

exp5-outline

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`./exp5-magic-8ball-1.pdf`

```
./exp5-magic-8ball-2.pdf
```

1 Setup

First you will need to download, unzip, and install the Arduino Integrated Development Environment (IDE) from <https://www.arduino.cc/en/Main/Donate> (does not need admin privileges).

2 How it works

The Arduino melody uses a piezo buzzer to create frequencies that resemble recognizable notes. You use the Arduino IDE to give the order, rate, and duration of the notes to play a specific tune. Piezos are inexpensive buzzers often used in small toys. A piezo element without its plastic housing looks like a gold metallic disc with connected positive (typically red) and negative (typically black) wires. A piezo is capable only of making a clicking sound, which we create by applying voltage. We can make recognizable notes by getting the piezo to click hundreds of times a second at a particular frequency, so first we need to know the frequency of the different tones we want. Table 7-1 shows the notes and their corresponding

frequencies. Period is the duration of time, in microseconds, at which the frequency is created. We halve this number to get the timeHigh value, which is used in the code to create the note.

<insert table with notes/frequencies here>

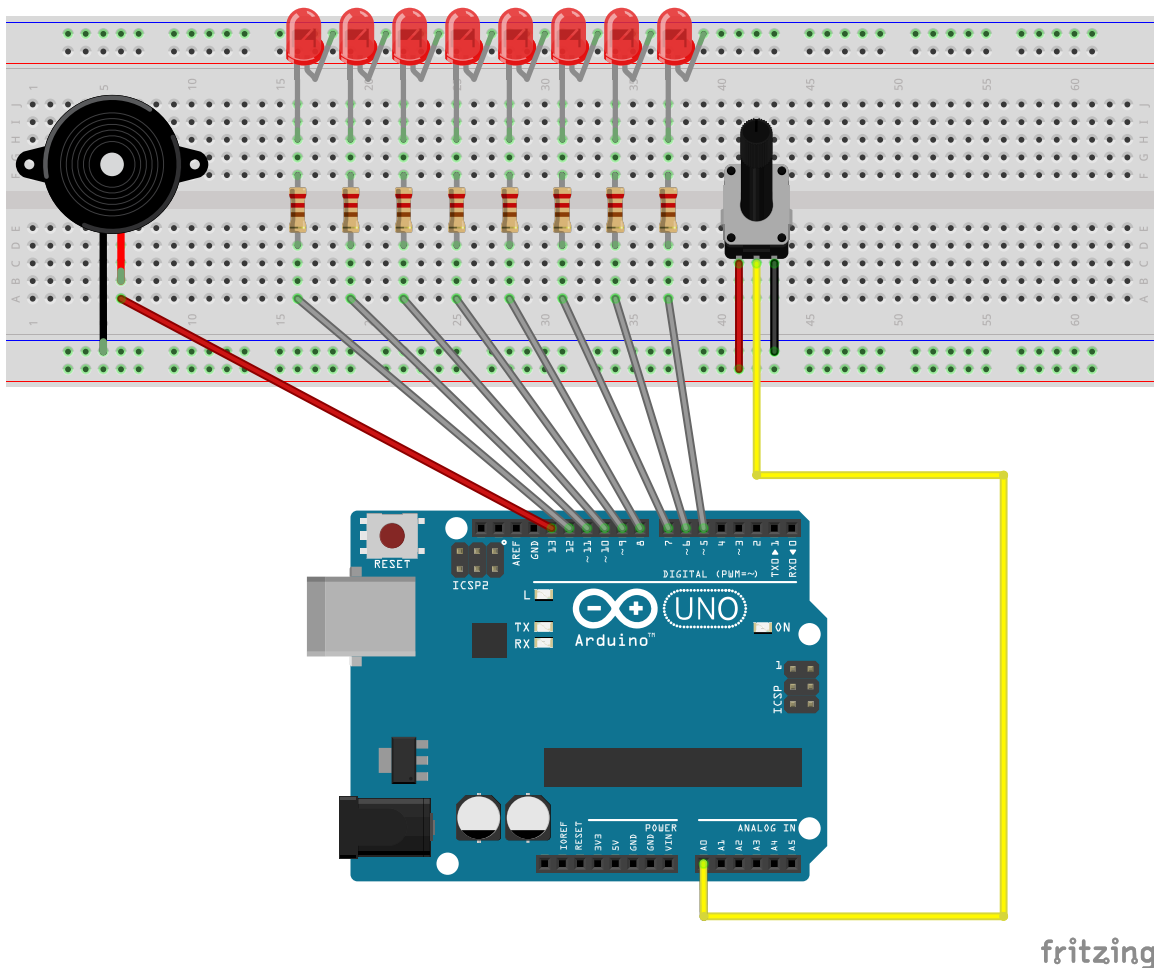
The code sends a square wave of the appropriate frequency to the piezo, generating the corresponding tone (see Project 2 for more on waveform). The tones are calculated through the following equation:

```
timeHigh = period / 2  
          = 1 / (2 * tone_frequency)
```

Turning the potentiometer up or down causes the pin connected to it to read a different value, which we use to set the overall tempo of the melody. We then use the calculated tempo to play the melody, and each time a specific note is played, the corresponding LED will light up.

3 Building The Circuit

The schematics for the circuits you will be building is below.



4 Programming the Arduino

The base code for programming the Arduino is provided. Using the Arduino IDE, open the .ino file.

PAUSE

The IDE allows you to do 4 things: edit the code, verify the code is correct (i.e. does not contain syntax errors), upload the code to the Arduino, and view the diagnostic output of things as they run on the Arduino.

Uploading to the Arduino is easy! Just click the Upload arrow in the IDE.

5 The Melody Code

In order to use the piezoelectric buzzer to play a tune we need to tell it 4 things:

1. How many notes are in the melody. This is the `MELODY_LENGTH` constant.
2. The names of the musical notes in the melody. This is the `notes` array in the code.
3. How long to play each musical note for in the melody. This is the `beats` array in the code.
4. How fast to play the melody. We use a potentiometer to make the melody play faster/slower depending on the value read.

6 Extending The Code

Once you have gotten the simple melody to play, try going online to find a short melody you like (such as one from a video game or movie), and see if you can figure out the notes and durations and get it to play!