# Waves: motion of a disturbance

Student activity • observation and reasoning

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## The question

**Does the material travel along with a wave?**

Observe a marked coil on a long demonstration spring. Compare the direction of the disturbance with the motion of the coil.

## Equipment

- Long demonstration spring and small tape marker
- Booklet, pencil and ruler

Check the spring for damage. Keep it on the surface, below face height, with secure holders and a clear sweep area. Use small motions; do not overstretch or release a stretched end. Keep fingers clear of closing coils.

Course coverage: Shared Physics / Double Award: 3.1–3.4. Transverse and longitudinal waves; wave quantities.

## Plan, model or apparatus sketch

**Draw the apparatus and wave or ray directions; label the normal or equilibrium position where relevant.**

# Method and reasoning

Read the whole sequence before starting

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**1.** Staff lay a demonstration spring on a clear smooth surface, stretch it only within its manufacturer's recommended range and attach a small light tape marker to a middle coil.

**2.** Two staff-approved holders keep the ends secure at surface level. Other learners observe from outside the sweep of the spring. Move one end gently sideways to create a single transverse pulse.

**3.** Sketch the direction of travel of the pulse and the sideways motion of the marker. Observe its return towards its resting position; it does not travel to the far end with the pulse.

**4.** Generate several small repeated sideways oscillations. Identify the resting line, amplitude and the distance between matching adjacent crests. Do not equate amplitude with crest-to-trough distance.

**5.** Move one end gently forwards and backwards along the spring to create compressions and rarefactions. Compare the marker's motion with the direction of wave travel.

**6.** Draw longitudinal and transverse models with separate arrows for material motion and wave travel. Define frequency and period, and explain energy transfer without net transport of the medium in this model.

## Cleanup

- Relax the spring slowly with both ends controlled, remove the marker and store without kinking.

# Record your evidence

Blank spaces are for your own work

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## Reference and task data

A spring models mechanical waves. For transverse waves, oscillations are perpendicular to propagation; for longitudinal waves they are parallel. Real water-surface particle motion is more complex than purely vertical bobbing. Electromagnetic waves do not require a material medium.

| Observation | Marker motion | Wave travel |
| --- | --- | --- |
| Single transverse pulse | | |
| Repeated transverse wave | | |
| Longitudinal compression | | |

**Show your calculations, labelled model or correction here.**

# Explain and evaluate

Use evidence and show calculation steps where relevant

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**1.** What moves along the spring?

**2.** Does the marked coil reach the far end?

**3.** How are transverse oscillations directed?

**4.** How are longitudinal oscillations directed?

**5.** What is amplitude?

**6.** How do frequency and period differ?