**The Zip Tube**

Before bicycle messengers, FedEx, and the Internet, transmitting physical objects and information across a city in a timely manner was a struggle. Morse code allowed short messages to be sent rapidly, but operators scrambled to keep up with demand.

The pneumatic post allowed telegraphs, long letters, and even small gifts to be transported almost instantaneously across major cities on every continent, save Antarctica. By 1945, Paris’ 450 kilometre tube system could transport a hand written note across the city in two hours.

Canisters were pushed and pulled through an intricate system of pipes by using a vacuum and air compression to zip them through tubes at high speeds. Pneumatic tube systems are still in use today in banks, hospitals, and even a garbage disposal system on Roosevelt Island, New York.

**How to use the Zip Tube:**

1. Remove the supplies from the box and stand up the purple Mason jar.
2. Ensure the lid of the jar is on tightly.
3. Move the brass valve (on the narrow tubing) to the closed position (perpendicular to the tubing).
4. Locate the aluminum ball in the tubing system.
5. Slide the aluminum ball into the end of the tubing farthest away from the Mason jar.
6. Holding the Mason jar steady, insert the vacuum pump into the valve in the lid of the Mason jar.
7. Holding the pump firmly on the valve, pump 15-20 times, or until you feel significant resistance.
8. Remove the vacuum pump, you should not hear any air escaping.
9. Release the brass valve so that it is parallel with the tubing and watch as the aluminum ball zips through the tubing.
10. Note how far the ball travelled.
11. Repeat steps 2-9, adjusting the level of compression on the jar and the shape of the large clear tube.

**Questions:**

1. What happens to the aluminum ball if you close the end of the zip tube (with the end cap provided) and release the valve?
2. Which is more effective, the open end or the closed end? Why do you think that is?
3. What happens if you use the pump on the Mason jar while the brass valve is open?

**How it works:**

By sucking air out of the Mason jar, a vacuum is created. When the brass valve is open it lets air back into the jar through the open end of the tube system. Because the aluminum ball is in the way of the air, the powerful suction of the air into the Mason jar pushes the aluminum ball through the tubing system. When the open end of the tubing is closed, there is no way for fresh air to get into the system, so the Mason jar has no air to refill with. Because there is no air to be sucked into the Mason jar, there is no air to push the aluminum ball through the tubing system.

Large pneumatic tube systems operate on a closed system, using both vacuum and compression to send canisters short or long distances. These systems can be very complex with multiple tubes and transit stations.