

14.5 The Doppler Effect

Name: _____ Class: _____ Date: _____

Total: 8 marks

Objective

Build the skills to answer exam questions on **the Doppler effect**.

You must be able to:

- describe the **Doppler effect** 多普勒效应 as a change in observed frequency due to relative motion
- explain why an approaching source is heard higher and a receding source lower
- give applications such as radar, sonar, and astronomical **redshift** 红移

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ The Doppler effect

When a source and observer move relative to each other, the **observed frequency changes**.

■ Higher or lower

- **Approaching** —waves bunch up → shorter wavelength → **higher** frequency (higher pitch).
- **Receding** —waves stretch out → **lower** frequency.

■ Applications

Speed-camera radar, sonar, and the **redshift** of distant galaxies (showing the Universe is expanding).

2 Practice

2.1 State what the Doppler effect is. [1]

2.2 State whether an approaching siren sounds higher or lower in pitch. [1]

2.3 Give one application of the Doppler effect. [1]

3 Exam-style questions

3.1 As a sound source moves toward you, the frequency you hear is [1]

- **A** higher
 - **B** lower
 - **C** unchanged
 - **D** zero
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3.2 The redshift of distant galaxies shows that they are [1]

- **A** approaching us
 - **B** receding from us
 - **C** stationary
 - **D** exploding
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3.3 A car sounding its horn drives past a stationary listener.

(a) Describe the change in pitch the listener hears as the car approaches and then recedes. [2]

(b) Name the effect responsible. [1]

4 Go further

- work through the **14.5 The Doppler Effect** lesson on the **Learn** page;
- read the **Waves and Sound** section of the AP Physics 2 handout on the **Know** page.

Solutions

2.1 the change in the frequency observed when a source and observer move relative to each other.

2.2 higher.

2.3 radar speed guns, sonar, or astronomical redshift (any one).

3.1 A.

3.2 B.

3.3 (a) the pitch is higher while the car approaches, then drops to a lower pitch as it recedes. (b) the Doppler effect.