Year 13 Science: Standing waves, harmonics, resonance and beats

Name: _____ Date: _____

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

Practice

1. A string 0.500 m long carries waves at 200 m s^{-1}. Find its fundamental frequency.

2. Find the wavelength of the 4th harmonic on that string.

3. A pipe 0.250 m long is closed at one end. Using v = 340 m s^{-1}, find the next frequency it can play above its fundamental.

4. Two tuning forks of 256 Hz and 260 Hz are struck together. Find the beat frequency.

5. The tension in a string is quadrupled. What happens to its fundamental frequency?

Exam-style question: a pan flute

Wiremu makes a pan flute from plastic tubes, each closed at the bottom. Take sound's speed as 343 m s^{-1} and ignore end corrections.

6. Calculate the fundamental frequency of a tube 0.180 m long.

7. Describe the displacement pattern of the next harmonic this tube can produce and calculate its frequency.

8. He plays the tube next to a 480 Hz tuning fork. Calculate the beat frequency and explain how the beats form.

9. On a hot day the speed of sound rises to 349 m s^{-1}. Explain what happens to the tube's fundamental and to the beats with the fork.

Fix the mistake

10. Correct this statement: "Nodes on a string are one wavelength apart."

11. Correct this statement: "A closed pipe's next harmonic after f_1 is $2f_1$."

12. Correct this statement: "Two notes of 256 Hz and 260 Hz give a beat frequency of 258 Hz."

13. Correct this statement: "Doubling the tension doubles the frequency."