



## Matchstick Rockets

**DESCRIPTION:** A small solid propellant rocket is made from a match and a piece of aluminium foil.

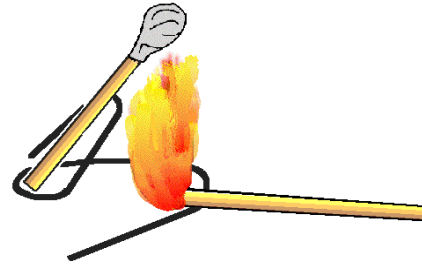
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### EQUIPMENT:

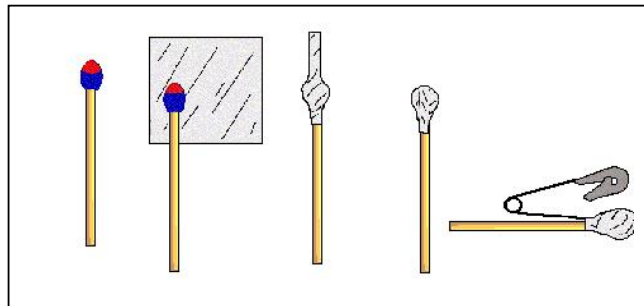
- 2 match book matches or wooden stick matches
- Small square of aluminium foil
- Paper clip
- Safety pin



### INSTRUCTIONS:

1. Take one match and wrap a small piece of aluminium foil around the match-head. Wrap the foil tightly.

2. Make a small opening in the foil wrapped around the match head by inserting the point of a safety pin and bending upward slightly.



3. Bend the paper clip to form a launch pad as shown in the diagrams. Erect the matchstick rocket on the pad. Make sure the pad is set up on a surface that will not be damaged by the rocket's exhaust such as a wooden board. Several layers of foil on the board work well.
4. Ignite the match by holding a second lighted match under the foil until its combustion temperature is reached.

**Caution:** It is important to brief those taking part in the activity on fire safety before commencing the activity. Be sure the match rocket is pointed away from people or burnable materials. It is recommended to have water or a fire extinguisher available. The foil head of the rocket will be very hot!



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## **DISCUSSION (*Exploring Beliefs and Attitudes*):**

The matchstick rocket demonstrates Isaac Newton's Laws of Motion as they relate to rocketry. Newton's third law states that for every action, there is an opposite and equal reaction. The exhaust of the fire products from the burning match (smoke and gas) is the "action" and the movement of the rocket in the other direction is the 'reaction.' The action thrust is produced when the match burns in an enclosed environment. The aluminium foil acts as a rocket combustion chamber. Because the opening in the foil is small, pressure builds up in the chamber that eventually escapes as a rapid stream of smoke and gas.

In an interesting variation of the experiment, try making holes of different diameters to let the combustion products out at different rates. A larger opening permits the smoke and gas to escape before it has time to build up much pressure. The escape of the products will be slower than produced by a matchstick rocket with a smaller opening. Isaac Newton's second law states that the force or thrust of a rocket is equal to the mass of the smoke and gas escaping the rocket, multiplied by how fast it escapes. In this experiment, the mass of the smoke and gas is the same for both cases. The difference is in how fast it escapes. Compare the distance travelled with the two matchstick rockets.



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