2023 Ph H2 Q1

Section: Our Dynamic Universe
Topic: Motion, Equations and Graphs

Question Summary

A van travels at **13.4 m s⁻¹** and brakes with a constant acceleration of **−2.85 m s⁻²** until it comes to rest at traffic lights.
We must find:
(a) The distance travelled during braking.
(b) The time taken to stop.
(c) The velocity–time graph, with values on both axes.

(a) Distance during braking

✅ **Answer:**
$s = 31.5\,\text{m}$

Working:
Use:
$v^2 = u^2 + 2as$

where $v = 0$, $u = 13.4\,\text{ms}^{-1}$, $a = -2.85\,\text{ms}^{-2}$.

$0 = (13.4)^2 + 2(-2.85)s$

$s = \dfrac{(13.4)^2}{2 \times 2.85} = \dfrac{179.6}{5.70} \approx 31.5\,\text{m}.$

(b) Time to stop

✅ **Answer:**
$t = 4.7\,\text{s}$

Working:
$v = u + at$

$0 = 13.4 + (-2.85)t$

$t = \dfrac{13.4}{2.85} \approx 4.7\,\text{s}.$

(c) Velocity–time graph

Answer:

- A straight line **sloping downwards** from $(t = 0, v = 13.4)$ to $(t = 4.7, v = 0)$.
- **Axes:**
  - Vertical axis (v): 0 to 13.4 m s⁻¹.
  - Horizontal axis (t): 0 to 4.7 s.

Quick Tips

- For uniform deceleration, the v–t graph is a straight line down to zero.
- Use $v^2 = u^2 + 2as$ when time isn't given.
- Time can be found from $v = u + at$.