Physics 200 (Stapleton) Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Measuring Speeds Using a Musical Instrument

Using a string instrument and the Doppler Effect to determine the speeds of noisy objects that are heard approaching and then departing:

**Velocity in Terms of Frequency Shift**

**Vobject = Vsound \* (fahead of source – fbehind source) / (fahead of source + fbehind source)**

Units for the object velocity are the same as those that you choose for the velocity of sound.

**Vsound = 340m/s = 761mph**

**1m/s = 2.23694mph**

**Velocity in terms of change in pitch**

**Vobject = Vsound \* (2^(∆p/12) -1)/ (2^(∆p/12) +1)**

**∆p = absolute value of the drop in pitch, measured in semitones (half-steps)**

**Practice:**

How fast is a car moving if its frequency drops from 622hz (D#) to 440hz (A)? This is equivalent to its pitch dropping 6 half steps (6 half steps: D# - D – C# - C – B – A# - A).

**Using a string instrument to determine the Speeds of Noisy objects that are approaching and then departing:**

Play the sound (use link on www.mrstapleton.com) and then try to match the pitch drop with your instrument (or the virtual piano link).

Find the velocities of the following sources using the frequencies from your instrument, the formula at the top of this page, and a speed of sound equal to 340m/s.

**1. Object A:**

**2. Object B:**

**3. Object C:**