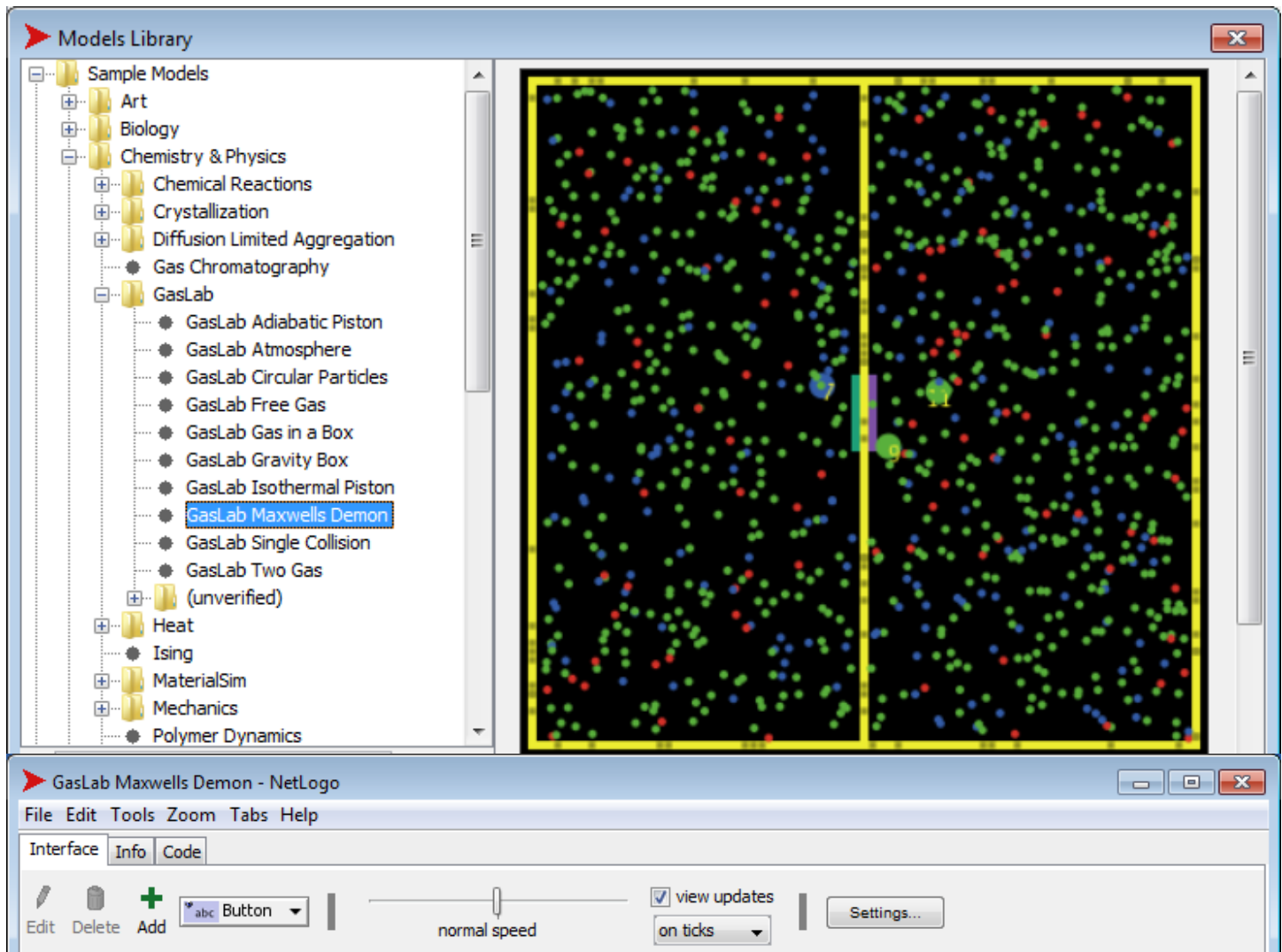


1. In the NetLogo models library, open File->Models Library; Sample Models -> Chemistry & Physics -> GasLab -> **GasLab Maxwells Demon**.
  - Click on the Information tab and carefully read the sections on "**What is it?**" and "**How it works.**" Try out the model. Read again. Take some notes. Play with the model. Then answer these questions.
    1. Who is "Maxwell's Demon," and what does the demon do?
    2. How does the model detect when two balls "hit" each other?
  - Click on the Interface tab. Change the number of particles to 500, click "setup," and then click on "go."
    3. In the middle interface, balls with numbers appear. What do these represent?
    4. What does the color of the balls represent?
    5. The balls are not always the same color as when the simulation started out. What makes them change their color?
    6. Describe what happens when your models is allowed to run over a long period of time (you may want to increase the speed). (*SPEED increase or decrease from NORMAL SPEED in NETLOGO are very useful.*)



Note: You can look at and read about the GASLAB Maxwell's Demon on the web.

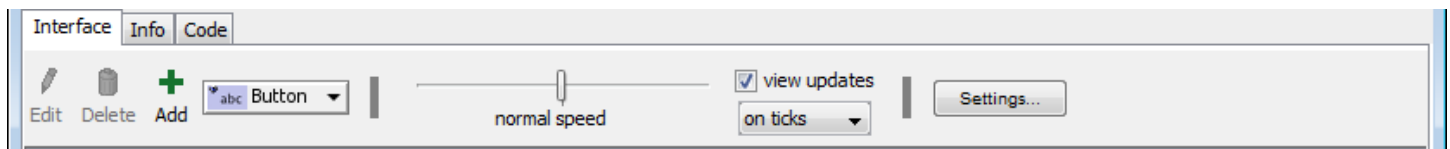
You can no longer run NetLOGO applets in a web browser. However, it is very easy to download and install NetLOGO from the same website.

<http://ccl.northwestern.edu/netlogo/models/GasLabMaxwellsDemon>

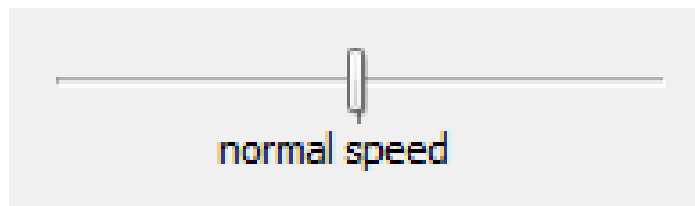
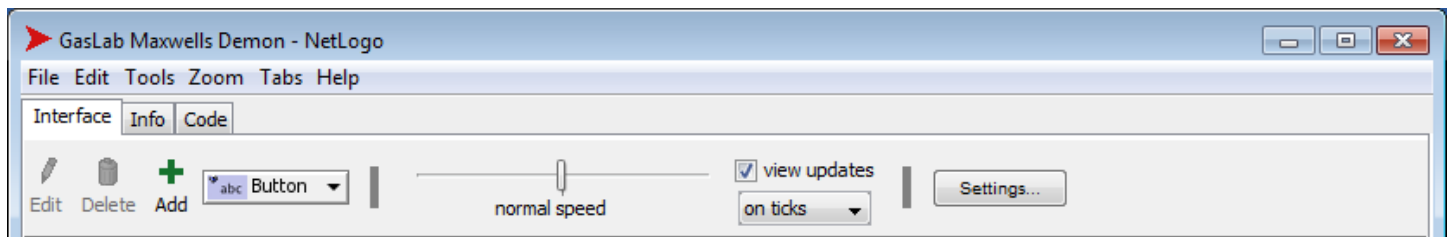
Here at the above URL you can find the same information that you see in the **INFO tab** for NetLOGO.

**Interface** **Info** **Code** are the three tabs you see right under the NetLogo menu.

The bottom graphic above shows the three different tabs **Interface** **Info** **Code**



Note that the normal speed adjustment allows you to SLOW DOWN or SPEED UP the application. I find that if you SLOW the GasLab Maxwell's Demon model way down, it can help you answer some of the questions as you see in slow motion the movement of the molecules and are able to read the numbers on them as they pass through the valve from one chamber or room to the other chamber or room.



**VIP: Please number each question and rewrite or retype each of the six questions and then write out your answer. You can rewrite each question in your own words.**

## Music with NetLOGO

2. Create the NetLogo model that will play the song **Twinkle Twinkle Little Star** once when the user of your model clicks a button. Give the user choices for the length of a quarter note in the song to be any of the following: 0.1, 0.2, 0.3, 0.4, 0.5 or 0.6 for the various TEMPO choices. Send the NetLogo model file as an attachment to [jacobson@cs.uni.edu](mailto:jacobson@cs.uni.edu) on or before the due date deadline. Use any musical instrument that you like.

The image shows three staves of musical notation for the song "Twinkle Twinkle Little Star". The first staff contains the first line of music with the lyrics "Twin-kle, twin-kle, lit - tle star, how I won - der what you are!". The second staff starts at measure 5 and contains the lyrics "Up a - bove the world so high, like a dia - mond in the sky.". The third staff starts at measure 9 and contains the lyrics "Twin-kle, twin-kle, lit - tle star, how I won - der what you are!". The music is written in a simple treble clef with a common time signature (C).

Using the list approach (using a **foreach** statement with two lists, one for note, one for duration of the note) is encouraged, but not required. See the <http://www.cs.uni.edu/~jacobson/025/logo/bday.html> page for more details.

### Much improved use of NetLogo to "sing" Happy Birthday

```
extensions [sound]

to playHappyBirthday
  ( foreach [ 60 60 62 60 65 64    60 60 62 60 67 65    60 60 72 69 65 64 62    70 70 69 65 67 65 ]
    [ .3 .1 .4 .4 .4 .8    .3 .1 .4 .4 .4 .8    .3 .1 .4 .4 .4 .4    .3 .1 .4 .4 .4 .8 ]
    [
      playNote ?1 ?2
    ]
  )
end

to playNote [ theNote theLength ]

  sound:start-note "TRUMPET" theNote 65
  wait theLength
  sound:stop-note "TRUMPET" theNote
end
```

## Much improved use

```
extensions [sound]

to playHappyBirthday
  ( foreach [ 60 60 62 60 65 64 60 60
            [ .3 .1 .4 .4 .4 .8 .3 .1
              [
                playNote ?1 ?2
              ]
            ]
        )
end

to playNote [ theNote theLength ]

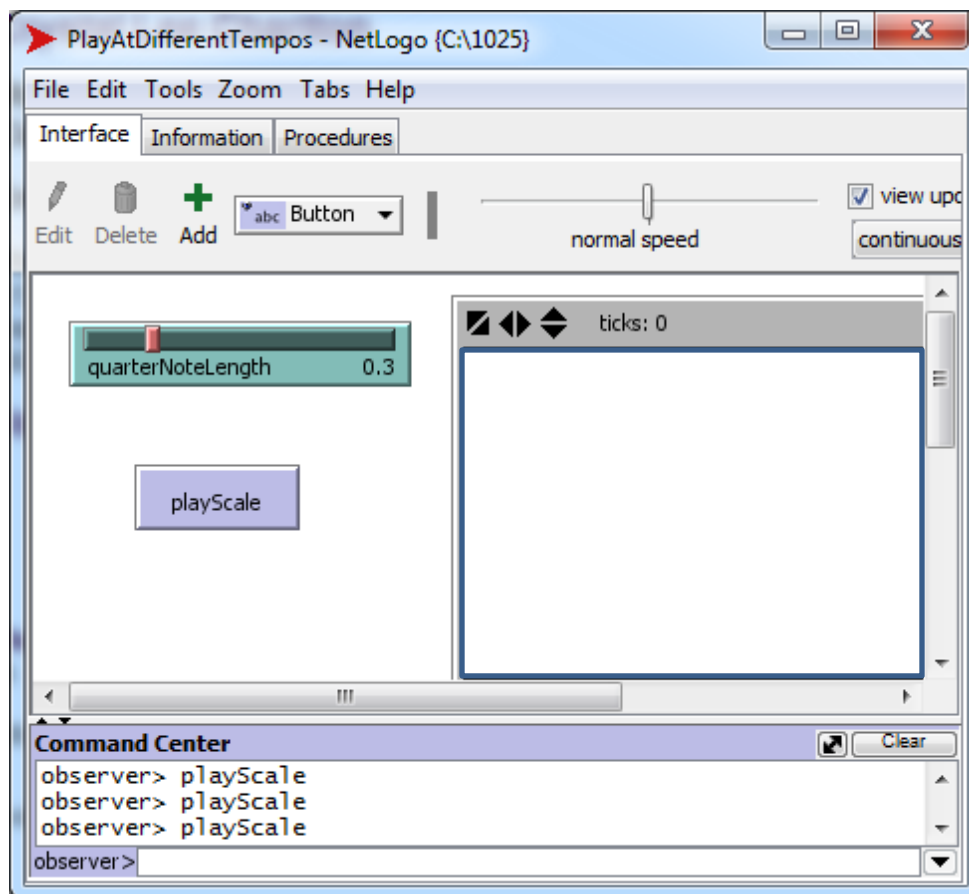
  sound:start-note "TRUMPET" theNote 65
  wait theLength
  sound:stop-note "TRUMPET" theNote
end
```

```
extensions [sound]

to playScale
  ( foreach [ 60 62 64 64 65 67 69 71 71 72 60 64 67 72 ]
            [ 1 1 .5 .5 1 1 1.5 .5 1 2 1 1 4 ]
              [
                playNote ?1 ?2
              ]
            )
end

to playNote [ theNote theLength ]
  sound:start-note "TRUMPET" theNote 65
  wait theLength * quarterNoteLength
  sound:stop-note "TRUMPET" theNote
end
```

Note that the Twinkle Twinkle Little Star song has only quarter notes and half notes. A quarter note gets 1 count and a half note gets two counts. There are 36 quarter notes in the song and 6 half notes in the song.  $32 \text{ plus } 2 \text{ times } 6 = 48$  counts or 48 beats in the song.



**FACE** for the spaces, **EGBDF** for the lines of the treble clef. Every Good Boy Does Fine = E G B D F. See also Moody Blues.

Note: You do NOT have to do Twinkle, Twinkle Little Star. You're welcome to do any other song, as long as you do 10 or 12 measures of it. One student did a portion of [Flo Rida's Club Can't Handle Me](#) back in 2009 or 2010!