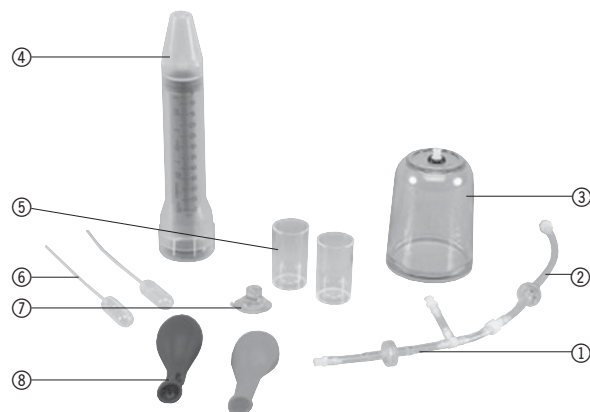# 3B SCIENTIFIC® PHYSICS

...going one step further

U45052 Vacuum set for students

Instruction Sheet

8/03 ALF

① Hose with T-piece and valve

② Hose with valve

③ Recipient (Experiment plate and bell jar)

④ Hand pump in case

⑤ Beaker

⑥ Pipettes

⑦ Mini bellows

⑧ Balloon

Equipment set for practical experiments introducing the basics of vacuum physics. Subjects that may be studied experimentally may include, for example:

- Determining the mass of air evacuated and its density.
- Effect of air pressure on a partially inflated balloon and a miniature bellows.
- Lowering of boiling point of liquids by reduced air pressure.

1. Safety instructions

- When attaching hoses do not use excessive force. Do not exert more than the pressure of your fingertips on the hose connectors when joining them together.
- To clean, use only warm water with a small amount of washing-up liquid. Never use solvents.

2. Description, technical data

A complete set of equipment consisting of an experiment plate incorporating a rubber ring and a bell jar that can be joined together with a recipient to enclose a coarse vacuum. The bell jar is equipped with a hose connection for attaching a plastic hose with a built-in valve. Evacuation is achieved using a simple hand pump. Beakers, bellows and balloons are provided for the experiments. All components are made of transparent plastic.

Experiment plate: 70 mm Ø approx.
Bell jar: 90 mm high approx.

2.1 Scope of delivery

1 Experiment plate with sealing ring
1 Bell jar
1 Hose with valve
1 Hose with T-piece and valve
1 Simple hand pump in case
1 Mini bellows
2 Balloons
2 Beakers
2 Plastic pipettes

3. Operation

3.1 Set-up of experimental apparatus

- Connect the hand pump to the bell jar via a hose as shown in the illustration.
- Slip the hose connectors inside one another and secure by turning with slight pressure from the fingertips.
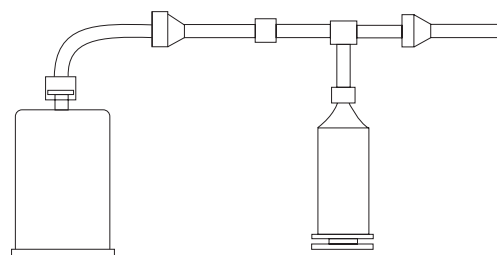
4. Sample experiments

4.1 Lowering of the boiling point of liquids
- Set up the apparatus as in the illustration.
- Fill the beaker with warm water and measure its temperature.
- Put the beaker on the experiment plate and place the bell jar over the top of them.
- Press the jar onto the plate and operate the pump until the liquid visibly starts to boil.
- Loosen the hose connection to the jar to let in air.
- Measure the temperature of the liquid once again.
- Compare the two temperatures and discuss.

4.2 Effect of reduced air pressure on a balloon
- Set up the apparatus as in the illustration.
- Put a partially inflated balloon on the experiment plate and place the bell jar over the top of them.
- Press the jar onto the plate and operate the hand pump 10-15 times.
- The balloon inflates.
- Alternative experiments can be performed using a mini bellows or a small quantity of shaving foam in a beaker.

4.3 Determining the mass and density of air
Also required:
1 set of scales measuring to the nearest 0.01 g
1 measuring beaker

- Press the bell jar and experiment plate together. Attach hose ② and determine the total weight.
- Connect the hand pump and evacuate the recipient.
- Loosen the connection between hoses ① and ② and measure the total weight of evacuated jar and hose connection.
- The difference in weight indicates the mass of air pumped out.
- Let air into the bell jar.
- Re-attach hose ② to determine the volume.
- Fill the recipient and hose ② with water adding a bung or holding your finger over the end of the hose.
- Pour the water into a measuring beaker and read off the volume.
- Determine the density of air by dividing the mass by the volume.

4.4 Filling a pipette without touching it
- Set up the apparatus as in the illustration.
- Fill a beaker with water and place it on the experiment plate.
- Put the open end of the pipette in the beaker and place the bell jar over the lot.
- Press the jar onto the plate and operate the hand pump a few times.
- Air disappears from the pipette.
- Let air into the recipient and the pipette will fill with water.