

Curriculum topics: ប្រធាន

បទកម្មវិធីសិក្សា

- Potential Energy

សក្តានុពលថាមពល

- Kinetic Energy

ថាមពលចលនា

- Energy Conversion

បំប្លែងថាមពល

- Motion ចលនា

- Simple Machines

ម៉ាស៊ីនធម្មតា

- Stored Energy រក្សា

ថាមពលទុក

- Experimentation

ពិសោធន៍

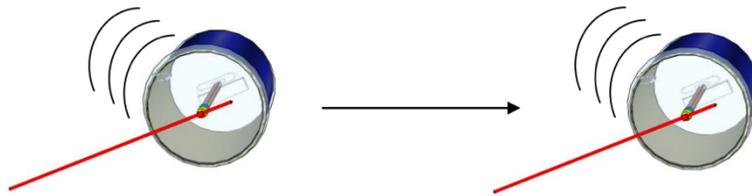
- **Subject:** មុខវិជ្ជា

Physical Science វិទ្យាសាស្ត្រ

Roller Racer

Explore the fun of energy conversion

ស្វែងយល់កំសាន្តពីការផ្លាស់ប្តូរថាមពល



Enjoy the hands on experience of building and using the Roller Racer. Explore the application of simple machines and energy conversion and investigate how changes in the amount of stored energy can affect performance.

រីករាយជាមួយការធ្វើពិសោធន៍ និងរ៉ូឡែរ។ សាកល្បងស្វែងរកម៉ាស៊ីនបំប្លែងថាមពលហើយសង្កេតមើលថាតើការផ្លាស់ប្តូរថាមពល ដែលអាចមានបំរែបំរួលពេលដំណើរការ

Grades : 2-12

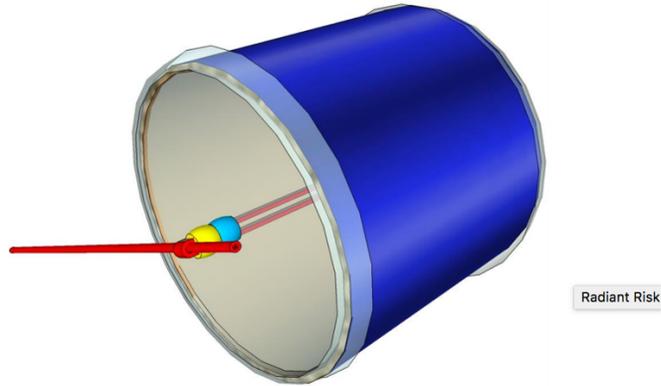


Figure 1

Safety Tip:ជំនួយសុវត្ថិភាព

Keep beads, straw away from small children, choking hazard

រក្សាគ្រាប់, ទុយោ, អោយឆ្ងាយពីក្មេង

Wearing eye protection/ keep face/ eyes away from project.

ពាក់របស់ការពារភ្នែក/រក្សាភ្នែក នឹងមុខអោយឆ្ងាយពីវា

Rubber bands contain natural latex which may cause rash or other reactions.

កៅស៊ូជីវិតមានបង្កអោយមានប្រតិកម្មណាមួយផ្សេង

Materials required per Roller Racer: សំភារៈត្រូវការ

សំរាប់រ៉ូឡឺរ

- 2 Clear lids, 93 mm diameter with a 4 mm indented rim. Each lid with a 5 mm center hole cut out

គំរូបង្ហាញចំនួន២ ទំហំ៩៣មីលីម៉ែត្រ នឹងជ្រុង៤មីលីម៉ែត្រ។ គំរូបនិមួយៗត្រូវចោះរុនទំហំ៥មីលីម៉ែត្រ

One sided corrugated sheet, 7.5 x 27.3 cm បន្ទះសង្កត់ ៧.៥ x ២៧.៣សង់ទីម៉ែត្រ

flute/ indentations parallel to the short side

- 2 Rubber band, 7.5 cm long x 1.6cm thick កៅស៊ូចំនួន២, ប្រវែង៧.៥សង់ទីម៉ែត្រ x កំរាស់១.៦ cm

- 2 small beads, 8 mm diameter គ្រាប់ទំហំ៨មីលីម៉ែត្រចំនួន២

- Thin straw, 17.7 cm long, 2.4 mm diameter ទុយោបំពង់ប៊ុតប្រវែង១៧.៧សង់ទីម៉ែត្រ ទំហំ២.៤ មីលីម៉ែត្រ

- 2 Paper clips ឃ្នាបក្រដាសចំនួន២

- Adhesive foam back, single sided, 2.3 cm 4.6 cm, x 5 mm thick ការបិទស្ពោខាង ក្រោយ, ២.៣ x ៤.៦ x កំរាស់៥មីលីម៉ែត្រ

● How to build it របៀបធ្វើវា

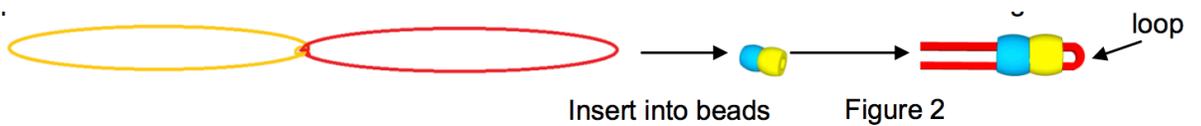
1. Interlock the two rubber bands as shown below. Pull the knot tight.

ចងកោស្ទីទាំង២នឹង ទាញអោយតឹង មើលក្នុងរូប

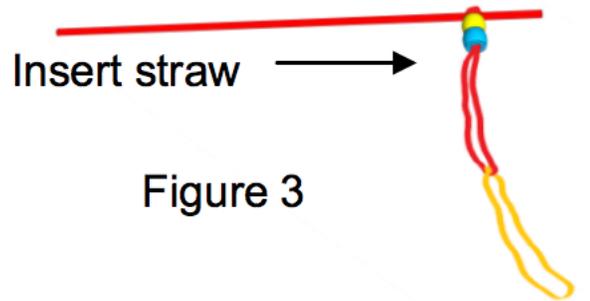


2. Insert the end of one of the rubber bands into and through each of the 2 beads until a small piece of rubber band sticks out. The 2 beads should be next to each other. See figure 2.

ញាត់កោស្ទីចូលក្នុងគ្រាប់កន្លះទាំង២។ គ្រាប់កន្លះទាំង២ត្រូវនៅជាប់គ្នា មើលរូបលេខ២



3. Insert the straw through the small loop in the rubber band created by the 2 beads until about 1/10 of the straw is through the loop. Pull on the other end of the rubber band to tighten the loop around the straw so the straw lies next to the beads.



ដាក់ទុយោបំពង់ប៉ុតនៅចន្លោះកោស្ទី ១ ភាគ១០នៃប្រវែងកោស្ទី។ ទាញកោស្ទីពីម្ខាងទៀតអោយតឹងជាប់នឹងកន្លះ មើលរូបទី៣

4. Insert the free end of the rubber bands into the hole in the first lid starting from the topside of the lid (groove is on the bottom side). Pull the rubber band through until the last bead is snug against the lid. The 2 beads and the straw secured by the small piece of rubber band will sit on top of the lid. See figures 4 and 5.

ញាត់ចុងកៅស៊ូចូលក្នុងចន្លោះគំរូ ញាត់ពីខាងលើ។ ទាញកៅស៊ូអោយកន្លះជាប់នឹងគំរូ មើលរូបលេខ៤ និង៥

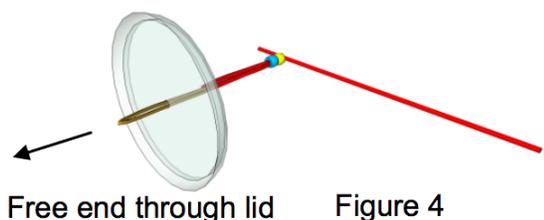


Figure 4

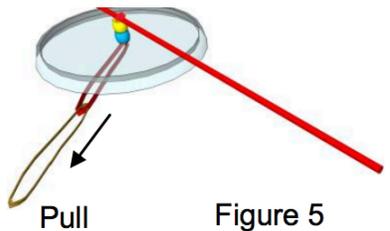


Figure 5

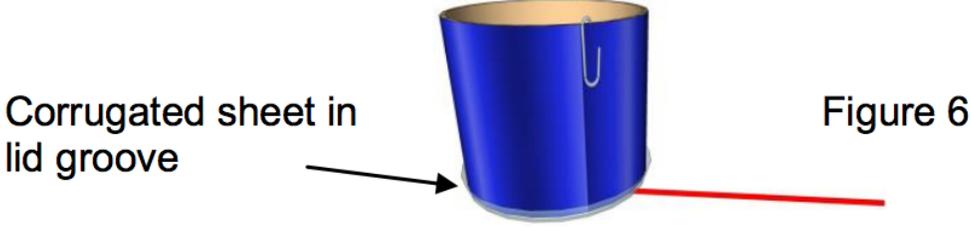
5. Place the lid on a flat surface with the groove upward.

ដាក់គ្របឱ្យឡើងលើផ្ទៃរាបស្មើ

6. Insert the long edge of the single sided corrugated sheet into the groove of the lid, shaping the corrugated sheet to form a circle. Overlap the ends when the groove is filled. See figure 6

បិទសន្លឹកបន្ទះអោយចេញរាងមូល ហើយបិទគ្របដែលបានធ្វើជាមួយទុយោបំពង់ប៊ីតនឹងកេស្វី មើលរូបលេខ

៦

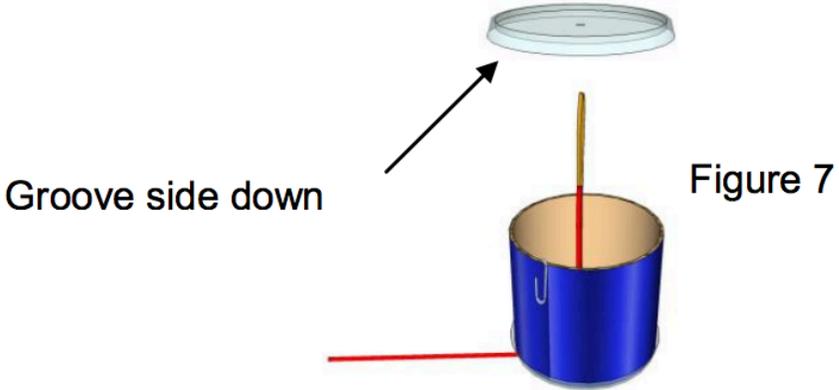


7. Place a paperclip over the overlapped ends, opposite the lid, see above.

ប្រើប្រាស់ក្រដាសខ្ចាស់ខាងចុងម្ខាងទៀត មើលរូបខាងលេខ

8. Hold the second lid, groove side down, above the cylinder. Pull the end of the rubber band up out of the cylinder and insert the end of the rubber band into the hole in the second lid. See Figure 7

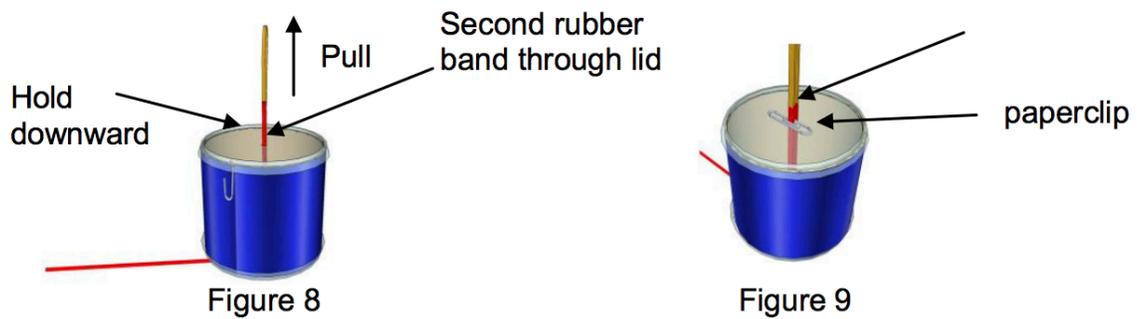
បិទគ្របមួយចំហៀងទៀត ហើយទាញកេស្វីចេញក្រៅ មើលរូបលេខ៧



9. Pull the lid on the cardboard cylinder, fitting the cardboard edge into the lid. Hold the lid in place while pulling the rubber band up until the knot between the rubber bands, and the top of the second rubber band comes through the lid.

See figure 8. Insert the paperclip into the loop between the knot and the lid. See figure 9

ទាញគំរូបចិទលើរ៉ូប៊ូដែលបានធ្វើ ហើយទាញកៅស៊ូតាមរន្ធគំរូបខាងលើចេញមករហូតដល់មុខដំណកៅស៊ូចងចេញមកដែរ មើលរូបលេខ៨។ ដាក់ឃ្នាបក្រដាសនៅចន្លោះមុខដំណចងនឹងគំរូប មើលរូបលេខ៩



10. Remove the release paper from the piece of adhesive foam. Place the foam on the lid next to the paperclip. See figure 10.

Keeping the paperclip parallel to the foam, press down on the foam to secure.

The foam will keep the paperclip from rotating when the straw on the other end is rotated.

ដកក្រដាសដែលបិទពីលើស្លោចេញ ដាក់ស្លោនៅជិតឃ្នាបលើគំរូ មើលរូបលេខ១០

ដាក់ឃ្នាបអោយស្របនឹងស្លោ ចុចចុះក្រោមដើម្បីទប់វា។ ស្លោនឹងទប់ឃ្នាបកុំអោយវិលនៅពេលទុយោម្ខាងទេតវិល

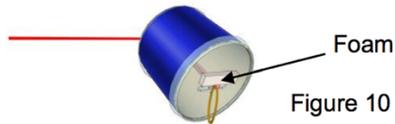


Figure 10

11. Wrap the excess rubber band around the foam. See figure 11

ប្រើកៅស៊ូរុំស្លោ មើលរូបលេខ១១

1. See figure 11.

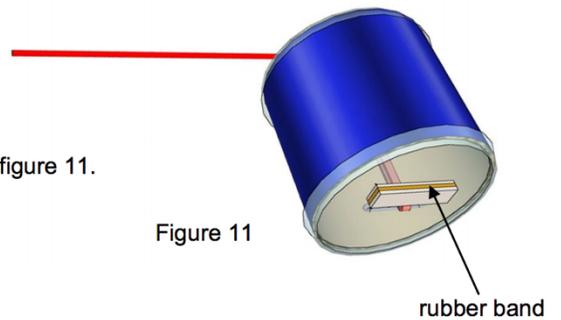
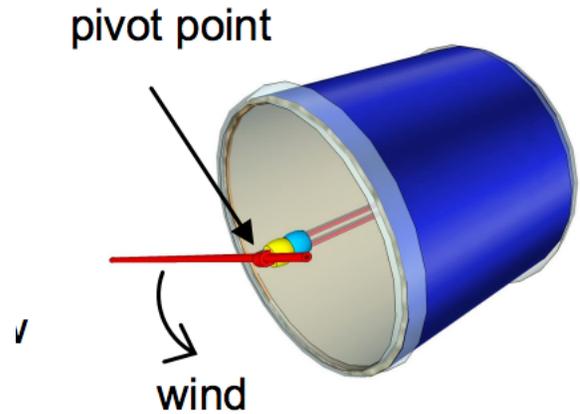


Figure 11

To do and notice ការធ្វើនឹងកំណត់សំគាល់

1. **Wind the roller racer.** Hold the roller racer in both hands. Using the finger of one hand rotate the straw around the pivot point (above the beads) a set number of times (10-20).

១. ការបង្ហាញរូបវិល្លៈ កាន់រូបវិល្លៈដោយដៃទាំង២ ប្រើប្រាស់
ដៃម្ខាងបង្ហាញរូបវិល្លៈ បង្ហាញរូបវិល្លៈដោយប្រើនិង១០ ទេ២០
ដង



2. Being careful to keep the straw still,
set the roller racer on a smooth surface, see figure 1. If the beads have become
tilted, move the straw so that the beads are at a right angle to the lid.

ទប់ទុកយ៉ាងណាក៏ដោយនៅមួយកន្លែង ដាក់ក្នុងវិល្លៈលើផ្ទៃរាបស្មើ មើលរូបលេខ១។

3. Aim the Roller Racer in a direction clear of obstacles and let go ! Note the
direction and distance of travel.

ដាក់ក្នុងវិល្លៈកុំអោយមានអ្វីនៅពីមុខវា ហើយចាំមើលទិសដៅវាវិលនឹងចំងាយដែលវាបាន

The science behind the activity វិទ្យាសាស្ត្រនៅពីក្រោយសកម្មភាព

Turning the straw, which acts as a lever, will wind up the rubber band and store
elastic potential energy. This energy is the result of the mechanical work done
by a moving finger as it applies a force over a certain distance. When the rubber
band is allowed to unwind, the potential energy (stored energy) is turned into
kinetic energy (energy of motion) and a small amount of heat that is generated

by the friction of the Roller Racer with the surface that it touches, as well as the air it moves through.

ការវិលរបស់ទុយោចំពង់ប៊ីត ដើរត្រូវបានបង្កើត វាជួយកោសិកាអោយវិលនឹងរក្សាថាមពល។ ថាមពលនេះបានមកពីមេកានិចដែលបង្កើតដោយដៃ ហើយវាចេញជាកំលាំងរយៈចំងាយមួយ។ នៅពេលកោសិកាវិលមកវិញ ថាមពលដែលរក្សាទុក នឹងប្រែទៅជាថាមពលចលនា ហើយកំដៅនឹងចាប់ផ្តើមមានដោយការកកិតនៃរូងរ៉ូល័រនឹងផ្ទៃនឹងខ្យល់ដែលអោយវាធ្វើចលនា

Learn More រៀនបន្ថែម

- Vary the number of times the straw is rotated when winding the Roller Racer and measure the distance travelled. The results can be plotted on a graph to show distance variations over trials; and distance versus number of winding-rotations.

ចំនួនដែលទុយោបានបង្កើតនឹងវាស់បានចំងាយដែលវិលបាន។ លទ្ធផលនៅលើក្រាហ្វអាចកំណត់បានពីចំងាយដែលបានមកពីការសាកល្បង នឹងចំងាយរៀបនឹងចំនួនជុំដែលវិលបាន

- Data can be collected on the number of rotations needed to travel a set distance.

ទិន្នន័យបានមកពីការប្រមូលគួរលេខចំនួនជុំវិលនឹងចំងាយដែលបានកំណត់

- Challenges for students can include:
 - Making the Roller Racer stop within a set range of distances

ការធ្វើអោយរូងរ៉ូល័រឈប់នៅនឹងចំងាយណាមួយ

- Staying on a set path for a set distance អោយវារីលនៅលើផ្លូវដែលបានកំណត់
- Rolling over an obstacle រុំឡូវិលពេលជួបឧបសគ្គ
- Hitting a target ទៅដល់គោលដៅ
- Travelling a curved path to a target វិលលើផ្លូវកោងទៅដល់គោលដៅ
- Finding a way to make the Roller Racer travel in a straighter path

រកវិធីធ្វើឡូអោយវិលត្រង់លើផ្លូវ

- Make a variation in this design by using a pair of CD's or other materials

ធ្វើរបៀបនេះដោយប្រើស៊ីឌី ឬរបស់ផ្សេងទៀត