2017 Ph H1 Q3

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

Question Summary:

A graph shows how the **vertical speed** of a skydiver changes with time after jumping from an aircraft.

A student makes three statements:

I. The **acceleration is greatest** between points **P and Q**
II. The **air resistance** between **Q and R** is **less than** the weight of the skydiver
III. The **forces** on the skydiver are **balanced** between **R and S**

Which of the statements is/are correct?

Step-by-step Evaluation:

🟩 **Statement I:** ✅ **True**

- The **gradient** of a speed–time graph represents **acceleration**

- Between **P and Q**, the graph is steepest — meaning acceleration is greatest

- After Q, the gradient gets smaller — indicating decreasing acceleration
✅ So **I is correct**

🟩 **Statement II:** ❌ **False**

- Between **Q and R**, the speed is **decreasing**

- This means the skydiver is **decelerating**

- Therefore, **air resistance must be greater than weight** to cause upward (net) force
❌ Statement says **less than** weight — so it's **incorrect**

🟩 **Statement III:** ✅ **True**

- Between **R and S**, the graph is **flat** → constant speed

- Hence, acceleration = 0 → net force = 0 → forces **balanced**
✅ This is Newton's First Law in action

✅ **Final Answer:**

C — **Statements I and III only**

📌 **Revision Tips:**

- **Speed-time graph:**

  - **Gradient** = acceleration

  - Flat line = zero acceleration → balanced forces

- **Deceleration** (downward motion slowing) = net force **upwards** → air resistance > weight

- **Terminal velocity** = constant speed → air resistance = weight