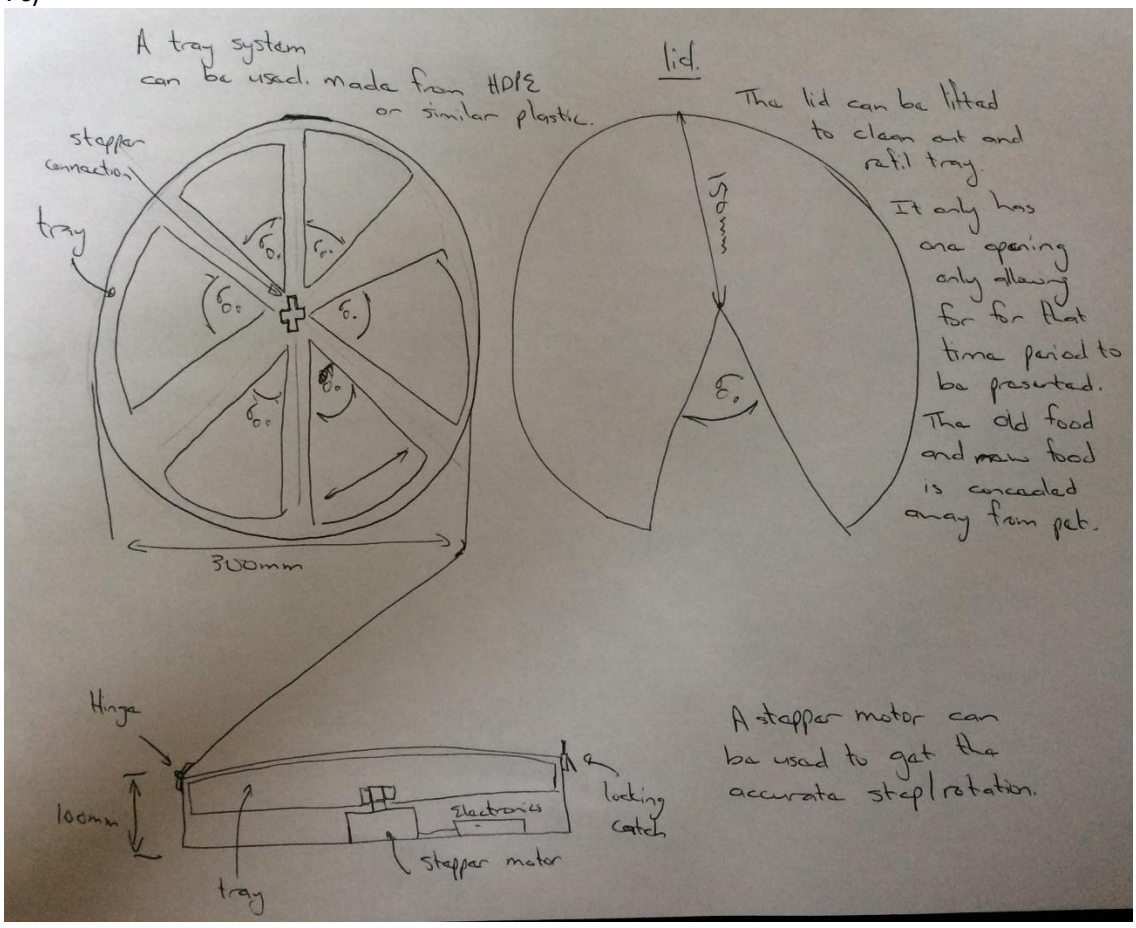



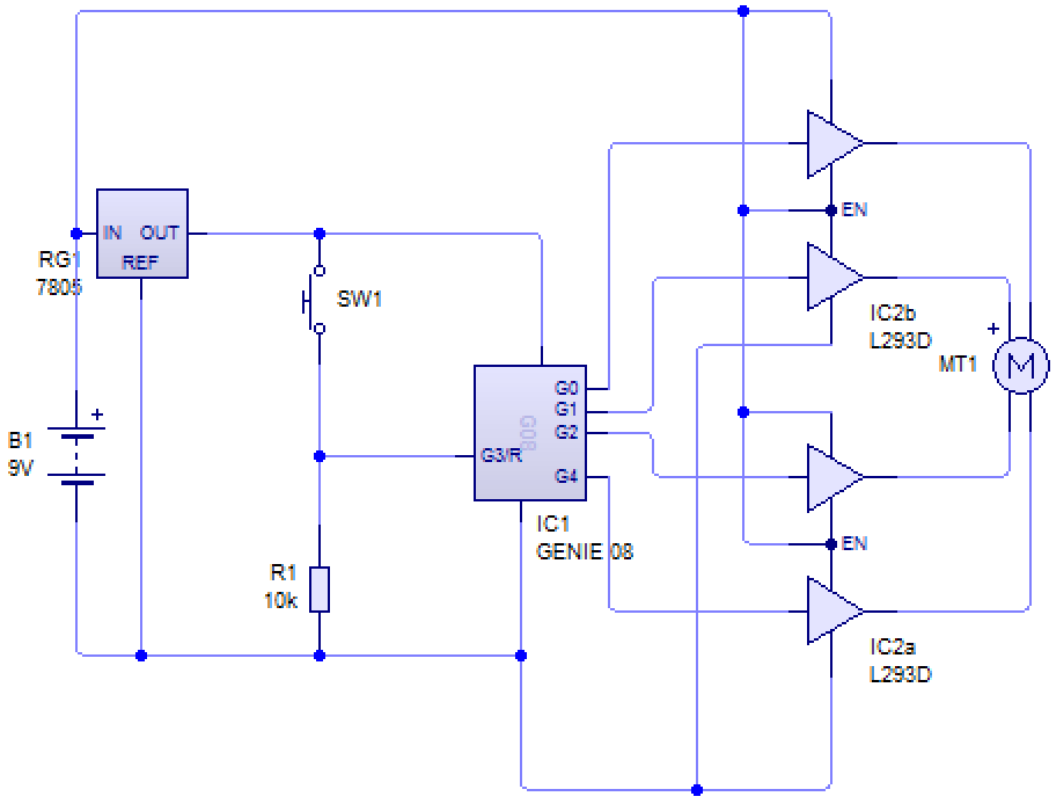
7bii)

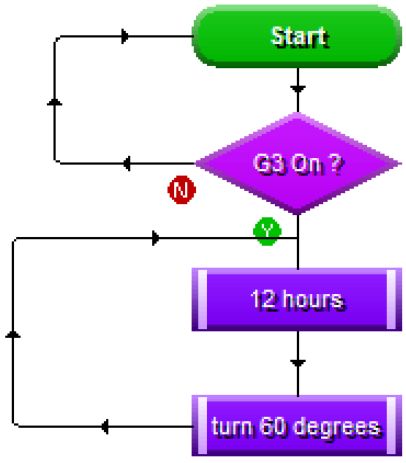
Using the same electrical system as above, you could use a peg and slot system to provide 90 degrees of movement. The rotary movement coming from the DC motor connected to the microcontroller.

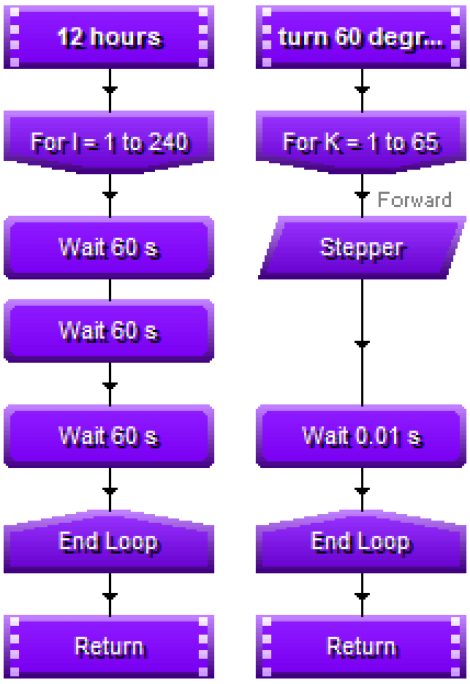



7c)




IN OUT
REF
RG1
7805
SW1
B1
9V
R1
10k
G0
G1
G2
G3/R
G4
IC1
GENIE 08
EN
IC2b
L293D
MT1
M
EN
IC2a
L293D


Start
G3 On ?
N
Y
12 hours
turn 60 degrees


12 hours
For I = 1 to 240
Wait 60 s
Wait 60 s
Wait 60 s
End Loop
Return
turn 60 degr...
For K = 1 to 65
Forward
Stepper
Wait 0.01 s
End Loop
Return