# Atmospheric pressure experiment set M

**C15-6065-W0**

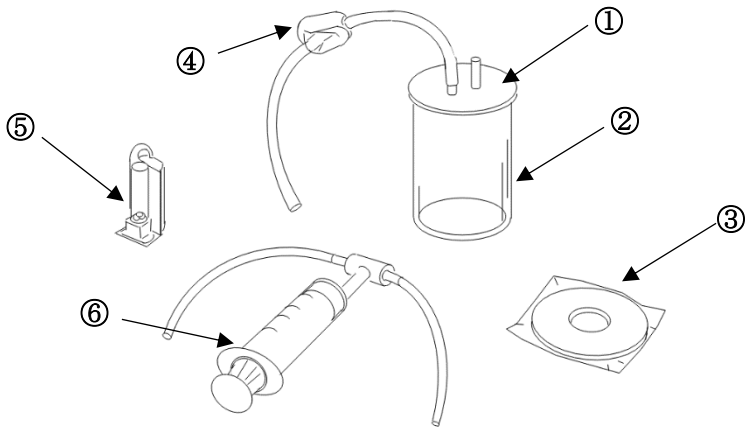
# Instruction manual

Apr 2021

# Purpose

**This lab set uses a vacuum pump to draw air from inside a container, creating a vacuum container from which the presence of air can be checked. The vacuum lid is equipped with two section inlets, turning restoration of normal pressure from a reduced pressure state into a simple process.**

# Name of each part




**① Vacuum lid ② Vacuum jar ③ Rubber packing ④ Pinchcock**
**⑤Vacuum buzzer (vibrating spy-window type) ⑥ Simple vacuum pump**

# Specification

① **Vacuum lid: Yellow copper (chrome plated), ϕ84 x 2mm (equipped with two section inlets)**

② **Vacuum jar (B) C15-6052-W1): Container: AS resin, ϕ74 x 110mm**

③ **Rubber packing: PE base semi-transparent rubber, ϕ88, ϕ28, t=3**

Note: The provided lid packing is covered with a protective sheet. If the packing is dirty or otherwise contaminated, rinse with water to clean.

④ **Pinchcock**

⑤ **Vacuum buzzer (vibrating spy-window type, Cat. No. C15-6052-02)**

A buzzer is emitted when a single AA-size battery is installed. When the diaphragm contacts the polystyrene balls, the balls are tossed around. The buzzer is designed in this way to visually identify the emittance of sound. (Batteries sold separately.)

Dimensions: approx. 30x34x74mm, Weight: approx. 29g (batteries not loaded)

⑥ **Simple vacuum pump (suction type; Cat. No. C15-6431)**

Move the plunger in a reciprocating motion inside the syringe cylinder to draw the air out of the container. - Suction mechanism: Yellow copper (chrome plated)

- Suction tube: Silicone resin, ϕ9 (outer diameter) x ϕ5 (inner diameter) x250mm
- Syringe cylinder: Plastic, 50ml - Degree of vacuum: approx. 30Torr (30mmHg)

# Experiments' Guide

## 1. Reducing pressure inside the vacuum jar and checking for the presence of air.

a) Attach the air intake tube to the vacuum lid and tighten the pinchcock column.

b) Attach the rubber packing to the underside of the vacuum lid. (Remove the rubber packing from its wrapping.)

Note: The rubber packing employs a newly developed rubber of high adherence and softness. If contaminated with dirt or dust, its adherence will deteriorate. To clean the rubber packing, rinse with water or wash with a detergent before re-using.

c) Attach the syringe cylinder to the simple vacuum pump (suction type). Next, connect the pump's draw tube to the suction inlet on the vacuum lid.

d) When the preparations illustrated above are complete, move the syringe plunger back and forth in a reciprocating motion to reduce pressure inside the vacuum jar, eventually sealing its lid hermetically. The lid cannot be removed in this state since the outside air is pushing down on the lid.

e) Loosen the pinchcock to let air into the container, enabling easy manipulation of the lid.

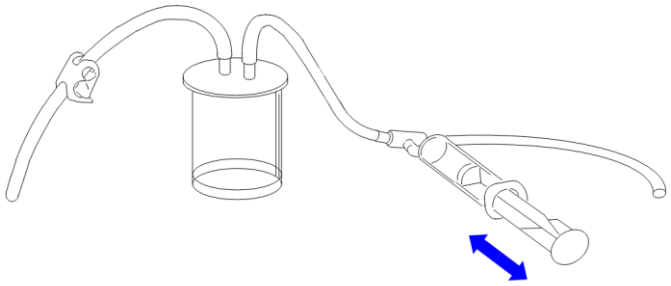


Fig.1 Simple vacuum pump setup

## 2. Experiments using the vacuum buzzer (Refer to Figs. 2 and 3.)

a) Use cellophane tape to attach one of the provided small bands to the underside of the vacuum lid as shown in Fig. 2.

b) Load an A-size battery into the vacuum buzzer. The buzzer will sound and the diaphragm will strike the polystyrene balls inside the vacuum buzzer, tossing them about. (Batteries not included.)

Reference: A piece of paper or other similar material can be wedged in the terminal of the battery to prevent the buzzer from sounding while the experiment is being set up. Remove the paper to set off the buzzer.

c) Hang the sounding buzzer from the rubber band attached to the vacuum lid and place it inside the vacuum jar. Be careful that the buzzer does not rub against the side of the container.

d) Confirm that a faint sound can be heard from the buzzer inside the container. The sound can also be verified by checking if the polystyrene balls are bouncing about.

e) As in experiment 1, draw the air out of the container using the pump. The buzzer will grow increasingly fainter until it can no longer be heard. However, the movement of the polystyrene balls proved that sound is still being emitted.

f) Tilt the vacuum jar until the buzzer contacts the inside wall. Vibration from the buzzer will be transferred along the glass, verifying that sound is still being emitted.

Reference: Sound can propagate in solids, liquids, and air, but not in a vacuum. Since this experiment fails to create a total vacuum, the sound of the buzzer can be heard if silence is maintained around the vacuum jar.

g) Loosen the pinchcock to allow air to slowly enter the container. The sound of the buzzer will become increasingly louder. The sound will gradually become faint, although the polystyrene balls continue to be about.

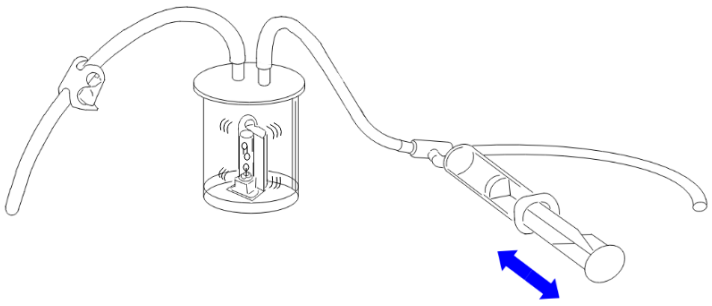


Fig.3

### 3. Cloud formation (Refer to Fig. 4.)

a) Dampen a piece of tissue with water and place it at the bottom of the container.

b) Add a small quantity of incense or similar substance that will serve as a cloud-forming agent, and close the lid.

c) Tighten the pinchcock and draw out the air using the pump. The inside of the container will become increasingly murky as clouds are formed.

d) Each time the vacuum is released, the cloudiness will disappear. Tightening the pinchcock will reproduce the cloudy state. This can be done several times to repeatedly observe the phenomenon. This experiment is unsuccessful unless a small amount of smoke is used to form the cloudiness.

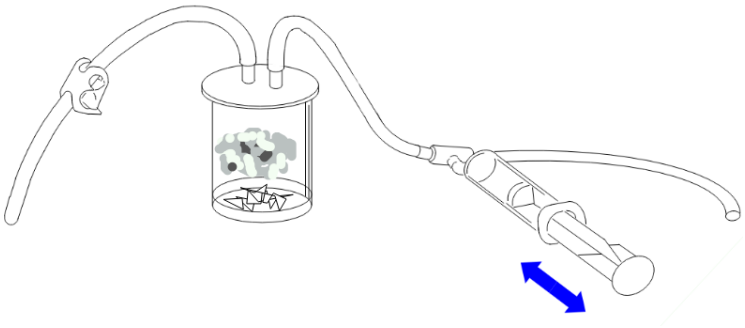


Fig.4

**4. Boiling under reduced pressure (Refer to Fig. 5.)**

a) Fill approximately 1/3 of the vacuum jar with water heated to 40~60° and close the lid.

Note: The container is heat-resistant against temperatures of up to 80°. Adding excessively hot water may cause the container to melt, crack, or otherwise deform.

b) Close the lid and tighten the pinchcock to draw the air out using the pump. As a vacuum is slowly created, the water will begin to boil without further heating.

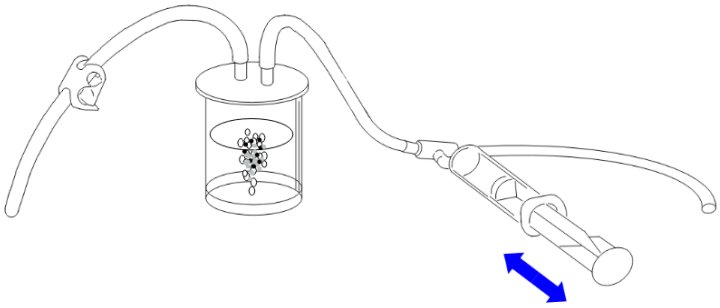


Fig.5

**5. Testing the amount of air drawn from the vacuum jar (Refer to Fig. 6.)**

a) Fill a 500 ml beaker with approximately 400 ml of water.

b) As in experiment q, draw the air out of the container using the pump. Submerge the free end of the air intake tube in the beaker of water.

c) After the air has been drawn out, loosen the pinchcock. The water in the beaker will be rapidly pumped into the vacuum jar.

d) The vacuum jar can be filled with water to approximately 90% capacity.

Reference: Water flows into the vacuum jar due to the air pressure exerted on the surface of the water in the open beaker.

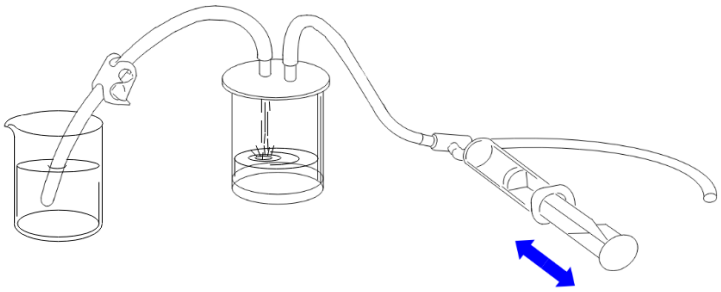


Fig.6

**6. Forcing the secretion of gas from pores in a plant leaf (Refer to Fig. 7.)**

a) Fill the vacuum jar approximately half full with water. Submerge a leaf in the water.

b) As in experiment 1, draw the air out of the container using the pump. Air bubbles will soon be seen forming on the underside of the leaf. Bubbles clinging to the leaf will be forced afloat by newly formed bubbles.

c) Bend the air intake tube in one spot to prevent air passage. Loosen the pinchcock and slowly extend the bent segment of the air intake tube to allow air to seep into the container.

Note: Air penetrating the container will agitate the water, hindering observation.

d) The bubbles clinging to the leaf will be reabsorbed by the leaf as pressure returns to normal in the container.

Reference: The fact that leaves have pores on the underside only and not on their surface is clearly demonstrated in this experiment.

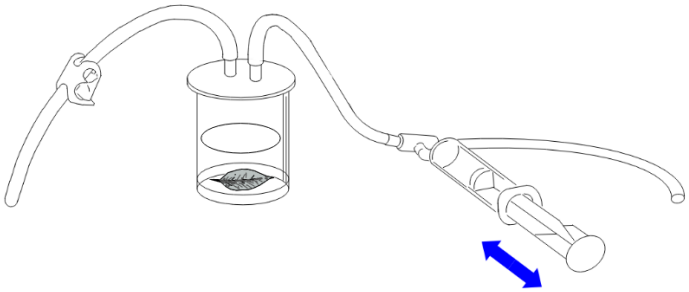


Fig.7

**7. Crushing an aluminum can (Refer to Figs. 8. and 9.)**

a) Secure the vacuum lid on top of a used beverage can. (A 65 mm diameter can is best.) Cans with pull tabs still attached are also acceptable.

b) Tighten the pinchcock and move the pump plunger back and force in a reciprocating motion to draw the air out of the can.

c) The aluminum can will be crushed from the pressure of the atmosphere.

Note: Use only aluminum cans for this experiment. Steel cans will not succumb to the degree of vacuum obtainable with the Simple Vacuum Pump.

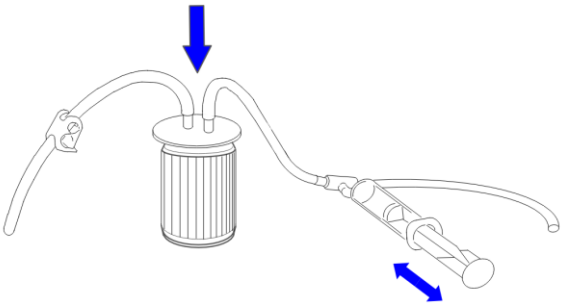


Fig. 8

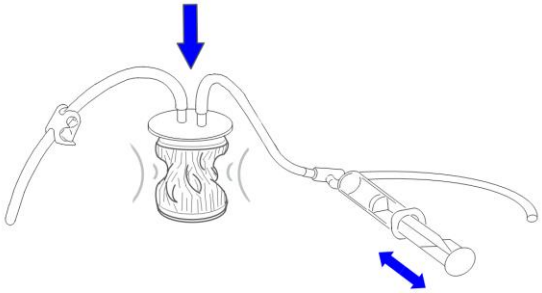


Fig. 9

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