MCAS: Woodwind Instrument Physics Name _____

Standing vs. traveling waves: Traveling waves move down a particular path, But standing waves are stationary oscillations in the form of a wave.
Woodwind Instrument: A woodwind instrument, such as a piccolo, flute, clarinet, or bassoon, works by producing standing waves inside of it.
Closed End At a closed end, there is always an anit-nodal point.
Open End At an open end, there is always a nodal point.
Fundamental Frequency: The simplest wave that exists inside of a woodwind instrument.
Harmonics All of the standing waves that fit inside of an instrument. The first harmonic is the fundamental frequency. The second harmonic is the next largest wave that fits. etc.
Speed of Sound In standard temperature and pressure air, the speed of sound is 343 m/s.
Wave formula: Speed = frequency x wavelength

Do you get a standing or a traveling wave shake the slinky at a constant frequency?
Do you get a standing or a standing wave with you move the slinky once?

List at least 3 woodwind instruments:

Is there a nodal or anti-nodal point an open end?

Is there a nodal or anti-nodal point at a closed end?

Question 1

A woodwind instrument has two OPEN ends. It has a length of 1.0 meter.
Draw the first 5 harmonics that exist inside the flute.
What is the wavelength of each harmonic?
What is the frequency of each harmonic?

Harmonic	Picture	How many wavelengths in picture?
1st		
2nd		
3rd		
4th		
5th		

Harmonic	Wavelength	Frequency	Speed
1st			343 m/s
2nd			343 m/s
3rd			343 m/s
4th			343 m/s
5th			343 m/s

Question 2:
A particular woodwind instrument has 2 CLOSED ends; It has a length of 0.40 m.

Draw the first 5 harmonics.
What is the wavelength of each harmonic?
What is the frequency of each harmonic?

Harmonic	Picture	How many wavelengths in picture?
1st		
2nd		
3rd		
4th		
5th		

Harmonic	Wavelength	Frequency	Speed
1st			343 m/s
2nd			
3rd			
4th			
5th			

Question 3:
A particular woodwind instrument one open end and one closed end.
It has a length of 0.50 m.

It is still a sound wave with a speed of 343 m/s.

Draw the first 5 harmonics.
What is the wavelength of each harmonic?
What is the frequency of each harmonic?

Harmonic	Picture	How many wavelengths in picture?
1st		
2nd		
3rd		
4th		
5th		

Harmonic	Wavelength	Frequency	Speed
1st			
2nd			
3rd			
4th			
5th			

HARMONICS Answers

Question 1

Harmonic	Wavelength	Frequency	Speed
1st	2 m	172 Hz	343 m/s
2nd	1 m	343 Hz	343 m/s
3rd	0.67 m	512 Hz	343 m/s
4th	0.5 m	686 Hz	343 m/s
5th	0.4 m	858 Hz	343 m/s

Question 2

Harmonic	Wavelength	Frequency	Speed
1st	0.8 m	429 Hz	343 m/s
2nd	0.4 m	858 Hz	343 m/s
3rd	.267 m	1285 Hz	343 m/s
4th	0.2 m	1715 Hz	343 m/s
5th	0.16 m	2144 Hz	343 m/s

Question 3

Harmonic	Wavelength	Frequency	Speed
1st	2.0 m	172 Hz	343 m/s
2nd	.67 m	514 Hz	343 m/s
3rd	0.4 m	858 Hz	343 m/s
4th	0.286 m	1199 Hz	343 m/s
5th	0.222 m	1559 Hz	343 m/s