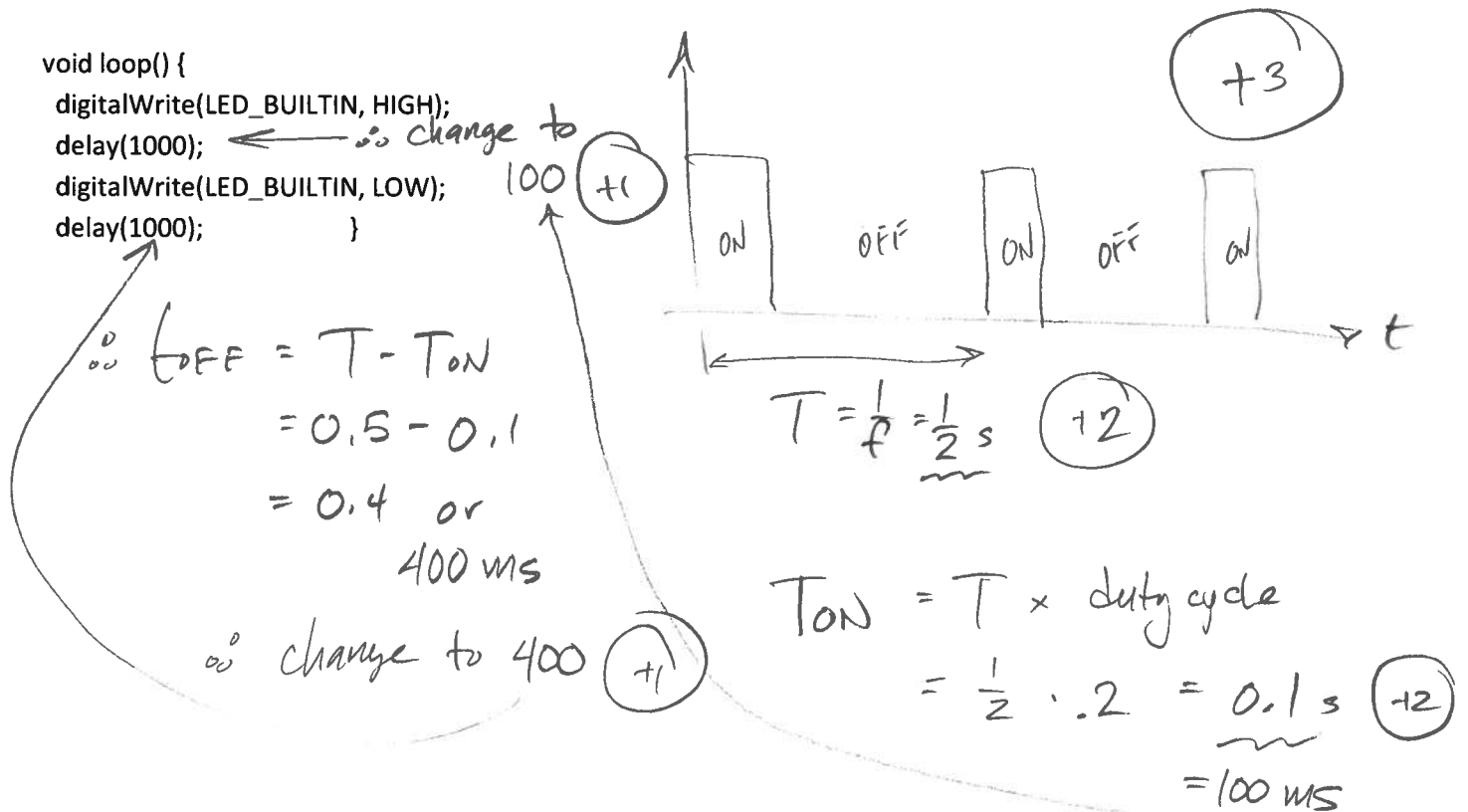
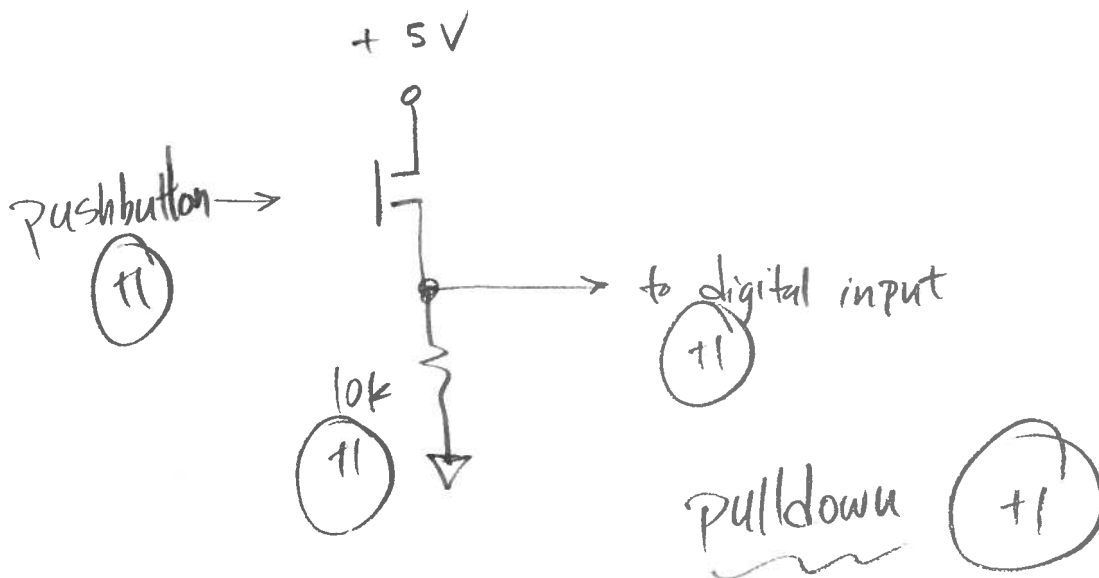


1) The following code is from the very first Arduino sketch that we investigated. Modify the code so the LED flashes with a frequency of 2 Hz and duty cycle of 20%. Draw a sketch that shows the waveform.

```
void loop() {
  digitalWrite(LED_BUILTIN, HIGH);
  delay(1000);
  digitalWrite(LED_BUILTIN, LOW);
  delay(1000);
}
```



2) A momentary pushbutton switch is normally open. Draw a circuit that achieves a LOW to HIGH state change in response to pressing the button. Does it use a pullup or pulldown resistor?



3) Is a potentiometer a *modulating* or *generating* sensor, and why? On what principal does the potentiometer convert angular or linear position into a useful signal?

(+1)
Modulating; doesn't generate voltage
 or current, only changes resistance (+2)



Voltage divider

(+1)

4) A 24-bit system has a voltage range of 0 to 3.3 V. How many possible levels are there, and to what nearest integer would a sensor voltage of 387.91 mV correspond? Write this number in binary.

$$\# \text{ of levels} = 2^{24} = 16777216$$

(+2)

$$16777216 \times \frac{0.38791}{3.3} = 1972136.3$$

$$\rightarrow 1972136$$

(+2)

$$\Rightarrow (\text{online calc.}) = 000 \overset{20}{1} \overset{19}{1} \overset{18}{1} \overset{17}{1} 0000 \overset{16}{1} 0 \overset{15}{1} \overset{14}{1} \overset{13}{1} \overset{12}{1} \overset{11}{1} \overset{10}{1} \overset{9}{1} \overset{8}{1} \overset{7}{1} \overset{6}{1} \overset{5}{1} \overset{4}{1} \overset{3}{1} \overset{2}{1} \overset{1}{1} \overset{0}{1}$$

$$\text{check: } 2^3 + 2^5 + 2^7 + 2^9 + 2^{11} + 2^{13} + 2^{15} + 2^{17} + 2^{19} + 2^{21}$$

Have a really nice break!

$$= 1972136$$

(+1)