

Exercise walk-through

The Doppler Effect ■ 14.5

eXercise

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

Method — The Doppler effect

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

Method — Higher or lower

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

Method — Applications

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

Practice 2.1 ■ 1 mark

State what the Doppler effect is.

Solution 2.1

Method: The Doppler effect

Worked steps

the change in the frequency observed when a source and observer move relative to each other **B1**.

Practice 2.2 ■ 1 mark

State whether an approaching siren sounds higher or lower in pitch.

Solution 2.2

Method: Higher or lower

Worked steps

higher **B1**.

Practice 2.3 ■ 1 mark

Give one application of the Doppler effect.

Solution 2.3

Method: The Doppler effect

Worked steps

radar speed guns, sonar, or astronomical redshift (any one) **B1**.

Exam-style 3.1 ■ 1 mark

As a sound source moves toward you, the frequency you hear is

A higher

B lower

C unchanged

D zero

Solution 3.1

Method: The Doppler effect

A higher



B lower

C unchanged

D zero

Worked steps

A.

Exam-style 3.2 ■ 1 mark

The redshift of distant galaxies shows that they are

A approaching us

B receding from us

C stationary

D exploding

Solution 3.2

Method: Applications

A approaching us

B receding from us



C stationary

D exploding

Worked steps

B.

Exam-style 3.3 ■ 2 marks

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.
- (b) Name the effect responsible.

Solution 3.3

Worked steps

(a) the pitch is higher while the car approaches, then drops to a lower pitch as it recedes **B1** **B1**. (b) the Doppler effect **B1**.