Year 12 Science: Physics in a selected context: the bungy jump

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. A 60 kg jumper falls freely for 15 m. Find their speed. Use $g = 9.8\ N\ kg^{-1}$.

2. A cord with $k = 80\ N\ m^{-1}$ is stretched by 20 m. Find its tension.

3. How much elastic potential energy does that cord store?

4. A 70 kg jumper moving at $14\ m\ s^{-1}$ is brought to rest in 2.0 s. Find the average net force.

5. Explain, using impulse, why a stiffer cord would hurt the jumper more.

Fix the mistake

6. Correct this statement: "The jumper is fastest at the lowest point because they have fallen furthest."

7. Correct this statement: "In $E_p = \frac{1}{2}kx^2$, I used $x = 40$ m, the whole fall."

8. Correct this statement: "The stretchy cord makes the change in momentum smaller."

9. Correct this statement: "I copied a good paragraph from a website and referenced it."

Answer key (for parents and tutors)

1. A 60 kg jumper falls freely for 15 m. Find their speed. Use $g = 9.8\ N\ kg^{-1}$.
   $v = \sqrt{(2gh)} = \sqrt{(2 \times 9.8 \times 15)} = \sqrt{294} = 17.1\ m\ s^{-1}$.

2. A cord with $k = 80\ N\ m^{-1}$ is stretched by 20 m. Find its tension.
   $F = kx = 80 \times 20 = 1600\ N$.

3. How much elastic potential energy does that cord store?
   $E_p = \frac{1}{2}kx^2 = \frac{1}{2} \times 80 \times 20^2 = 16\,000\ J$.

4. A 70 kg jumper moving at $14\ m\ s^{-1}$ is brought to rest in 2.0 s. Find the average net force.
   $\Delta p = m\Delta v = 70 \times 14 = 980\ kg\ m\ s^{-1}$, so $F = \Delta p \div \Delta t = 980 \div 2.0 = 490\ N$.

5. Explain, using impulse, why a stiffer cord would hurt the jumper more.
   The jumper's change in momentum is the same either way, but a stiffer cord stops them in a shorter time, so by $F\Delta t = \Delta p$ the force on them is bigger.

6. Correct this statement: "The jumper is fastest at the lowest point because they have fallen furthest."
   They are momentarily still at the lowest point; they are fastest where the tension equals the weight, before the bottom.

7. Correct this statement: "In $E_p = \frac{1}{2}kx^2$, I used $x = 40$ m, the whole fall."
   x is how far the cord has stretched, $40 - 12 = 28$ m, not the distance fallen.

8. Correct this statement: "The stretchy cord makes the change in momentum smaller."
   The change in momentum is the same; the cord makes the stopping time longer, so the force is smaller.

9. Correct this statement: "I copied a good paragraph from a website and referenced it."
   Copied or closely reworded text is not evidence of your understanding; explain it in your own words with your own calculations.