10 Throwing things

When you throw something in the air it goes up and down, and also travels sideways.

Do you know how to throw a ball or a stone the greatest distance? Do you throw it high in the air, send it close to the ground, or throw it somewhere between these two?

When something is thrown through the air it is called a **PROJECTILE**. It goes up as high as it can, then falls down. At the same time, it is moving sideways (Picture 1).

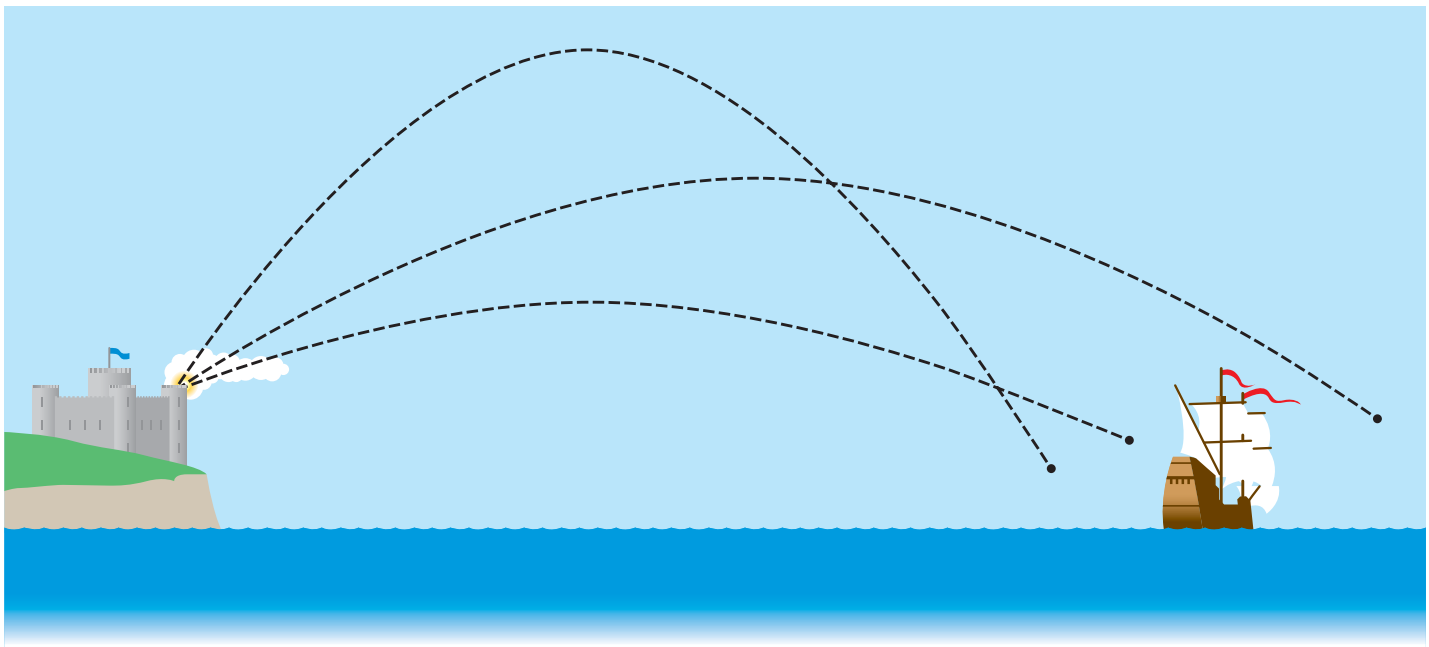
If you throw a ball straight up, all of your force is used up in making the ball go up, and almost none is used to make it go sideways at all. It gets very high in the air, but doesn't go sideways.

If you throw it sideways, you put all of your force into making it go sideways as far as it will go, but very little force is used to make it go up.

Cannon

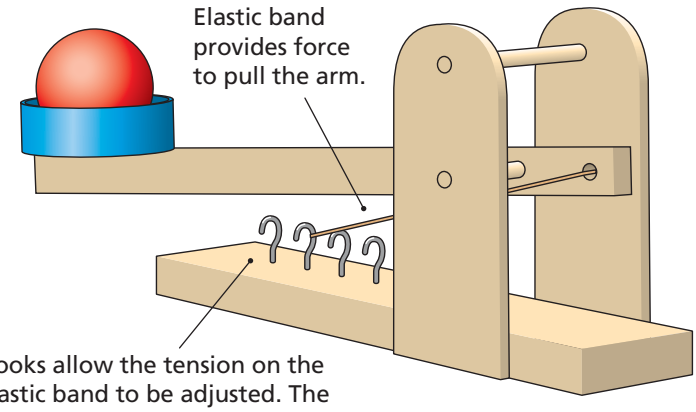
In the days of cannon, the problem of how to aim was just like throwing. The amount of gunpowder (which produced the force) was always the same, so the distance the ball could reach depended on the angle at which it was fired. Picture 2 shows a simple way of finding out what angle throws a projectile the greatest distance. In this case, the angle of the ramp changes, but the stretch of the elastic band (the force) is always the same.

▼ **(Picture 1) How far a ball, a cannonball, a stone or any other object travels depends on how hard it is thrown and the angle it is thrown at.**



The effect of air

As the projectile flies through the air, the air resists it and slows it down. This may slightly change the angle which gives the furthest distance. The best angle for sending a projectile the furthest is 45 degrees, that is half-way between the horizontal (sideways) and the vertical (straight up).

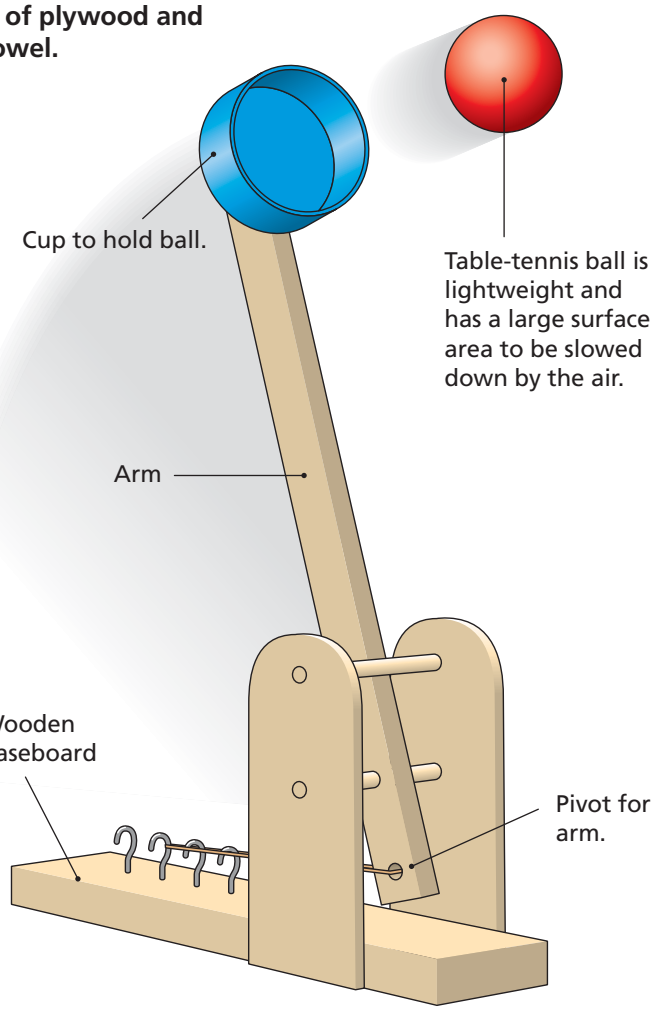


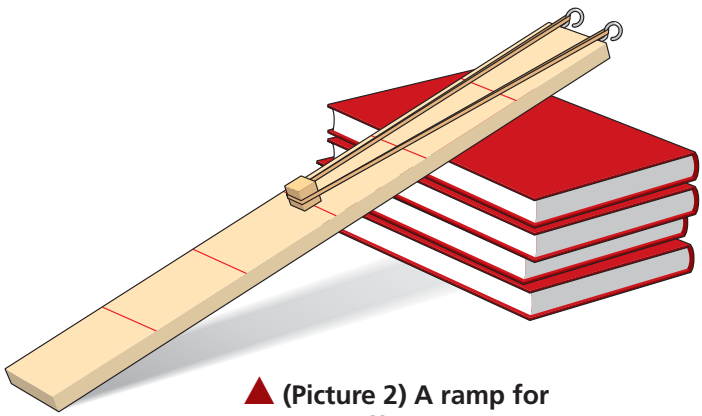
Ballister

The distance you can throw something depends on the force you use to throw it, as well as the angle you throw it at. Picture 3 shows you how to make a medieval throwing machine called a ballister. The machine is designed so that when you press down gently on the front edge of the rod, the ball will be thrown into the air.

You can make a fair test of how far a ball will travel with different amounts of force by stretching the elastic band by different amounts. The different hooks allow for different amounts of stretch.

▶ (Picture 3) A ballister, made from a sheet of plywood and a wooden dowel.





▲ (Picture 2) A ramp for sending off projectiles.

Summary

- **Something that is thrown through the air is called a projectile.**
- **A projectile travels furthest when it is thrown from an angle of about 45 degrees.**

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