A-LEVEL PHYSICS • EXERCISE SHEET

7.2 Transverse and longitudinal waves

Name: _____ Class: _____ Date: _____ **Total: 13 marks**

Objective

Build the skills to answer exam questions on **transverse and longitudinal waves** — comparing them and reading their graphs.

You must be able to:

- compare **transverse** 横波 and **longitudinal** 纵波 waves
- give examples of each and identify **compressions** and **rarefactions**
- interpret displacement–distance and displacement–time graphs

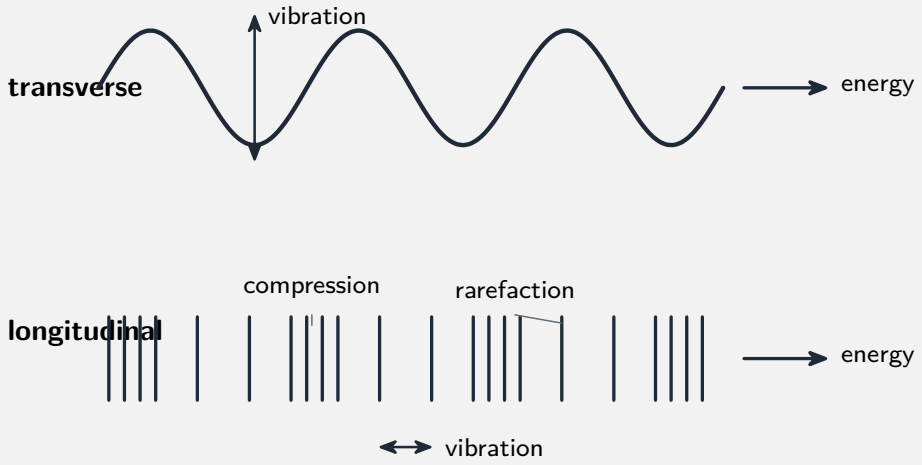
1 Worked examples

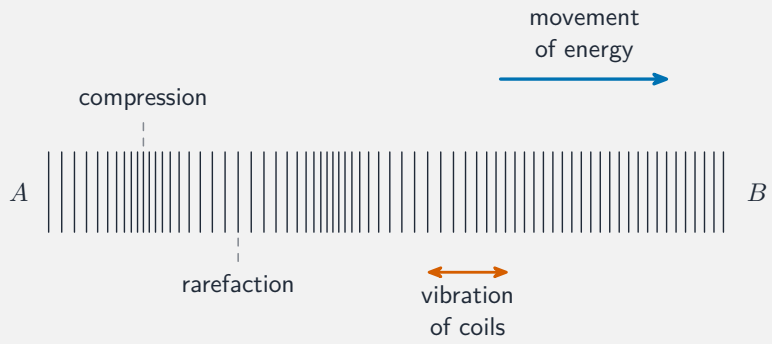
Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

Transverse vs longitudinal

- **Transverse:** particles vibrate **perpendicular** to the energy travel (rope, all EM waves, water ripples).
- **Longitudinal:** particles vibrate **parallel** to the energy travel; the wave is **compressions** and **rarefactions** (sound, slinky squashes).

A key difference often tested: only **transverse** waves can be **polarised** (restricted to one plane of vibration); longitudinal waves **cannot** (covered fully in 7.5).





A longitudinal wave on a slinky

Graphs

Both look like a **sine curve**. A **displacement–distance** graph gives the **wavelength** λ; a **displacement–time** graph gives the **period** T (then $f = 1/T$).

2 Practice

Now apply the methods above.

2.1 State the difference between a **transverse** and a **longitudinal** wave. [2]

2.2 Give **one** example of a transverse wave and **one** of a longitudinal wave. [2]

2.3 Name the two features that make up a **longitudinal** wave. [1]

2.4 State what you read from a **displacement–time** graph and from a **displacement–distance** graph. [2]

3 Exam-style questions

3.1 Which of these is a **longitudinal** wave? [1]

- **A** light

- **B** a wave on a rope
- **C** sound
- **D** water ripples

3.2 Sound is a longitudinal wave. Describe how the **air particles** move as the wave passes. [2]

3.3 State whether **all electromagnetic waves** are transverse or longitudinal. [1]

3.4 A displacement–time graph for a wave shows a period of 0.020 s. Calculate the **frequency**. [2]

3.5 State **one** property that a **transverse** wave has but a **longitudinal** wave does not. [1]

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4 Go further

You are now ready for the real exam questions on this subtopic. Open the **7.2 Transverse and longitudinal waves** past-paper sheet in the Library, or try these in **Practice mode**:

- 9702/11 N25 —Q24 (transverse and longitudinal waves)
- 9702/13 N25 —Q25 (longitudinal wave graph)
- 9702/11 J25 —Q25 (comparing wave types)
- 9702/12 J25 —Q25 (wave properties)

Solutions

2.1 In a **transverse** wave the particles vibrate **perpendicular** to the direction of energy travel; in a **longitudinal** wave they vibrate **parallel** to it.

2.2 Transverse —any one: light/EM wave, wave on a rope, water ripple. Longitudinal —sound, slinky compression wave.

2.3 Compressions and **rarefactions**.

2.4 Displacement–time → the **period** T (and so frequency); displacement–distance → the **wavelength** λ.

3.1 C —sound.

3.2 The air particles vibrate **back and forth parallel** to the wave's direction, forming regions of high pressure (**compressions**) and low pressure (**rarefactions**).

3.3 Transverse.

3.4 $f = 1/T = 1/0.020 = 50$ Hz.

3.5 It can be **polarised** (restricted to one plane of vibration) —a longitudinal wave cannot.