

Velocity and acceleration in the lab

ASHPHYS · REVISION CHEAT SHEET

AS Level

9702 AS Ch.2

Chapter 2: Accelerated motion

Lesson 2.7

Sections 2.7

Goal: Analyse a ticker tape to find velocities and an acceleration.

01 The big picture

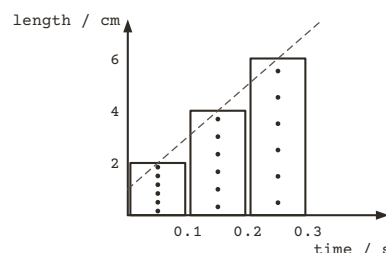
A ticker-timer prints dots on a moving tape at 50 per second, so each space between dots is 0.020 s. Cut the tape into strips of 5 spaces: each strip is 0.10 s, and its length $\div$ 0.10 s is the average velocity during it.

Stuck side by side, the strips form a velocity–time graph (a tape chart). Strips growing by the same amount each time mean uniform acceleration. Motion sensors and video analysis give the same data automatically.

Ticker-timer [paraphrase]

Marks a dot on a tape every 0.020 s (50 Hz) as the tape is pulled through.

Fig. 1 · A tape chart



Equal steps in strip length mean equal rises in velocity: uniform acceleration.

02 Key equations

Velocity from one strip

$$v = \frac{\text{strip length}}{0.10 \text{ s}}$$

Acceleration

$$a = \frac{\Delta v}{\Delta t}$$

Symbols and units

v average velocity during a strip m s^{-1} Δt time between strip centres s

03 Sample problems with solutions

Sample 1 · A tape chart

Five-space strips from a 50 Hz ticker-timer are 2.0 cm, 4.0 cm and 6.0 cm long (Fig. 1). Find the velocity during each strip and the acceleration.

Step 1. Each strip lasts $5 \times 0.020 = 0.10$ s:

$$v = \frac{0.020}{0.10}, \frac{0.040}{0.10}, \frac{0.060}{0.10} = 0.20, 0.40, 0.60 \text{ m s}^{-1}$$

Step 2. The velocity rises by 0.20 m s^{-1} every 0.10 s:

$$a = \frac{0.20}{0.10} = 2.0 \text{ m s}^{-2}$$

Answer: 0.20, 0.40, 0.60 m s^{-1} ; uniform acceleration 2.0 m s^{-2}

Unit check: $\frac{\text{m s}^{-1}}{\text{s}} = \text{m s}^{-2} \checkmark$

04 Practice problems

P1 How long is 10 spaces on a 50 Hz ticker tape?
Answer: 0.20 s

P2 A five-space strip is 3.5 cm long. Find the average velocity.
Answer: 0.35 m s^{-1}

P3 Five-space strips are 1.5, 2.5 and 3.5 cm long. Find the acceleration.
Answer: 1.0 m s^{-2}

P4 All the strips on a tape chart are the same length. What does that show?
Answer: Constant velocity (zero acceleration)

05 Other useful information

Common mistakes

- ✗ **Wrong:** Count the dots instead of the spaces.
- ✓ **Right:** Time = number of spaces $\times$ 0.020 s; 6 dots make 5 spaces.

Exam tips

- The acceleration uses the time between strip centres: 0.10 s for neighbouring strips.

What the syllabus asks

- 9702 topic 2: measure velocity and acceleration. Coursebook 2.7.

Explore: [Practice questions for this lesson](#)