Experiment 3: Page 77

Aim: To determine the magnitude of the velocity of an object that falls freely.

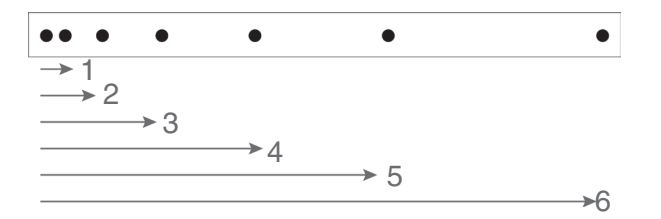
Investigative question:
How will a free-falling object accelerate for time intervals that increase constantly?

Hypothesis:
A free-falling object will constantly accelerate downwards for time intervals that constantly increase.

Variables:

Independent variable (Which is changed.)	**Dependent variable** (Which is measured.)	**Controlled variable(s)** (Which remain(s) the same.)
Time interval	**Displacement of the interval**	**Mass; gravitational force; period of ticker timer; friction; air resistance**

Apparatus:



Results:

Spaces between consecutive dots	**Distance between dots: ΔD (m)**	**Time = (period) × number of consecutive spaces Δt (s)** $T = \frac{1}{f} = \frac{1}{50} = 0{,}02$ s	**Velocity (m·s^{-1})** $v_{interval} = \frac{\Delta D}{\Delta t}$
1		**0,02**	**at 0,01 s**
2		**0,04**	**at 0,02 s**
3		**0,06**	**at 0,03 s**
4		**0,08**	**at 0,04 s**
5		**0,10**	**at 0,05 s**
6		**0,12**	**at 0,06 s**

Answer the following questions:

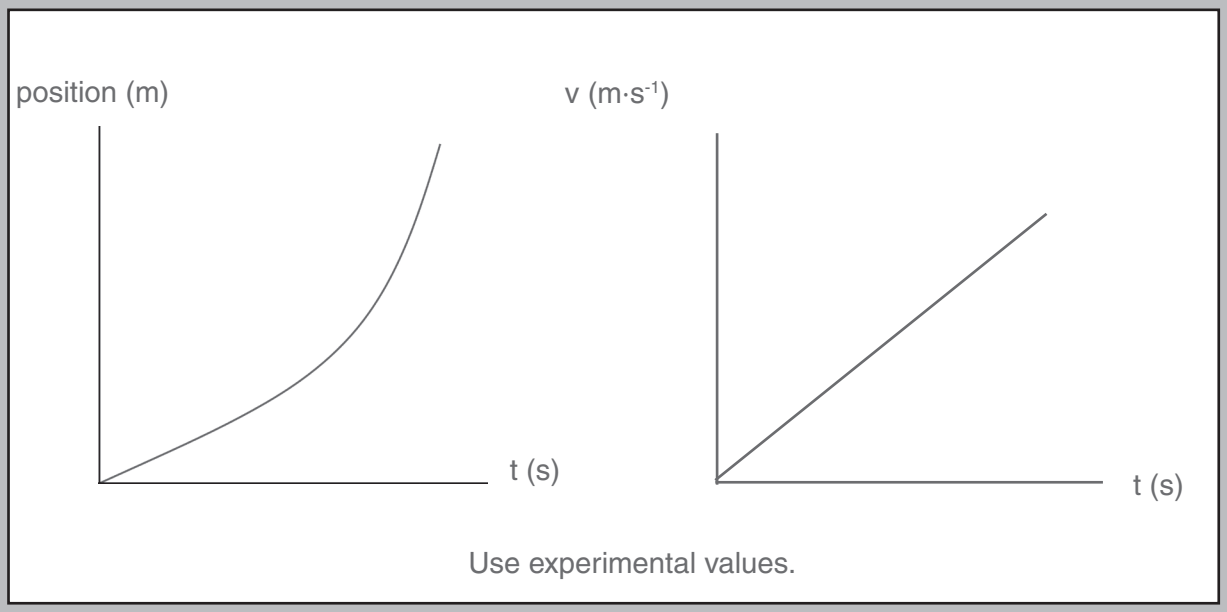
1. Does the distance (ΔD) between dots increase by the same amount each time?

Yes

2. What does this suggest about the acceleration of the object?

The acceleration is constant.

Use your results and draw a displacement-time and velocity-time graph.



Use experimental values.

3 How can you:

3.1 use the position-time graph to calculate the acceleration due to gravity? Explain the process in words only.

Draw two tangents to the parabola. Determine each tangent's gradient (= instantaneous velocity) and read the time of the tangent from each gradient. Now use the two instantaneous velocities to determine:

$$a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i}$$

3.2 use the velocity-time graph to calculate the acceleration due to gravity?

Calculate the gradient of the graph.

4. Use the answer in Question 3.2 and compare it to the value of 9,8 $m \cdot s^{-2}$. Give an explanation if your value differs.

There is still upward air resistance. The acceleration is therefore less than 9,8 $m \cdot s^{-2}$.