

TRAFFIC LIGHTS

National Curriculum Science PoS Sc4: 3f

QCA Science Unit 5F: Changing sounds

Scottish 5–14 Guidelines Properties and uses of energy: Level D

HOW TO GATHER THE DATA

You will need a sound sensor that is easily portable, such as Ecolog or Explorer, and a safe place for the children to stand while they collect the data. (Explorer is available from DCP Microelectronics at dcpmicro@aol.com; Ecolog is available from Data Harvest.) It is a good idea for the children to have an adult with them in order to make sure that they do not distract any drivers. The sensor should be placed about 2m from the road, pointed at the road, and not moved. You can collect as much data as you like and interpret it at a later stage. The children might find it helpful to note down what was happening at various points. The data have been simplified for this activity, but they are real data of the kind that children can collect. Note that the data will be easier to interpret if you choose a place where there are reasonable gaps between the vehicles.

THE SCIENCE BEHIND THE DATA

Sound is produced by vibration, and sound vibrations can pass through the air to a sensor. The loudness (volume) of a sound depends on the size of the vibrations – for example, vibrations caused by a heavy lorry on the road can be heard some distance away. The pitch of a sound depends on how close the vibrations are: if an object is vibrating rapidly, it gives many vibrations in a short time and the pitch of the sound is high.

The noise made by vehicles is a combination of the engine vibrating and the tyres vibrating. As a car approaches a sensor, the sound gets louder; as it goes away, the sound gets quieter. The pitch also changes: it is higher as the

car approaches and lower as the car goes away. When the car is approaching, the vehicle moves nearer in the time taken between one vibration and the next. The vibrations are closer together than those produced by a stationary vehicle, so the pitch of the sound is higher. As the car moves away, the opposite happens: the car has moved further away between one vibration and the next. The vibrations are further apart, so the pitch of the sound is lower.

These data were collected on a busy city road, so the peaks were close together (indicating frequent traffic) and the level of background noise was higher than it would be in a more rural area. It is surprising how much can be interpreted from the graph. More able children may realise that since the traffic from the minor road was quieter, the sensor must have been nearer to the major road. They might also suggest that the first car on the graph was turning away from the sensor and the second one went straight across the junction, so was louder. They could investigate the relative loudness of different vehicles.

Answers

1. The loudness of the sound increased whenever a car was passing by. (The child needs to realise this in order to answer the subsequent questions, so it is a good idea to check this answer before proceeding.)
2. Five (one for each peak).
3. At 30 seconds.
4. The sound level dropped (because no traffic was moving).
5. Two (one for each peak).
6. At 50 seconds.
7. The first set.
8. The first road is a main road, and the second is a side road with less traffic. (Accept any other sensible suggestions.)
9. The first set.
10. The loudness was much higher for the first set.
11. There is always some background noise on a street, especially during the day.