# Year 13 Science: The Doppler effect

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

## Practice

1. A 600 Hz source moves at 20.0 m s$^{-1}$ towards a stationary listener. Using v = 340 m s$^{-1}$, find the frequency heard.

2. The same source moves away from the listener at 20.0 m s$^{-1}$. Find the frequency heard.

3. Find the wavelength of the sound in front of the source in question 1.

4. A galaxy's 486.1 nm hydrogen line is measured at 484.2 nm. Is it approaching or moving away, and how fast?

5. A car drives in a circle around you at constant speed, sounding a 400 Hz horn. What frequency do you hear?

## Exam-style question: a jet boat on the river

**A jet boat on the Waikato River sounds a 750 Hz horn while travelling at 22.0 m s$^{-1}$ straight towards Mere, who is standing on a jetty in its path. Take the speed of sound in air as 343 m s$^{-1}$.**

6. Calculate the frequency Mere hears.

7. Explain why Mere hears a different frequency from the one the horn emits.

8. The boat swerves past the jetty and travels directly away at the same speed. Calculate the frequency she now hears.

9. An underwater microphone ahead of the boat picks up its 400 Hz engine note as 406.0 Hz while the boat approaches at 22.0 m s$^{-1}$. Calculate the speed of sound in the water.

## Fix the mistake

10. Correct this statement: "The source is approaching, so I used v + vs on the bottom."

11. Correct this statement: "The siren itself gets higher as the ambulance speeds up."

12. Correct this statement: "The sound travels faster in front of the moving ambulance."

13. Correct this statement: "At the moment the car passes me I hear the lowest pitch."