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|  |  |  | | Skydiving and Newton's Laws | | | | | | | |  | |  |  | | | |  | | |  | | | |  | | |  | | |
| A 55.0 kg Base Jumper leaps out of a hot air balloon at t = 0 seconds. The table below shows her vertical acceleration at certain times during the first 20 seconds of her fall. Study the table before you make your predictions.  Predict the following answers to 1-2 before doing any calculations.   1. When does she open her parachute? Between 12-14seconds 2. When is she going the fastest? 12 seconds (For some reason I asked this again!?)   Analyze   1. Sketch the Free Body Diagrams, making sure to show that stronger forces have longer arrows and equal forces are the same length arrows. Also, which force does NOT change size as the jumper falls? Fg stays the same size 2. How much does the jumper weigh? 539N 3. Write Newton’s Second Law equation. Then using the appropriate FBD, expand the 2nd Law. Next, determine the drag force acting on the jumper for each of the times.   F=ma Fd-Fg = ma Fd=ma + mg Fd = m(a+g) at t=0 Fd= 55(-9.8 +9.8) Fd=0  At t=4s: Fd = 55(-4.9 +9.8) Fd=269.5N   1. Fill in the values for each box. 2. Estimate how the jumper will feel at each of the following instances. (normal, weightless, lighter, or heavier than normal) 3. t = 0.1 sec weightless 4. t = 4.0 sec light 5. t = 12.0 sec normal 6. t = 14.0 sec heavy | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| time (s) | 0 | | 4 | | | | 12 | 14 | | | | | 16 | | | 18 | | | | | | | | 20 | | | | | |
| Acceleration (m/s/s) | -9.8 | | -4.9 | | | | 0 | +6 | | | | | +3 | | | +1 | | | | | | | | 0 | | | | | |
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| Free Body Diagram |  | |  | | | |  |  | | | | |  | | |  | | | | | | | |  | | | | | |
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| Direction of motion | down | | down | | | | down | down | | | | | down | | | down | | | | | | | | down | | | | | |
| Accelerating?  up/down/NOT | down | | down | | | | not | up | | | | | up | | | up | | | | | | | | not | | | | | |
|  | 0 | | 269.5N | | | | 539N | 869N | | | | | 704N | | | 594N | | | | | | | | 539N | | | | | |
| F(drag) |  | |  | | | |  |  | | | | |  | | |  | | | | | | | |  | | | | | |