

A2 ACTIVITY 6: THE ENERGY OF SWING

Background

The pendulum is a simple machine for transferring **gravitational potential energy** to **kinetic energy** and back again. This activity centres on the conversions between **kinetic potential energy** and **gravitational potential energy** as a pendulum swings back and forth.

When the pendulum is at the highest point of its **swing** it has no **kinetic energy** but at that moment its **gravitational potential energy** is at its maximum.

As the pendulum swings downwards, the **gravitational potential energy** is transferred to **kinetic energy**, causing the pendulum to **accelerate**.

At the lowest point of the swing the **kinetic energy** is at a maximum and **gravitational potential energy** is at a minimum.

The pendulum **swings** upwards until it reaches the top of its **swing**. At this stage the **kinetic energy** is at a minimum whilst the **gravitational potential energy** is at a maximum.

This cycle continues, **but the energy does not remain the same**. Each swing becomes lower as some energy is used as the pendulum overcomes air resistance – **friction**.

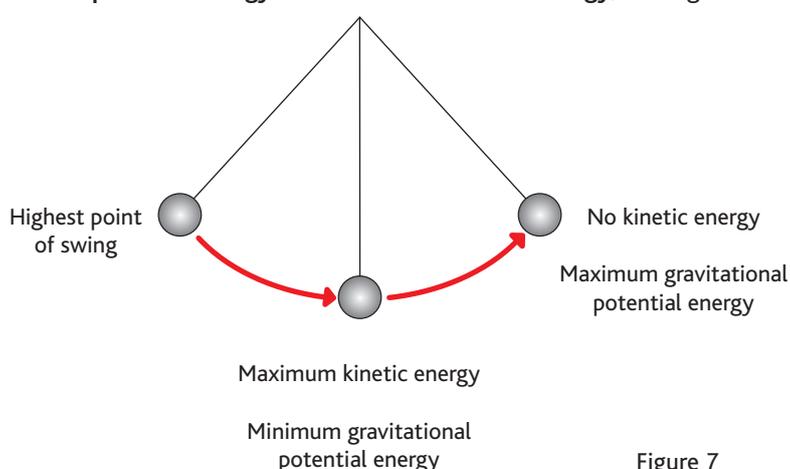


Figure 7

Equipment required:

- Retort stand
- Squash ball or similar
- Small cup-hook or a thumb-tack attached to a piece of string
- Sellotape
- Newton's cradle (optional)

What to do:

1. Set up the Newton's cradle. Ask the class if anyone can tell you what will happen if you pull back one of the balls and then release it. After collecting predictions, pull back a ball at one end of the Newton's cradle, and release it. Compare observations with predictions. Ask the class to predict what would happen if you pulled back two balls and released them. If a Newton's cradle is not available a video of this activity is available [here](#).
2. After watching the video the following activity can be carried out. Fix the cup-hook or attach the thumb-tack to the squash ball using Sellotape. Using the string, suspend the ball from the retort stand.

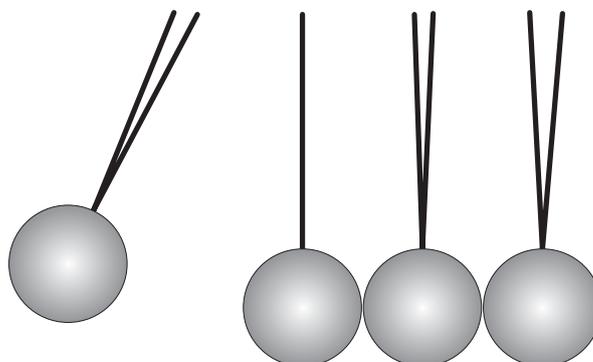
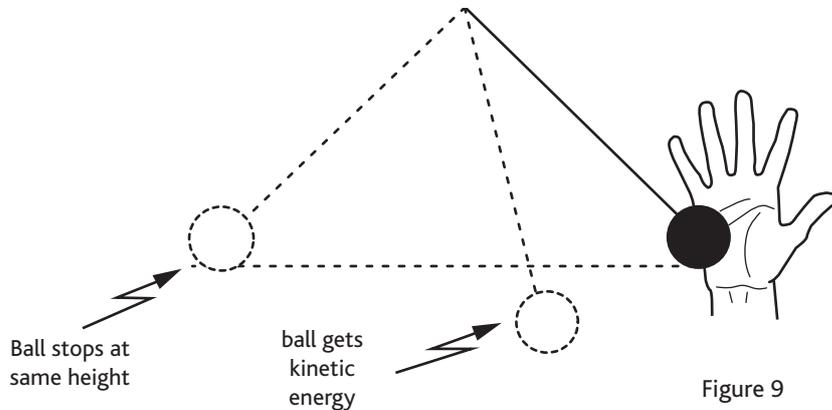


Figure 8

3. Pull the ball back a distance and ask a student to hold their palm at that point, as shown in Figure 9.



4. Release the ball and observe it as it oscillates. Remind the student not to move their hand.
5. As the ball swings back and forth it is behaving like a pendulum. Prompt discussion by asking questions such as – Can you think of where you may have seen a pendulum in action? How about if you are on a swing? What about a trapeze artist?

What next:

- It may have been a while since students sat on a swing. Ask them to think back on what it was like to swing. Ask them to consider the following questions:
 - ① *How would someone on a swing reach a good height without anyone pushing them?*
 - ① *What would they do to make themselves swing faster and higher?*
 - ① *What energies are involved in this process?*
- [Click here](#) for a short video on swings – it might be useful to show after the students have offered some explanations on the swing questions above.