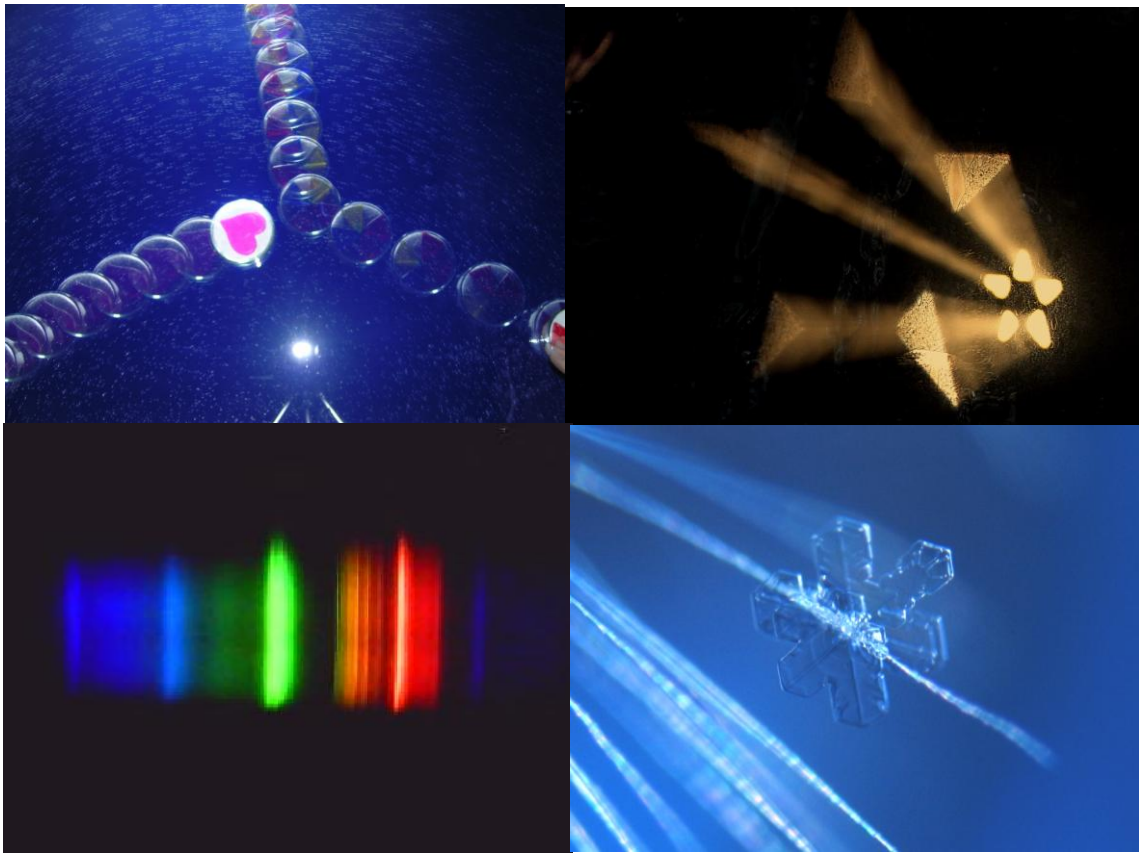


Experiments to Understand Physics Phenomena Observed In Daily Life

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Semarang, Indonesia



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Organized by **Maju Makmur MMandiri Research Center**
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Name

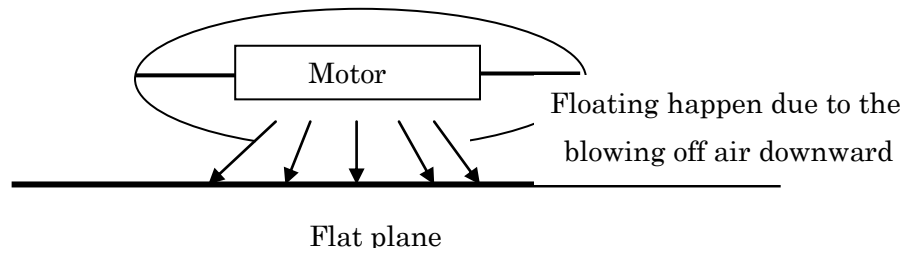
Chap. 1 Mechanics

1., Demonstration of the First Law

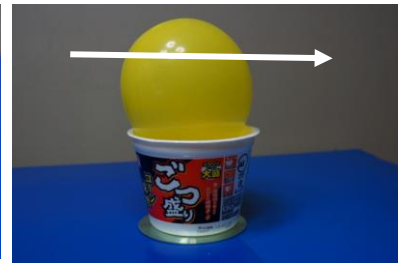
*how to reduce the friction between two objects

<Hover Craft>

- No friction takes place due to thin air space between two objects.



- Let make a frictionless tool using a balloon and CD.



Experiment on frictionless motion

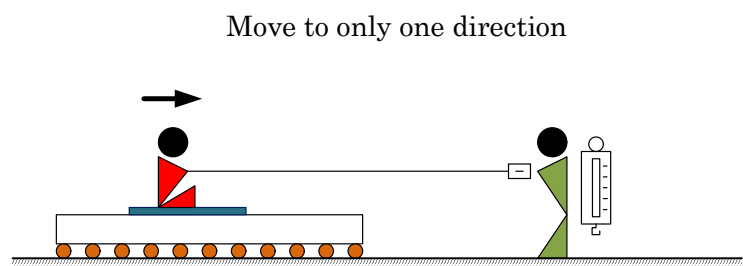
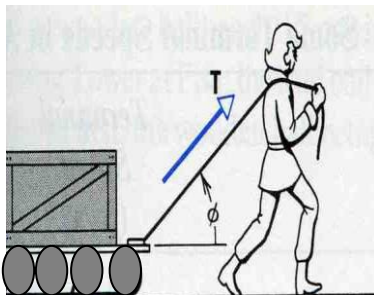


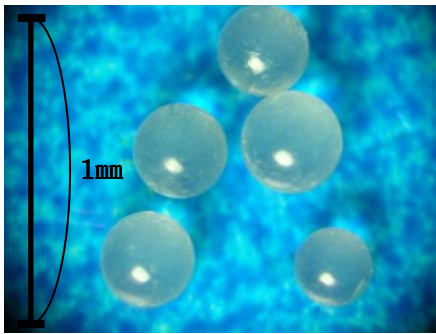
力学滑走台 ¥210.000

One dimensional frictionless equipment employed in school (air blowing off type).

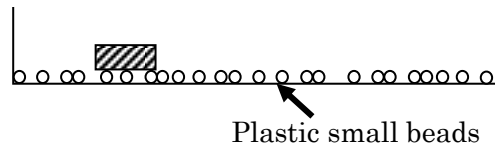
<Frictionless equipment using small beads>

*principle: the use of rollers.

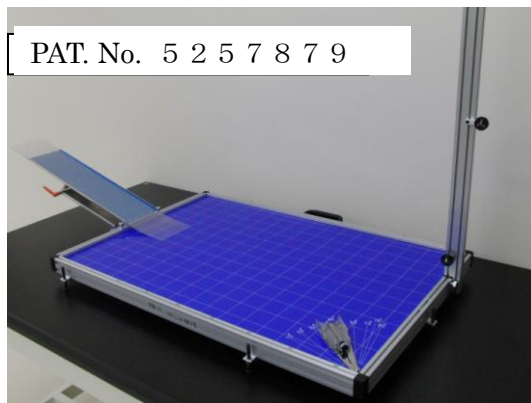




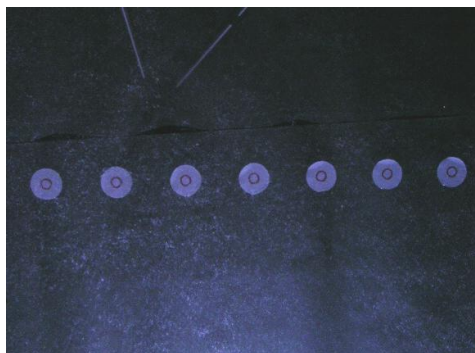
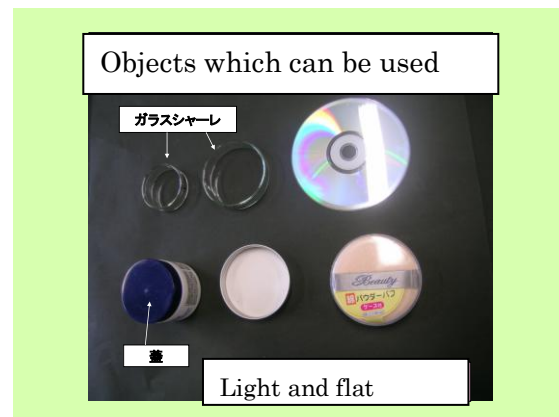
Microscopic view of small beads



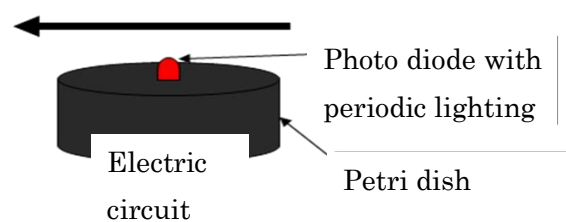
Attention: Don't touch your fingers to beads. If you touch them, please wipe your hands with a wet tissue, or wash them out under flowing water.

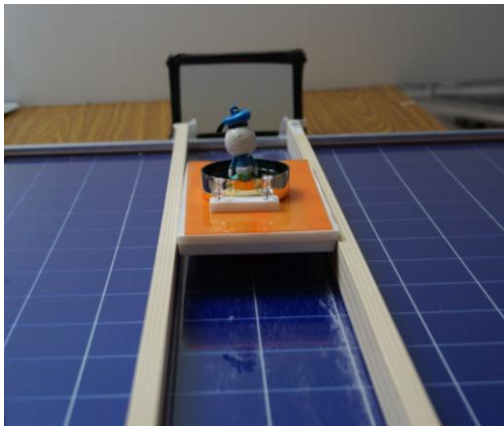


Frictionless equip. using small beads



Trace of uniform motion using the frictionless table; flash lamp was operated with a periodical interval of 0.25 second.





Experiment to demonstrate the effect of seat belt; if the doll was not buckled to the seat belt, it will collide to the wall.



The blade will get into the wooden handle by applying the law of inertia.



A knife is slightly stabbed.



Strike the apple on the table.



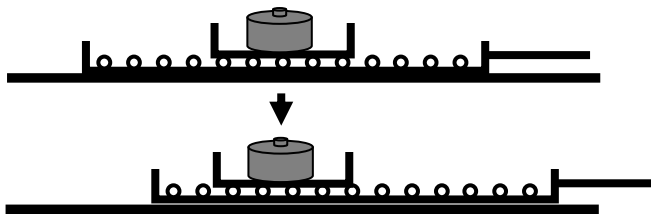
The knife is stabbed deeply. It is due to the law of inertia.

<Let's play a game like a Pee-Kay (player killing) game >

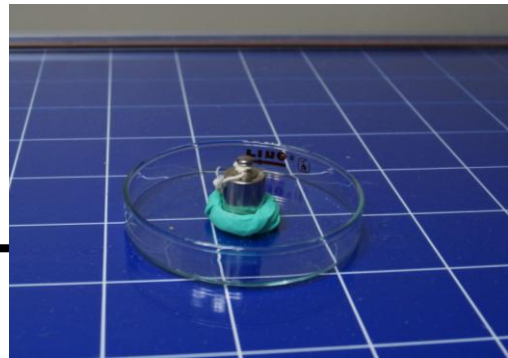


Everybody has a chance to shoot with the plastic lid and aim to at the goal!

<The law of inertia for standstill object>



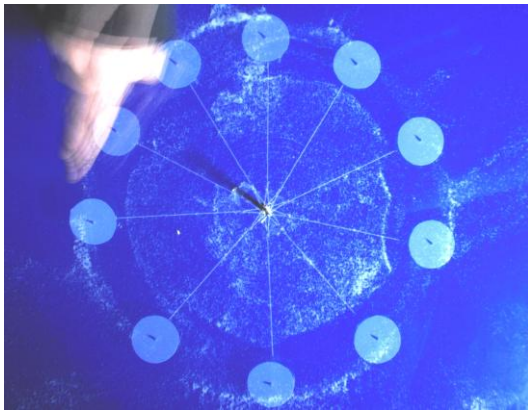
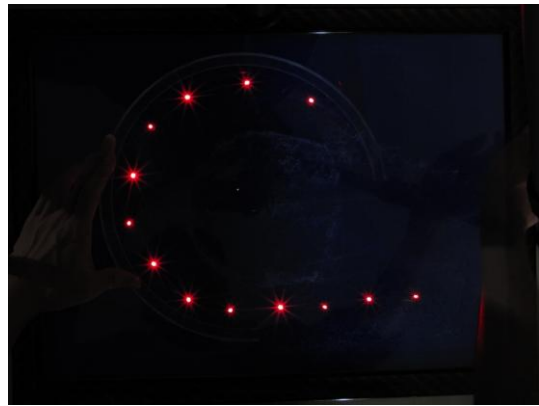
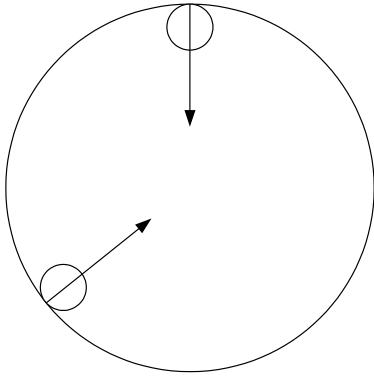
Try to move quickly the frictionless plate, then the object will not move due to the inertial law.



The beaker and water will stay as it is if we pull the cloth quickly. In order to make the beaker move, a very large force is required which cannot be conveyed through the friction.

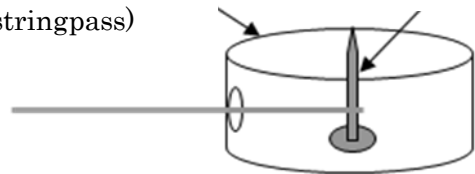
<Demonstration of uniform circular motion>

• It is difficult to see the uniform circular motion because of the existence of friction. However, our frictionless equipment has realized it.



Plastic lid (with a hole to let a string pass)

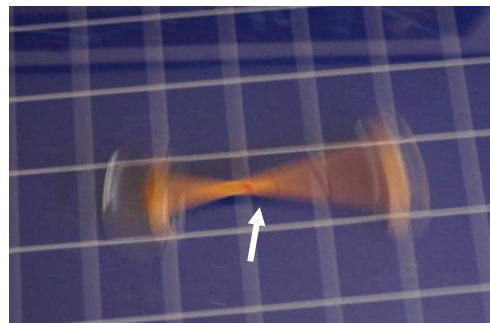
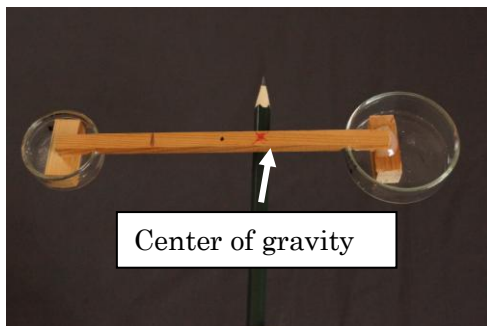
Fixed pin



- Since there is no friction in the space of universe, planets can move eternally around the sun.

<rotation of rigid body>

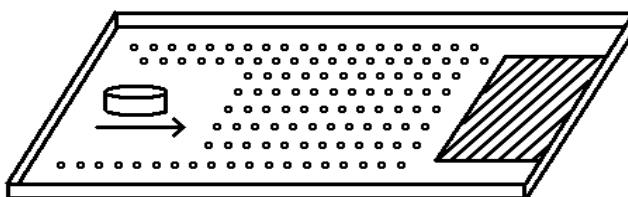
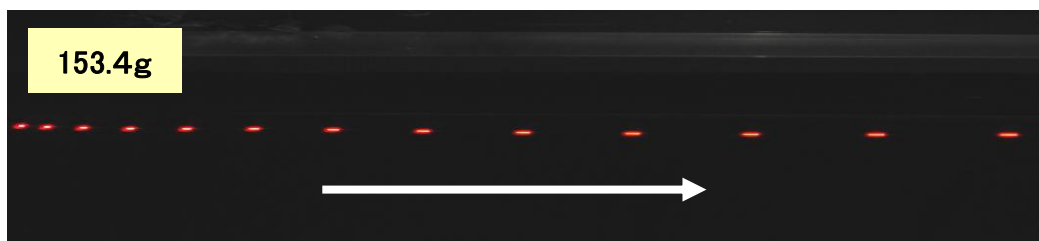
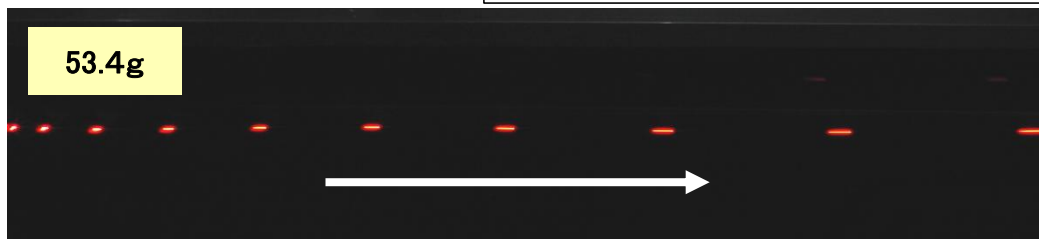
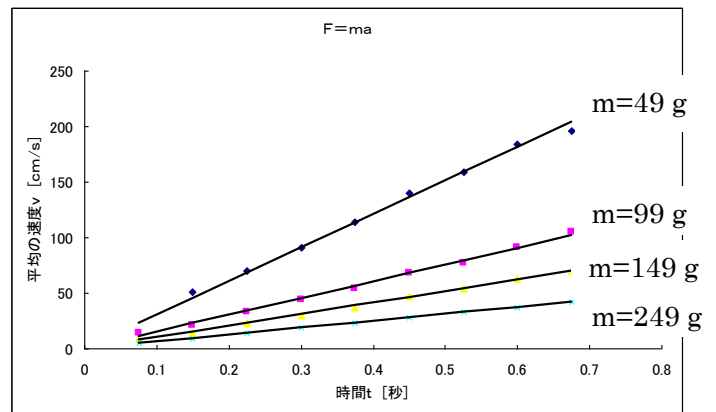
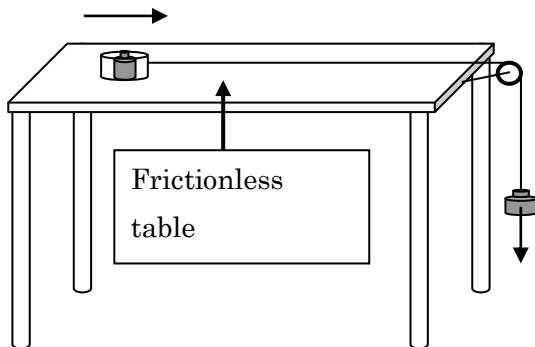
- Confirmation of rigid body rotation around the point of center of gravity.



2., Demonstration of the Second Law

$$F = m \times a$$

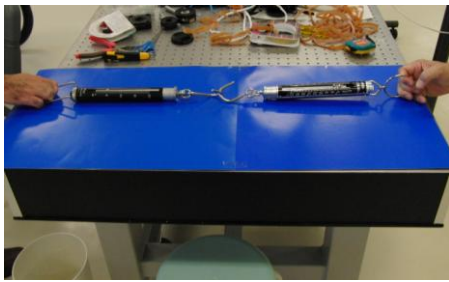
(Acceleration motion takes place when force is applied to an object)



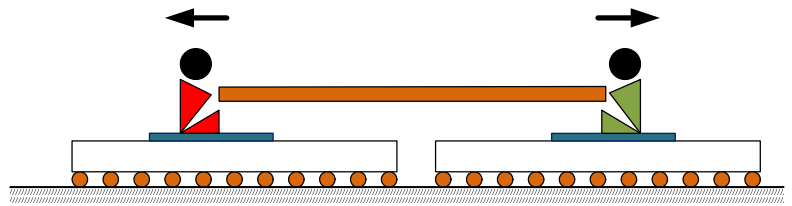
On the paper, force is in minus direction, thus minus acceleration takes place, and velocity decreases.

2., Demonstration of the Third Law

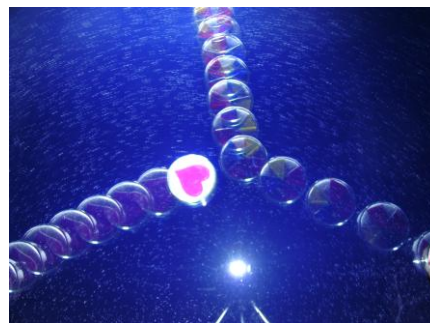
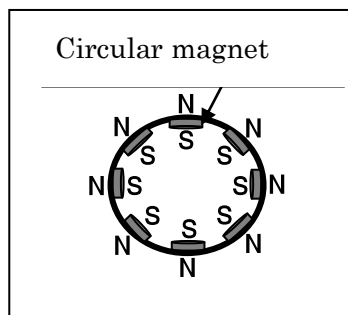
• Usually in the physics textbook, the Third law is demonstrated by using two spring balances. Even in dynamic phenomenon, the Third law is always fulfilled, but usually it is difficult to visualize it.



Two spring balance indicate that the same force happen.

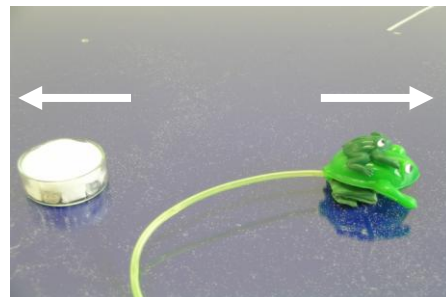


The weights are pushing each other on the rollers.



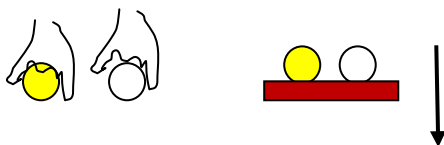
On the frictionless table

One magnet is standstill, while another one moves close to it, then due to the repulsion force the standstill magnet starts to move, and bending in trace takes place in another one due to the Third Law.



4. Falling object

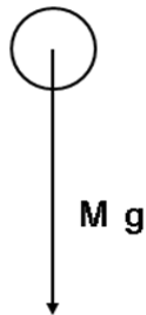
*How to realize that the two objects fall down precisely at the same time





A pulsar
falls down
due to gravity

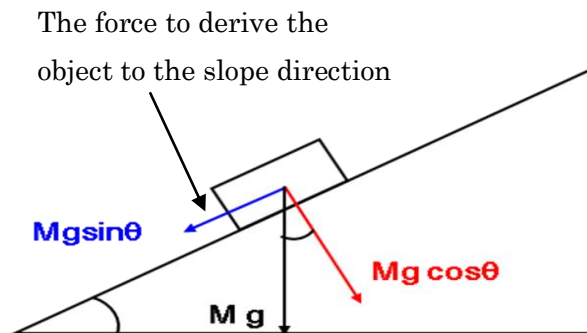
Free falling object



$M = \text{mass}$

$a = g$ (acceleration of gravity)

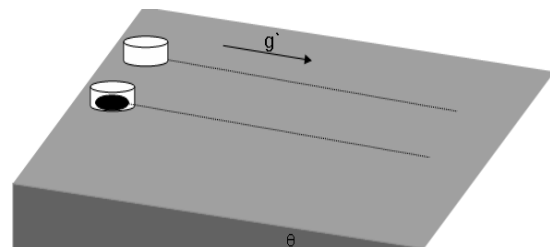
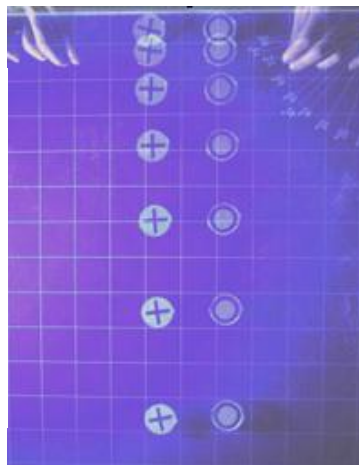
Falling on the slope



$$a = g \times \sin \theta$$

$g \rightarrow g \sin \theta$ (smaller than g)

Strobe-photograph of the falling objects that have different mass on the frictionless slope.



Using the slightly inclined frictionless slope, we can see very slowly accelerating motion. This activity will make students easy to understand. .



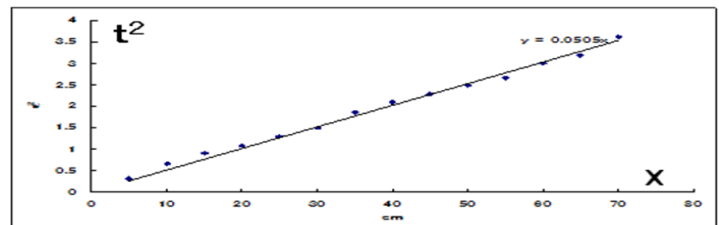
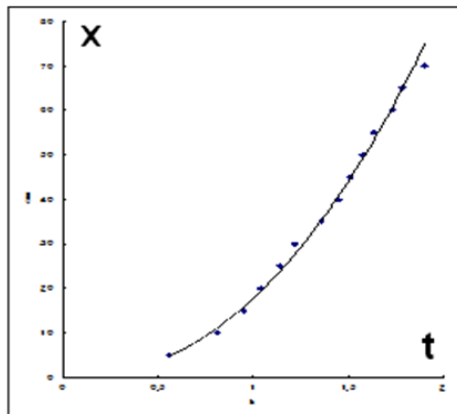
$$x = \frac{1}{2} (g' \cdot t^2)$$

$$g' = g \cdot \sin \theta$$

$$\sin \theta = 0.01$$

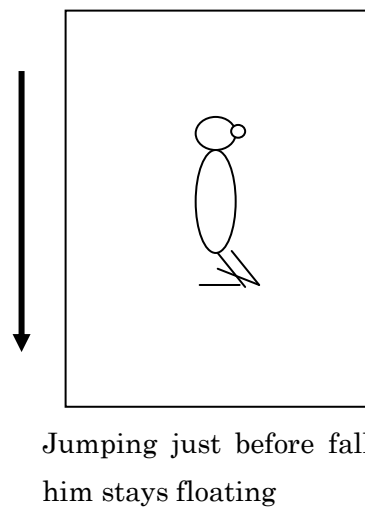
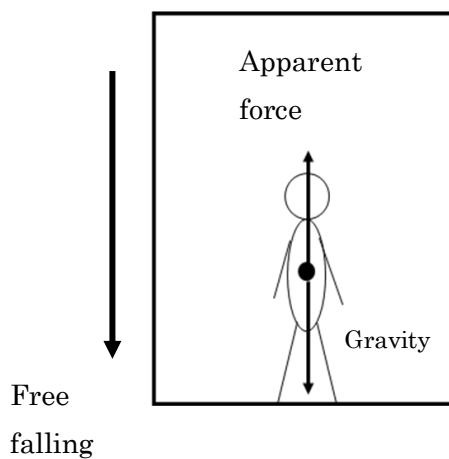
Slightly Inclined glass plate with small beads

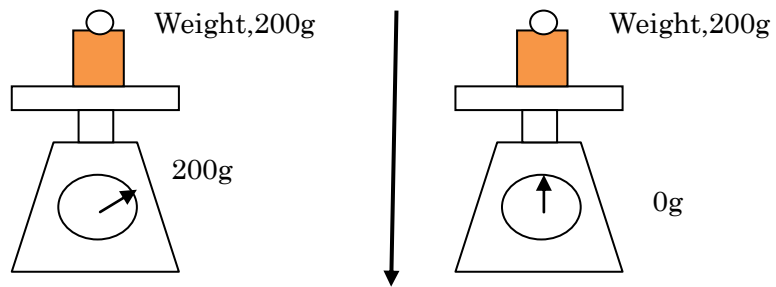
- Quantitative experiments are available using stopwatch



X = distance from the start,
t = time from the start ,

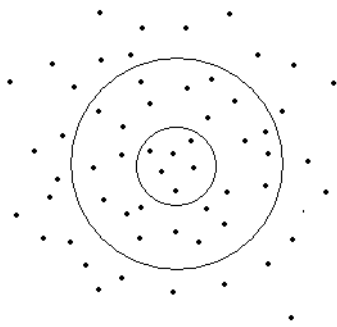
<non- gravity experiment>



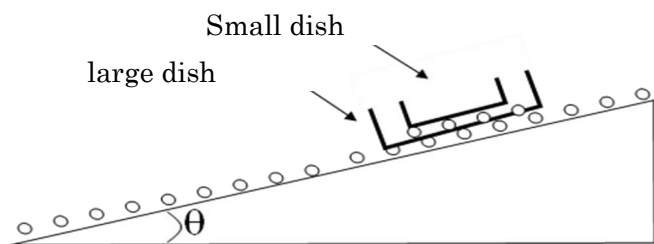


The balance shows zero g
During the falling.

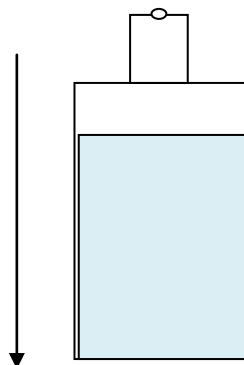
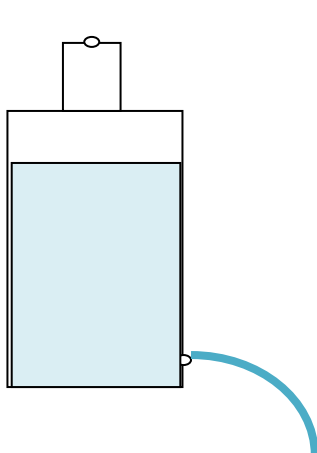
Attention: Put some soft cushion to support the falling balance !!



Top view: circles show
Petri dishes, and dots
represent small beads

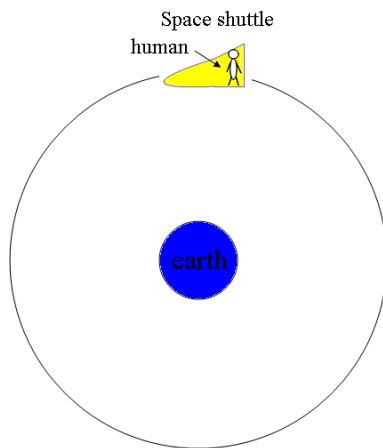


Please observe that the smaller Petri dish has
no contact with the large Petri dish (like
floating) while they fall on the frictionless slope.



Free falling

No water flowing
takes place, when
the pet bottle falls
freely. It is due to
no gravity on the
water.

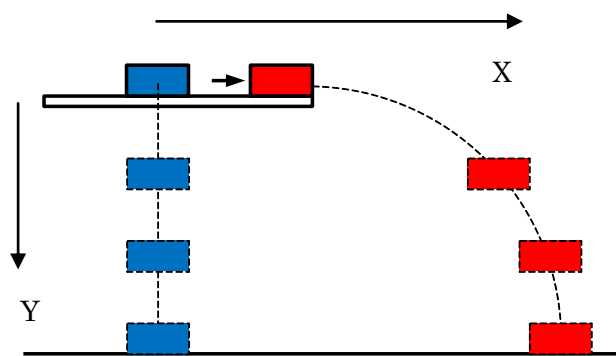


Human in the space shuttle has the same acceleration motion (circular motion) as the space shuttle itself, thus human never feel any gravity;

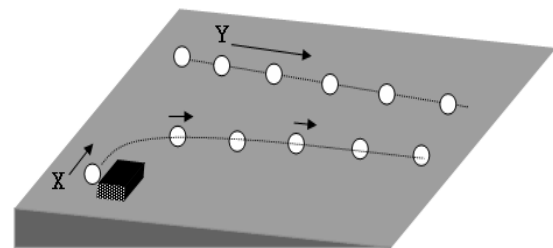
Newton said: The moon always falls toward Earth due to gravity. Namely, the space shuttle and human always fall toward Earth in the same manner.

5. Motion in a slope

1) Horizontal projection

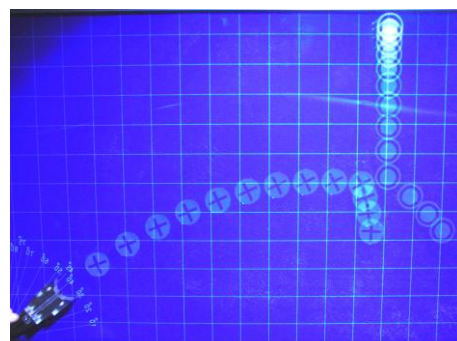
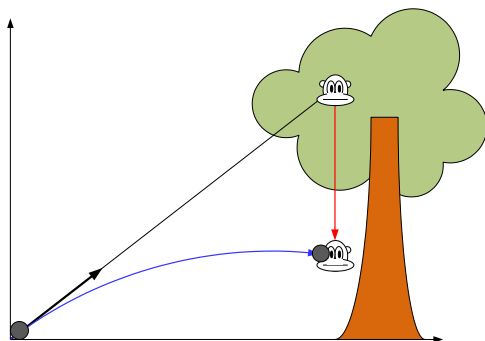


Note that the motion to X direction and the motion to Y direction are independent.



The phenomena can be observed very slowly by using the frictionless plate..

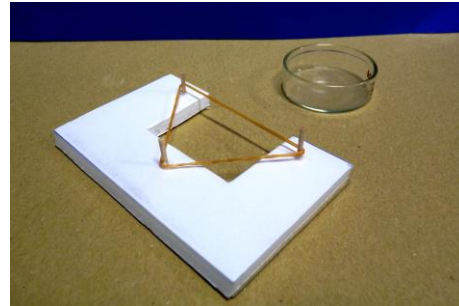
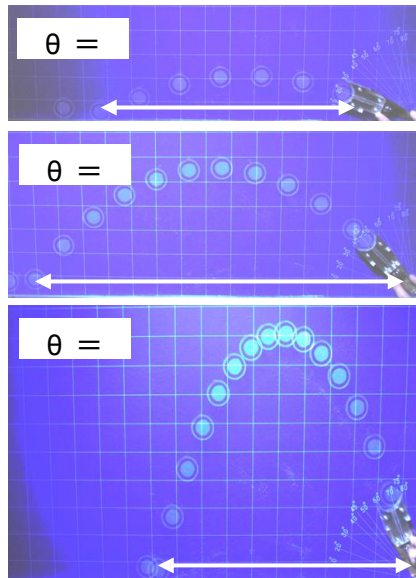
2) Monkey hunting.



Slow motion Monkey Hunting

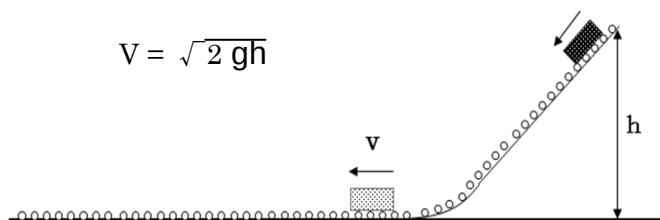
The price of commercial tool is about US400\$ and it is less effective since the motion finish in a short time.

3) Projection to 45 degree

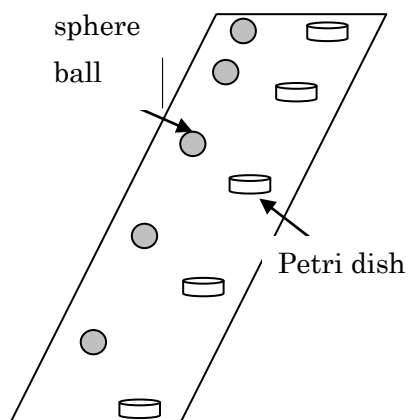


Tool that can project Petri dish with a constant speed.

6.From potential energy to kinetic energy

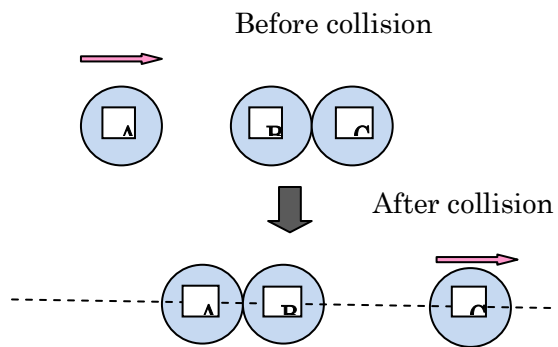


Speed meter

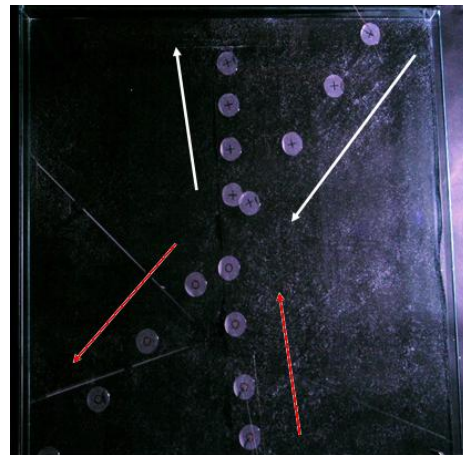


In the case of rolling ball, potential energy is consumed for rotation, thus the speed is lower compared to that of the Petri dish on the frictionless slope.

7.Collision

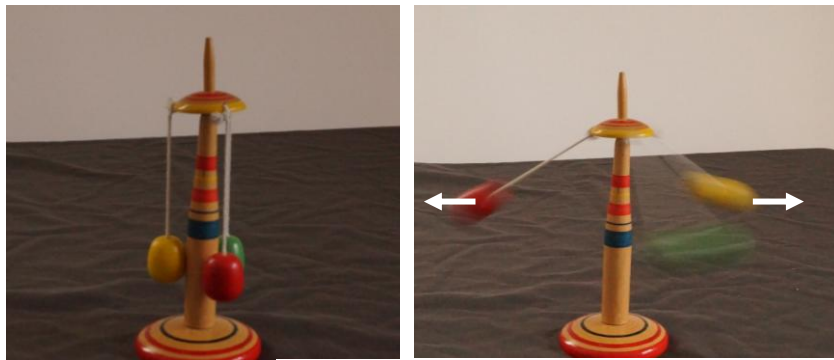


Aluminum disks (50 mm diameter and 5 mm thickness) were used in this experiment on the frictionless table.

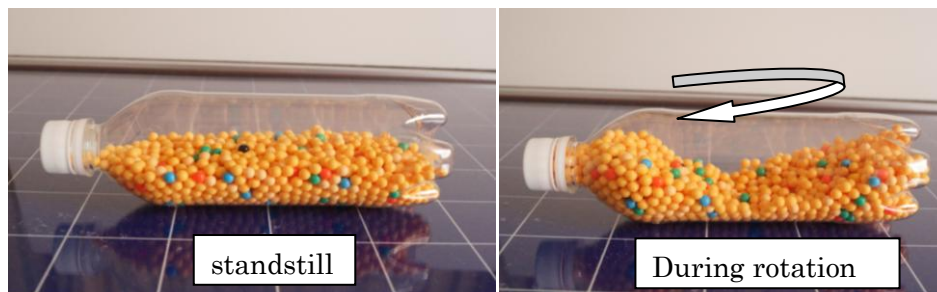


Demonstration of the momentum conservation in collision process, which was done on the frictionless table.

8.Centrifugal force

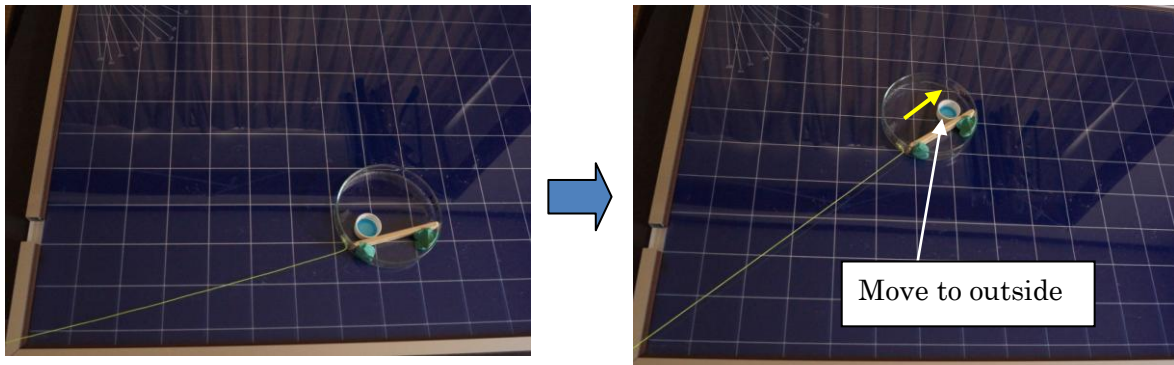


Merry-go-round



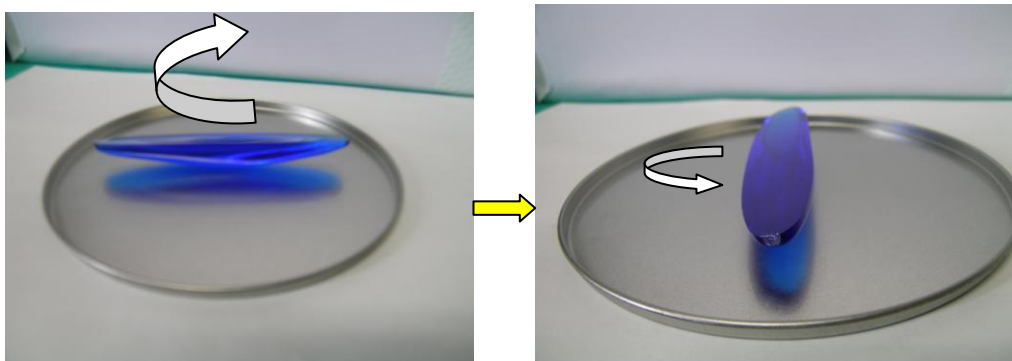
The particles move to outer side since they receive the centrifugal force.

- direct demonstration of the centrifugal force



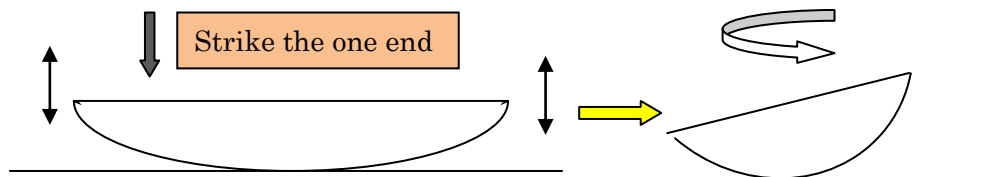
Try to rotate the big Petri dish with a string, then the small Petri dish move towards outside due to the centrifugal force; beads should be scattered both on the table and in the big Petri dish.

- Top of “Latru back”

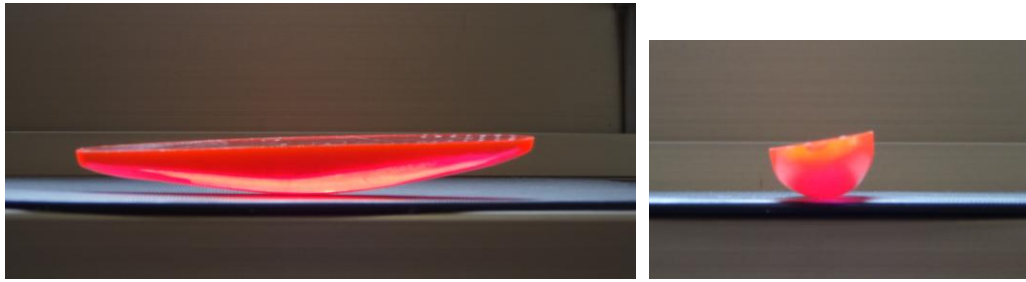


Turn to clockwise, then it finally change to anticlockwise rotation.

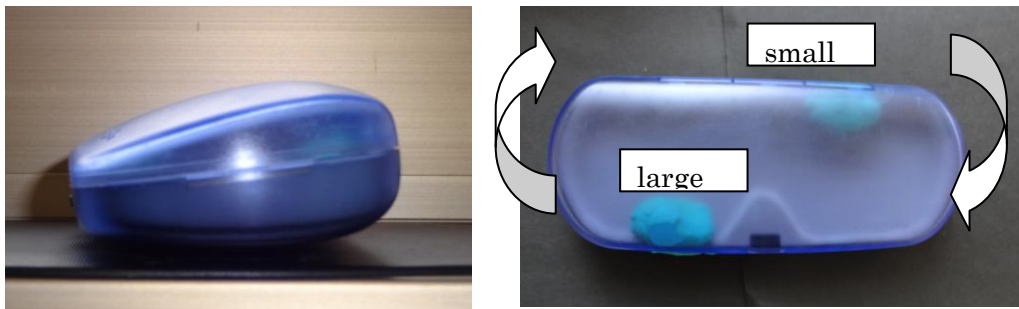
- Turn to anticlockwise, then nothing happen.



Strike the one end, then it start to rotate anticlockwise.



Cross sectional view of the top (anti-symmetric)



Similar experiment using spectacle case