

### OBJECTIVE

An emitter, placed on a bicycle, emits a musical sound.

An observer, placed on the path of the bicycle, records this sound.

The objective is to determine the speed of the bicycle by two different ways.

### AVAILABLE EQUIPMENT

A microphone, a data acquisition system connected to a computer equipped with Latispro software, a junction box that connects the audio output of the computer to the data acquisition system, headphones.

### AVAILABLE RECORDINGS AND HELP CARD

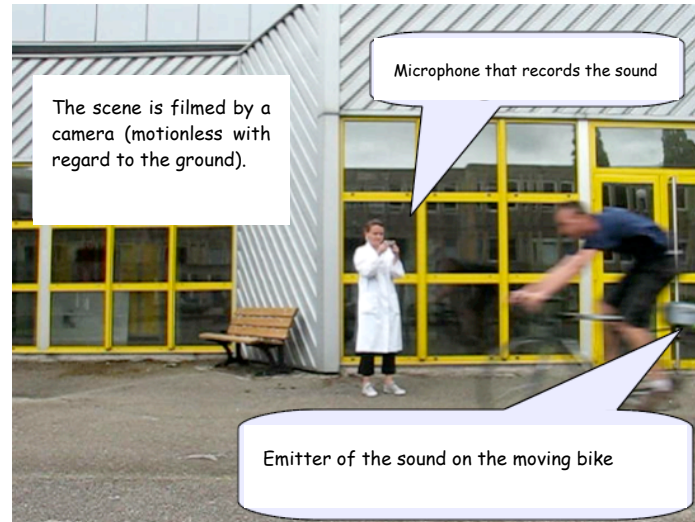
Sound file of the musical sound emitted from the moving bike.

Sound file of the musical sound emitted from a stationary source.

Sound file of the horn of a car approaching and moving away.

Video of the bike recorded by an observer placed on the path of the bike.

Latispro help card: acquisition and spectral analysis; acquisition and video.



### I- FIRST METHOD: BY USING THE VIDEO

*Suggest a procedure to determine the speed of the bicycle by using the video recording.*

*Call the teacher for approval. Then, carry out the procedure.*

### II- SECOND METHOD: BY USING THE SOUNDS FILES

#### 1- PRELIMINARY WORK: UNDERSTANDING THE DOPPLER EFFECT

*Listen to this video: <https://www.youtube.com/watch?v=h4OnBYrbCjY>. Then fill in the following text.*

The **Doppler effect** is the ..... change in the ..... of a wave caused by ..... motion between the source of the wave and the observer.

#### Applications:

Even if from the .....’s perspective, the horn is playing the same ..... the entire time, as the vehicle is coming towards you, the sounds waves reach you at a higher frequency which you interpret as a higher ..... because the frequency of sounds waves is .....

And when the vehicle passes you and is leaving away from you, the sound waves spread out and so you hear the sound at a lower frequency, a lower .....

That’s how the Doppler effect works with sounds.

But it also affects another kind of wave: .....

If a star is moving towards you, even if it is a little bit, you will see the light emitted by the star at a ..... frequency than it actually is. As a small change in frequency for visible light will change its ....., higher frequency light waves means ..... light (this is called blueshift) and lower frequency light waves means ..... light (this is called redshift).

Therefore the colour of a star depends on its ..... motion to you.

#### 2- DETERMINING THE SPEED OF THE BICYCLE BY USING THE DOPPLER EFFECT

*Suggest a procedure to determine the speed of the bicycle by using the sounds files.*

*Call the teacher for approval. Then, carry out the procedure.*

### III- CONCLUSION

*Compare these two methods.*