**Learning Objective:** Students obtain a feeling for what vacuum is and how/why different objects behave in a vacuum environment.

**Supplies per group:**

**Vacuum jar supplies** per group:

|  |  |  |
| --- | --- | --- |
| 1 | 16 oz mason jar  12/$10 at QFC |  |
| 2 | 2 one-way or check valves  10/$7 on Amazon  common pet-store item |  |
| 1 | Tees  Common pet-store item  25 tees/25 connectors total for $6 on amazon |  |
| 1 | Hose connector  Common pet-store item  Will be attached to jar lid to connect hose |  |
| 4 1” pieces | Tubing, 3/16 inner diameter, 5/16 outer, vincon pvc (from UW chemistry stockroom, 0.12/ft) |  |
| 1 | 60 ml syringe. Note 150 ml is suggested but these are expensive! 10/$9 on Amazon (also  $1.08/syringe in UW chemistry stockroom) |  |
|  | Drill- for drilling hole in lid. Hot glue gun for attaching hose connector to lid. This will be pre done. |  |

**Items for experiments:** Marshmallows, balloon, carbonated water, water bottle, soap (if they have some at home)

**Worksheet for observations**

**Instruction sheet for assembling the vacuum chamber**

**5-10 minute group introduction:**

Ask the group: What is in outer-space?

You should get answers like stars, planets, comets, etc.

But what there are huge distances between all of these objects. What is between? Vacuum, that is, nothing. (now technically there are still fundamental particles due to radiation- but this is beyond the scope of this lesson).

Ask the students what is around us right now? (answer is air). Tell them we are going to create chambers in which we are going to remove the air and we will see what happens to objects inside.

**Activity 1: Break into groups and make the vacuum chamber (10 min)**

**Activity 2: Experiment with items that represent the effects of vacuum on different objects. Discuss observations with the group. Here we provide explanations. (25-30 min)**

1. Exp 1: Marshmallow should get bigger. Then if air is let in, it should return to normal size. The reason is that the air pockets inside the marshmallow expand into the vacuum taking the marshmallow molecules with them.
2. Exp 2: Balloon- the air inside the balloon is expanding now that there is no outside pressure to push back.
3. Exp 3: Carbonated water: the bubbles should escape more quickly.

**Wrap up (6 minutes):**

Ask the students what they learned about today. Reinforce the idea that vacuum is the absence of air/gas.

Video on the worlds larger vacuum (3-4 minutes)

https://www.youtube.com/watch?v=E43-CfukEgs

**On-line resources:**

*Video this lesson is based on:*

See https://www.youtube.com/watch?v=qFzzN3oUUHE