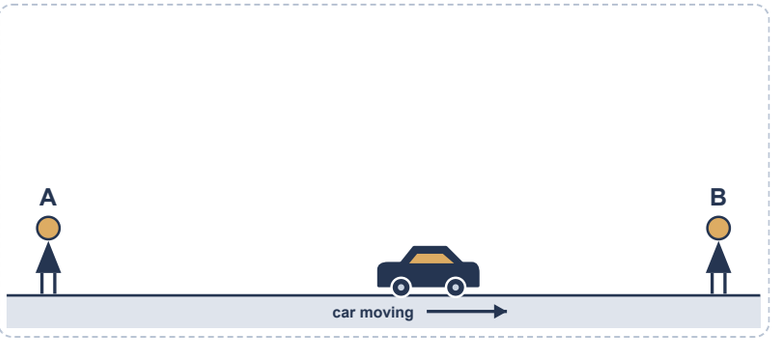
Doppler Effect

A car drives past two people

Draw wavefronts to show the sound emitted from the car



wave speed = frequency × wavelength

$$v = f \times \lambda$$

USE **constant** **increases** **decreases**

What happens to the…	at A	at B
☐ Speed of sound in air		
☐ Distance between wavefronts		
☐ Wavelength		
☐ Frequency		

State and explain

A **State and explain what happens to the frequency of the sound heard at A.** *The car is moving away from A.*

1. The speed of sound in air _____
2. The distance between wavefronts _____
3. so the wavelength _____
4. so the frequency _____

B **State and explain what happens to the frequency of the sound heard at B.** *The car is moving towards B.*

1. The speed of sound in air _____
2. The distance between wavefronts _____
3. so the wavelength _____
4. so the frequency _____

Exam-style question

An ambulance drives along a straight road at a steady speed with its siren on. The siren emits sound of frequency **700 Hz**. The diagram shows the wavefronts of the sound. X and Y are two people standing by the road.

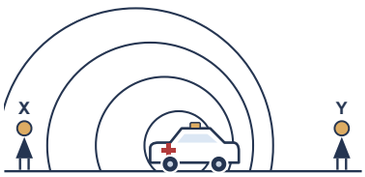
(a) State which way the ambulance is moving. Give a reason from the diagram. **[2]**

(b) Explain why person Y hears a higher frequency than 700 Hz. **[3]**

(c) The speed of sound in air is **340 m/s**. Calculate the wavelength of the 700 Hz sound when the ambulance is stationary. **[3]**

(Total for question = 8 marks)

DIAGRAM



Not to scale. Each circle is a wavefront.

ANSWER

The Doppler Effect

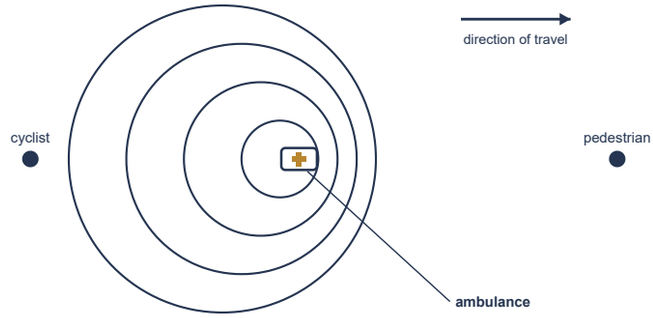
Two past-paper style questions on the **Doppler effect**. Each one is a longer explanation — plan your answer, then write it as a **chain of steps**, each one leading to the next.

Question 1

[5 marks]

An ambulance drives along a straight road with its siren on. The siren gives out sound at a constant frequency.

The diagram shows the wavefronts of the sound. A pedestrian stands in front of the ambulance. A cyclist is behind it.



(a) Explain why the frequency of the sound heard by the pedestrian is **higher** than the frequency given out by the siren. **(4)**

(b) State how the frequency heard by the **cyclist** compares with the frequency given out by the siren. **(1)**

Question 2

[5 marks]

A weather station uses radar to track a storm.

The radar sends microwaves towards the rain. The raindrops reflect the microwaves back to a detector at the station.

The rain is being blown **away** from the station. The detected microwaves have a different frequency from the microwaves that were sent out.



(a) State the name of the effect that causes this change in frequency. **(1)**

(b) Explain how, and why, the frequency of the detected microwaves is different from the frequency that was sent out. **(4)**

(Total for Questions 1 and 2 = 10 marks)