DO YOU ACCEPT THIS CHALLENGE?

Students will design, build, test, and document a Rube Goldberg-like device that completes a required task through an optional series of specific actions.

- Device made of a series of actions
- Device must run autonomously
- Specific Start and End Task
- Use up to 12 unique actions defined in the rules (once each)

- **No impound at Regionals**

- **Impound only at the State Tournament**

SAFETY FIRST

Students must wear high impact safety spectacles and the device must be free of hazardous materials.

Unsafe devices must not run and teams receive only participation points

SAFETY FIRST

3.h. There is a 9-volt limit.

3.j. Candles, flames, matches, cell phones, hazardous liquids, gases, materials (e.g., rat traps, lead objects, combustible fuses, dry ice, liquid nitrogen, flammable gas), and unsafe handling of chemicals are not permitted.

SAFETY FIRST

Students will be allowed to remove unsafe items during their set-up time. Once the device is declared safe, it will be allowed to run.

General Tips

- ALWAYS go for reliability over "cool factor"

- Make every action run as smoothly as possible

- Make a highly reliable, consistent timer

- Use as high-quality materials as you can afford

NO
- Arduinos
- Raspberry Pis
- Programmable components
- Electrical timers
- Spring timers
- Voltages > 9 v.

- Use of electricity except actions 2 ,5, 11 & final task

Not this Raspberry Pi

Set-up

If teams can set-up their device and have it ready to run in 30 minutes or less, they will be awarded 50 points.

MISSION: POSSIBLE

Be sure to check, double-check, and triple-check the device so that it meets all construction parameters and is reliable.

Violations are serious! Even one!

- Starts and ends correctly
- Operates autonomously
- Consecutive sequence
- Visible-top & 2 sides open
- No parallel paths
- No dead-end paths
- Use each object used only once
- All tasks must contribute
- Include a timer
- 12 defined actions

MISSION: POSSIBLE

THE START=100 pts.

Drop an unaltered ping-pong ball into the device from above it.

This action must cause an unaltered golf ball to move & initiate the next action.
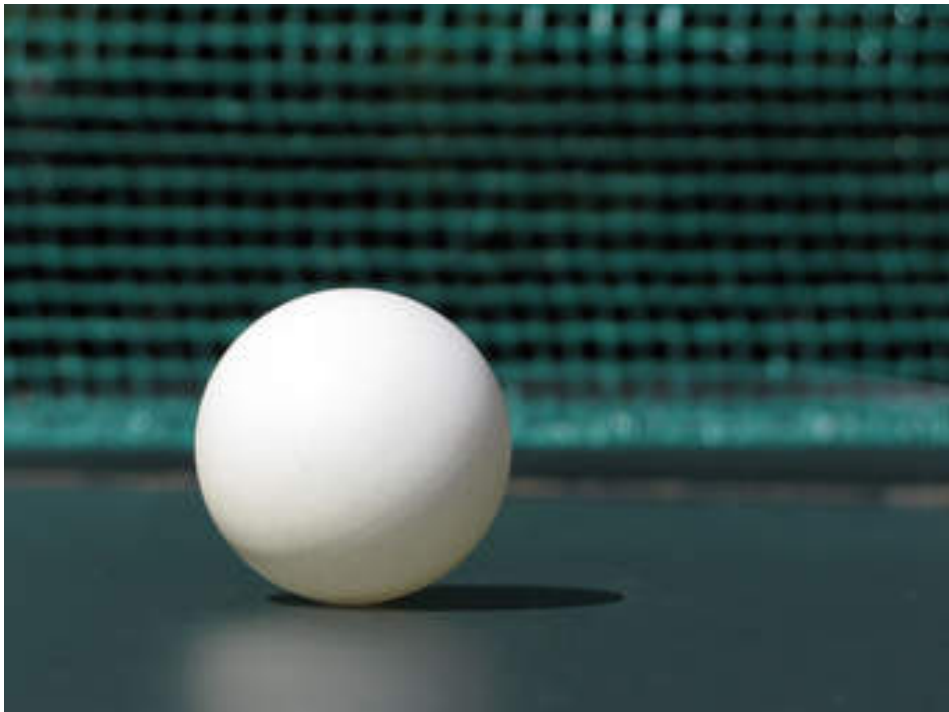
Size does count! The device must get through the door!

Penalty points will be assessed for each dimension greater than 60 cm.

.1 Point awarded for each .1 cm under 60 cm. Dimension (1 pt. per cm.)

Be sure each dimension is under 60 cm. Dowels, rods, bolts, the plunger, etc. sticking out the device are measured too.

Each action can only count one time.

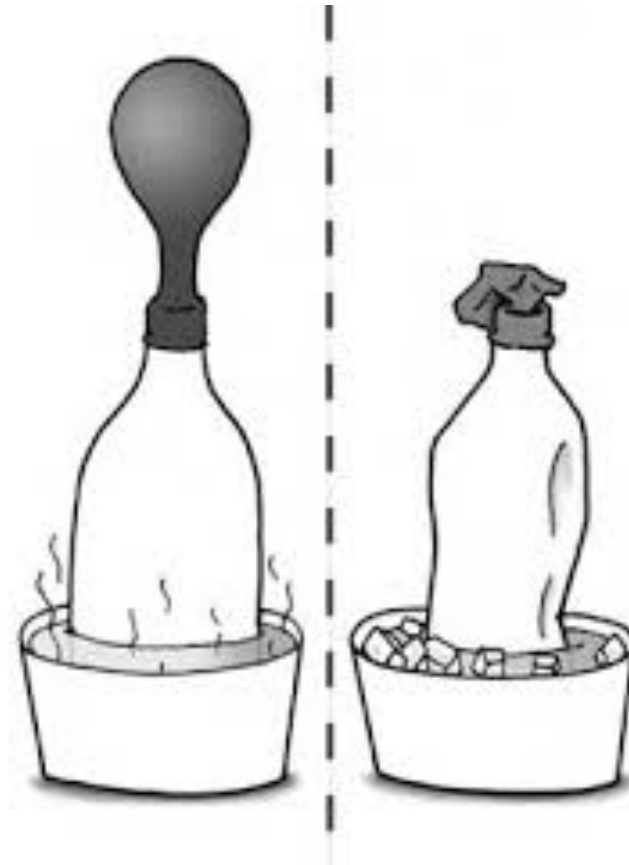I. Use vinegar & baking soda to inflate an <u>un-guided</u> balloon to strike an object

$\geq$ 20 cm. away

to continue sequence.

Each action can only count one time.

II. Use the drop in temperature
from endothermic action
to start the next action.

MISSION: POSSIBLE

Each action can only count one time.

III. Drop two effervescent heartburn relief tablets into water so the reaction triggers the next action.
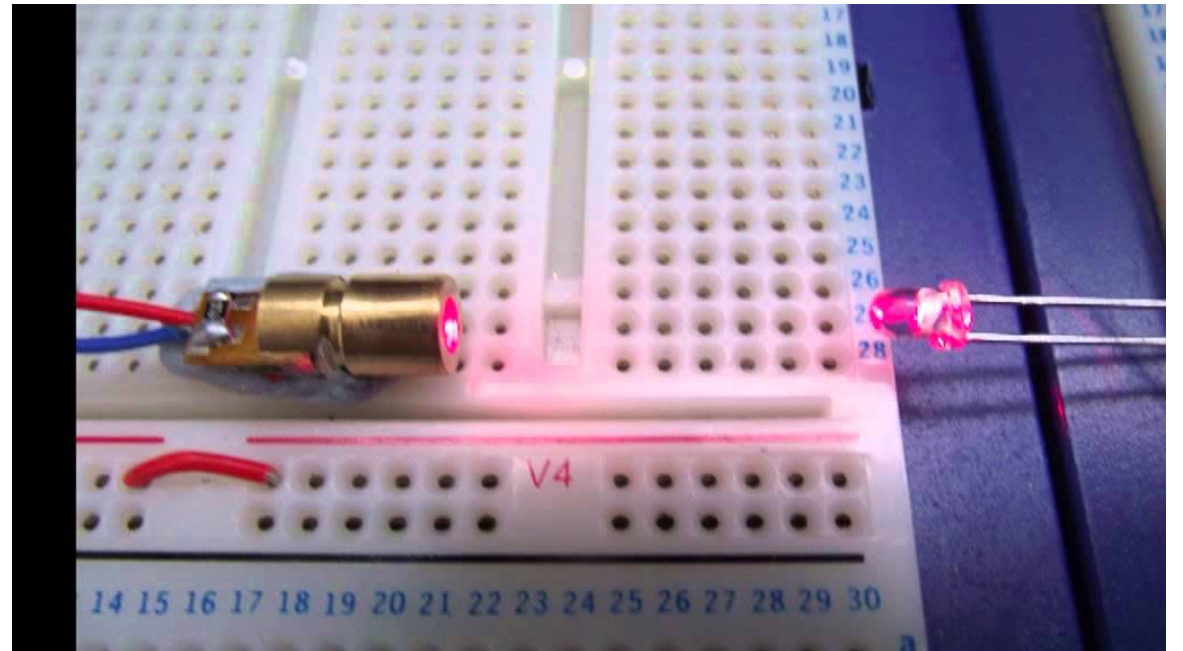
Each action can only count one time.

IV. Add water to a container to raise a golf ball located in the same container at least 5 cm so that the golf ball rolls **out** of the top of the container and initiates the next action.
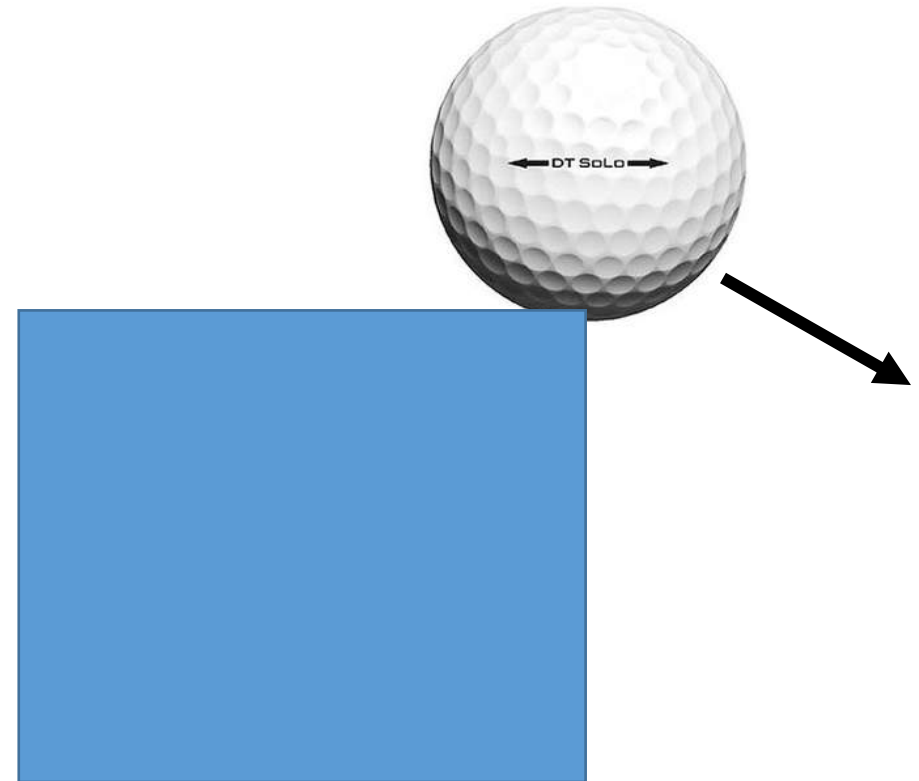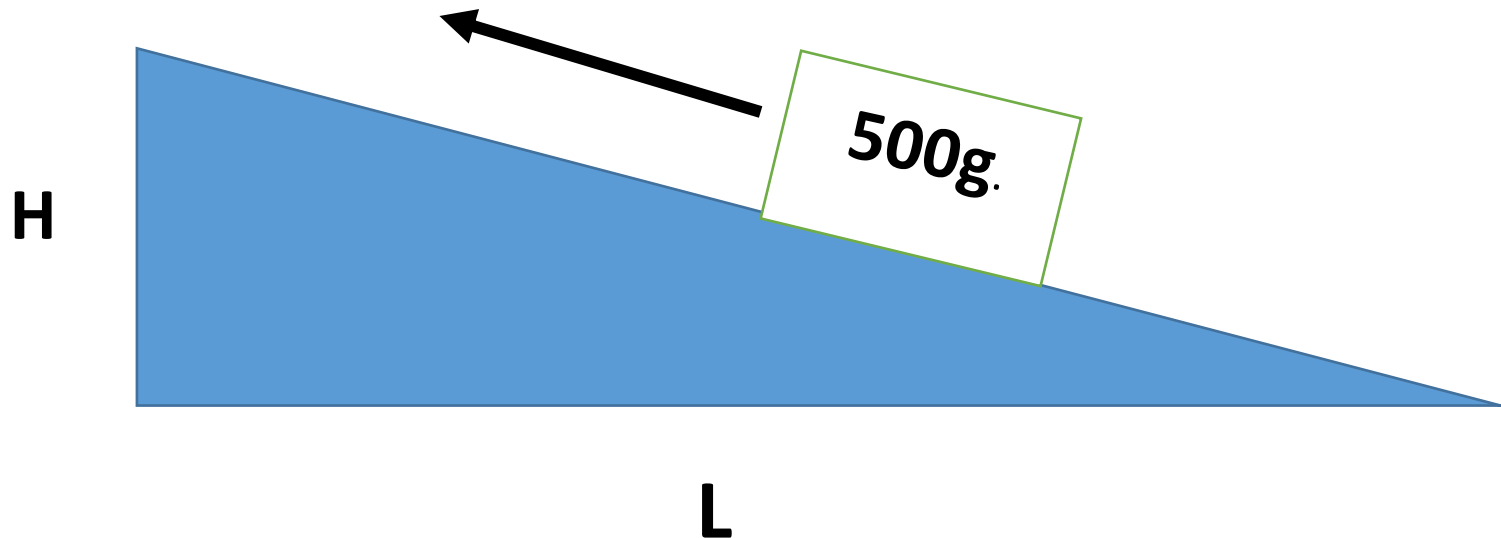
V. Use infrared where
transmitter and receiver
are ≥20 cm. apart
to begin next action.

VI. Push or pull an object with a mass $\geq$ 500 g
at least **10 vertical cm** up
an inclined plane with
an IMA $\geq$ 2
before the object initiates the next action.

H

500g.

L
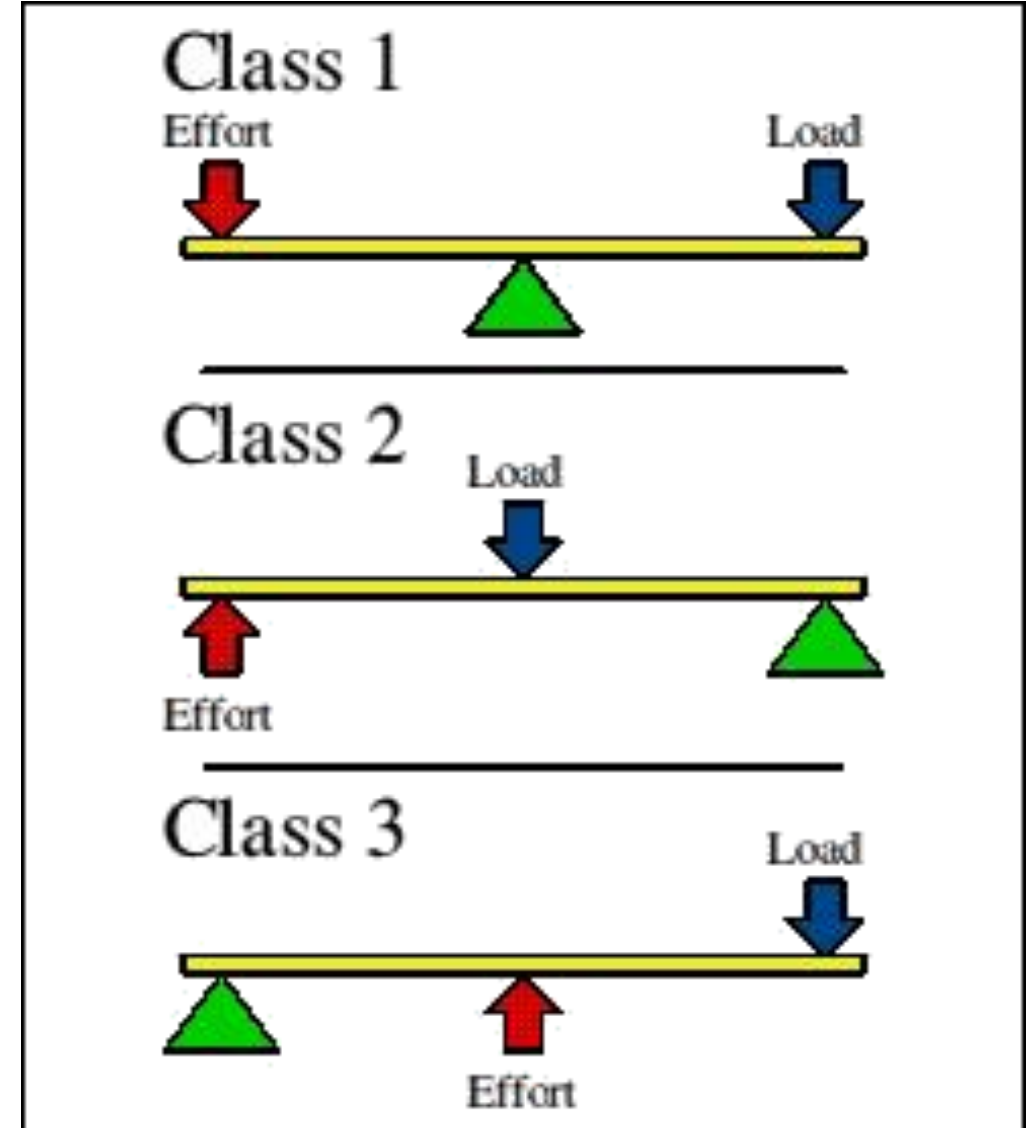
VII. Use a pulley system with an IMA >3
    to lift an object >500g.
    at least 10 cm. vertically
    before the object initiates the next
    action

Let's make one!

VIII. Use the AMA of all 3 classes of levers in sequence to initiate the next action.
(in any order)

IX. Use gravity to clearly rotate a screw at least two full rotations so that it moves an object at least 2 cm **before** that object initiates the next action.

X. Flip unmodified US quarter out the top of the device so it falls back into the device from heads up to tails up and it starts the next action.
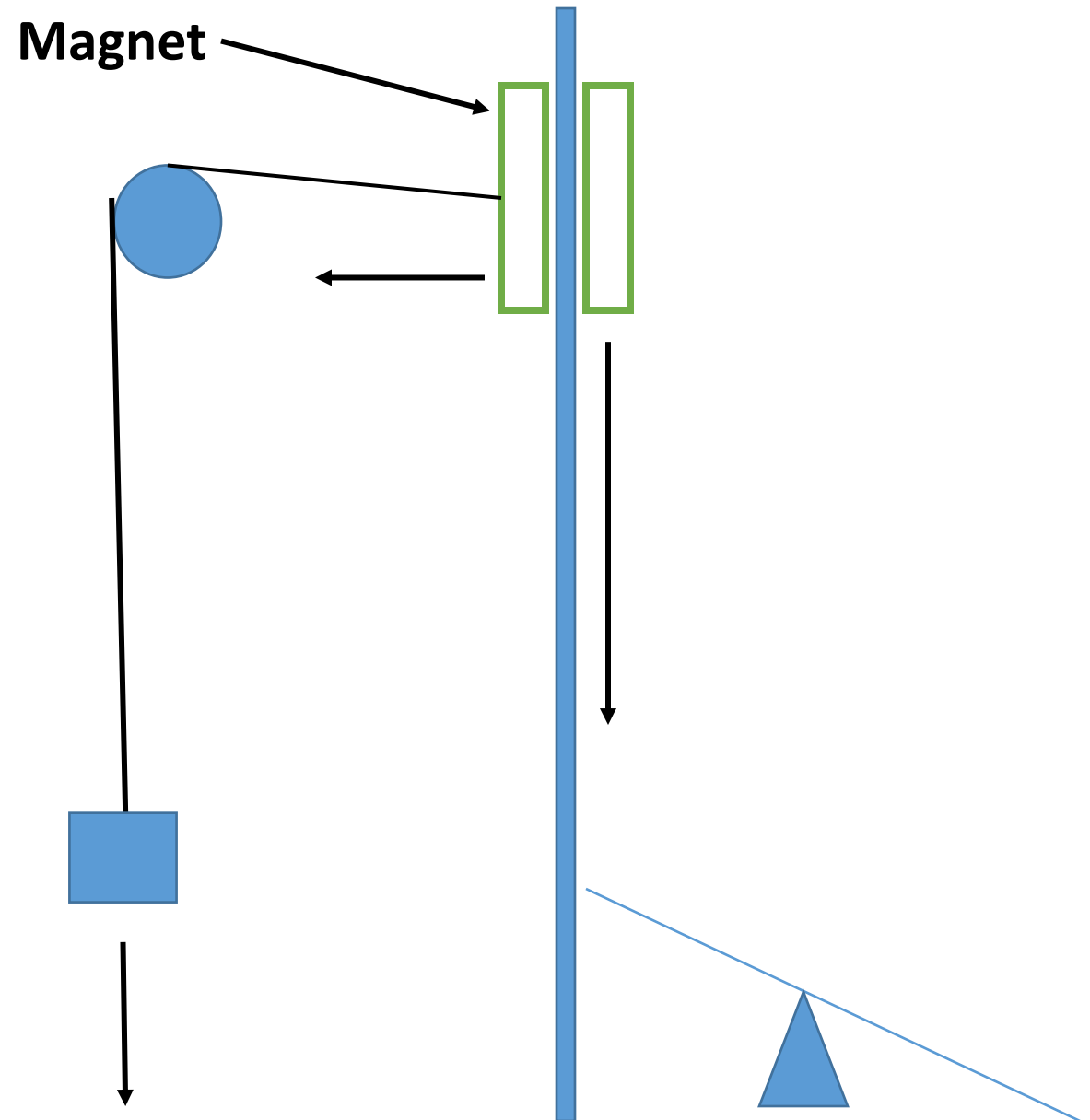
XI. Use electricity to directly or indirectly break a string or fishing line so that the breaking of the line initiates the next action.

Let's draw what this looks like!

Magnet

XII. Remove a magnet from a surface so that a magnetic object falls due to the removal of the magnetic force. That object must initiate the next action.

Actions-The fine print!

- **Receive points only if successful**

- **Listed on the Action Sequence List (ASL)**

- **All Actions must contribute to the completion of the Final Action**

- **Each action must contribute to only one scoreable Action**

    No double dipping

- **No parallel sequence of actions allowed**

Even finer print!

- **Actions between the Start Action and Final action may be in any order.**

- **Additional actions may be built into the device between the scoreable actions but will not earn points.**

- **Additional action must contribute to the completion of the final action.**

- **Additional non scoreable actions must be listed on the Action Sequence List (ASL)**

- **Each moveable/adjustable/physical object in the device can only be utilized by one action.**

Timing

Starts when ping-pong ball drops into the device;

Stops when either the platform stops or 180 sec. elapse; **Scoring Ends**

Ideal time at Regionals is 60 seconds (S=61-90) (N=91-120);

Get two points for each full second of operation up to 60 seconds;

Lose one point for each full second past 60 seconds up to 180 sec.;

If the device stops and does not start the platform moving, the clock keeps running up to 180 sec.;

Teams will not be allowed to touch the device more than three times;

The Final Task – (250 points)

Must raise at least 20 cm. before going above the device and then stopping.

What if it stops too soon?

**What if 180 sec. expire before it stops?**

What if the battery falls over?

What is the battery falls off platform?

Top must be square and 5-10 cm. on each side.

Sample ASL

No.	Action Description	Action NUmber	Points
1	Magnet pulled away from the side of the device, drops other magnet into cup	-	100
2	Magnet dropped into cup is input into lever system, lever system output tips bottle	VIII	50
3	Tipped bottle mixes baking soda and vinegar, creating pressure inside bottle to inflate balloon. Balloon hits block 20 cm	I	50
4	Block falls on switch, powering circuit	-	-
5	Circuit powers infrared laser, laser trips receiver switch 20 cm away	V	50
6	Receiver switch allows power to motor, motor winds up string pulling mass through pulley system	VII	50
	…and so on		
10	Block falls on recorder power switch, playing phrase "the end"	-	250

2 copies of Action Sequence List (ASL)
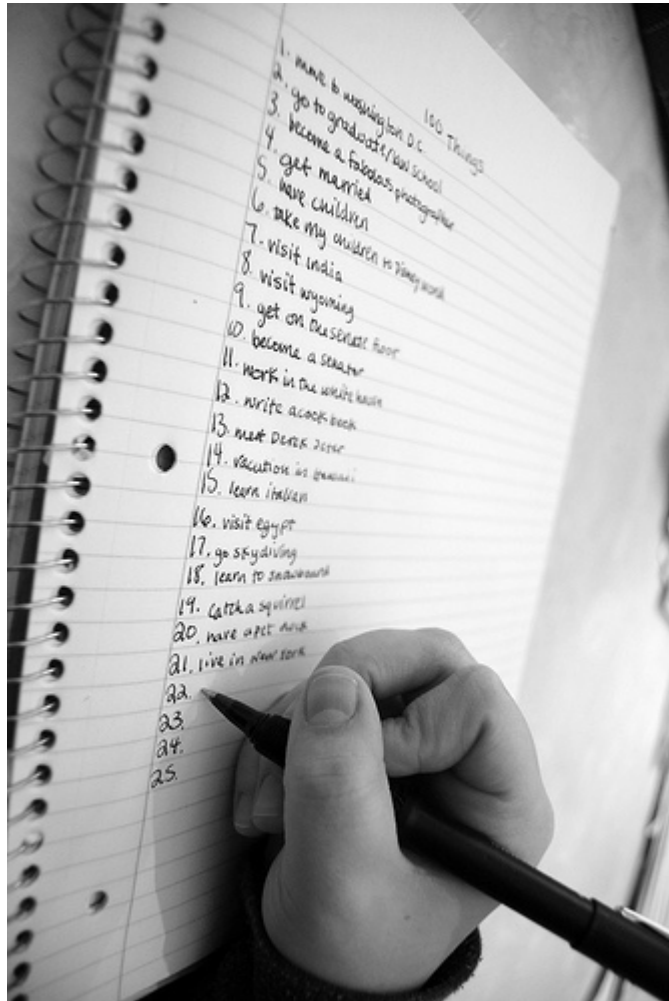
25 points each for:

- Correctly submitted on-time
- Correct format
- Accurate*
- Actions numbered to match device in correct sequence

Scoring

- 2 pts - each full second of operation up to the "ideal" time.
- 100 pts – Start Action
- 250 pts - Final Action completed in 3 mins. (150 points if battery falls over, but stays on platform & meets other requirements.)
- 50 pts – no more that 30 min. setup
- 50 pts – each successful unique Scorable Action (max 600 pts)
- .1 pt for each .1 cm that the dimensions of the device are under 60.0 cm x 60.0 cm x 60.0 cm
- 75 points for no touches
- 1 point per full second past 30 sec. for a non-electrical timer if all conditions are met (2 pts., if chemical).

- Exceeding dimensions =25 each

- 25 pts., if 2 sides & top not visible

- Touches = 25 pts. each (up to 3)

- 1 pt. per full sec. over ideal time

- Anything leaving device = 50 pts.

- 150 points for each electrical timer

- 150 pts. for each use of electricity other than actions 2, 5, 11 & final task

Two More

No Parallel Paths
(No actions in the
path will count.)

Stalling can lead to
disqualification!!!

Points not Awarded

- Points will not be awarded for actions when a touch or adjustment leads directly to the action's completion.

- Actions skipped or completed out of sequence on the ASL will not earn points.

- Points will not be awarded for action completion after time has elapsed.

Why we call it:

It can be done!