Grand Piano Music Box

Experiment Objectives

1. Understand the principle of the piano music box.
2. Learn how to use the piano music box.
3. Stimulate children's interest in learning through scientific experiments and cultivate their scientific thinking.

Introduction

Guess:

A group of ducks can sing,
Few are black,
Many are white,
Press the duck's head,
And a little hammer inside
plays music.

(Guess a musical instrument)

Answer:

Do you recognize these instruments?

- Trumpet

- Drum set

- Erhu (Chinese two-stringed instrument)

Do you know what these instruments are?

- Guzheng
(Chinese zither)

- Flute

- Gong

Have you ever made your own small musical instrument?

Quiz:

How can you make your own instrument produce sound?

How can you make it produce high, low, loud, or soft sounds?

Answer

The loudness of sound is related to the strength of vibration.

The pitch of sound is related to the speed of vibration.

When an object vibrates strongly, we hear a louder sound.

When an object vibrates weakly, we hear a softer sound.

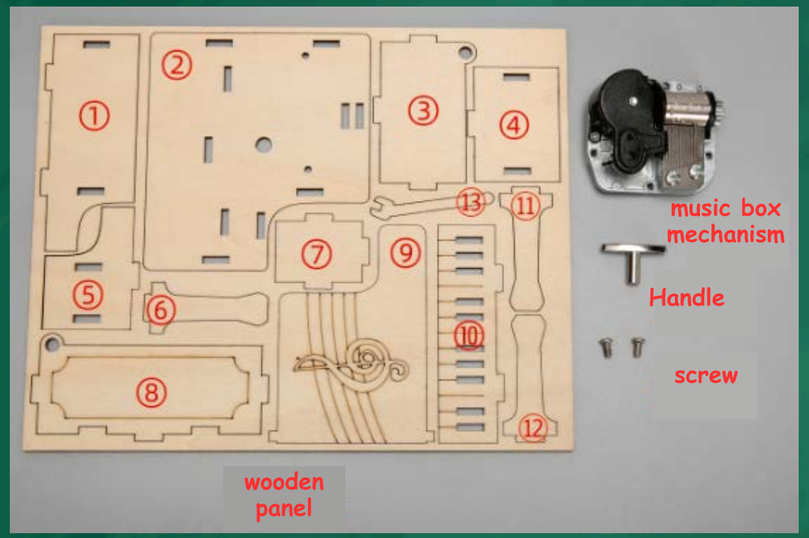
Scientific Knowledge:

The main parts of a music box include a power source (spring or handle), cylinder, soundboard, damper, base, and transmission mechanism.
The principle: The power source drives the cylinder (with small raised bumps) to rotate at a constant speed. When the bumps pass over the soundboard's metal tines, they pluck them (lifting and releasing), causing them to vibrate at specific frequencies to produce sound.
The soundboard is made from an elastic metal plate cut into strips of different thicknesses and widths, each producing a different frequency. Each bump on the cylinder corresponds to a musical note. As the cylinder rotates, the bumps pluck the tines in sequence to play a melody.
A typical music box cylinder rotates once every 8–17 seconds, enough to play the main part of a tune. High-end music boxes can play for 30 seconds to 8 minutes per cycle.
The damper (or governor) controls the speed of rotation by creating air resistance as it spins, preventing the spring from releasing energy too quickly and making the song play too fast

Let’s do a small experiment about the piano music box together!

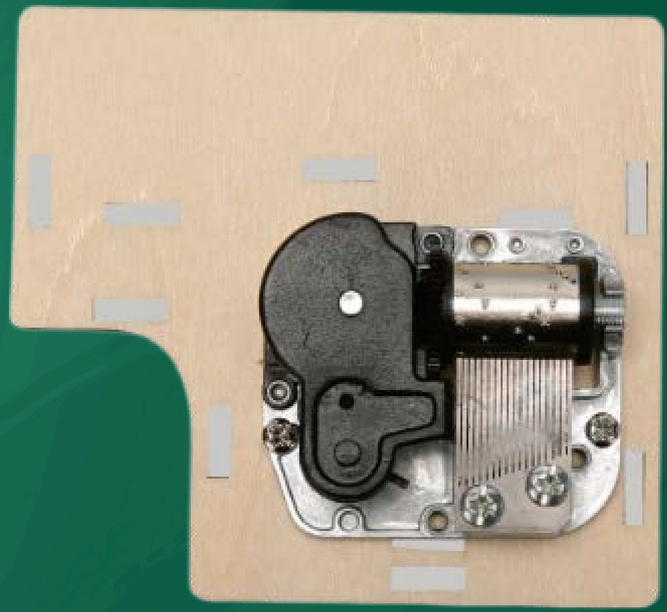
Experiment Steps

1



Recognize the materials

2



Fix the music box mechanism onto board No. 2

③

Connect board No. 1 and board No. 3

④

Fix steps 2 and 3 together, then attach boards No. 9 and No. 10 as shown

⑤

Connect board No. 4 and board No. 7

⑥

Connect board No. 5 and board No. 7

⑦

Connect board No. 8 to board No. 10

⑧

Combine step 6 and step 7 as shown

9

Install the assembly from step 2 underneath step 8

10

Attach the three leg supports

11

Install the handle at the bottom of the piano and fix the base with two screws

12

Use board No. 13 to support board No. 7 as shown — the piano music box is complete!

Experiment Principle:

The music box was first invented by Swiss clockmakers. It mainly consists of a spring, gears, a metal cylinder with raised dots, and metal comb teeth.

When the cylinder is driven by the spring, it rotates, and the raised dots pluck the metal teeth of different lengths, causing them to vibrate and produce sound.

In this experiment, we use a hand-cranked mechanism. By turning the handle, the cylinder rotates directly, allowing us to clearly observe how the music box produces sound.