**Research Question**

What are the optimal PID settings for heating the Eppendorf tube?

**Independent Variables**

1. PID settings (Kp, Kd, Ki)

**Dependent Variables**

1. Rise time for Eppendorf to reach 65°C
2. Overshoot of 65°C
3. Settling time
4. Steady-state error

**Extraneous Variables**

1. Electrical settings
   1. Use bench power supply to keep voltage and current stable.
2. Nichrome wire length
   1. Use the same length of nichrome wire for each PDMS mould, with a similar coil design.
3. PDMS size
   1. Use the same PDMS mould for the entire experiment
4. Ambient temperature
   1. Do experiments in the same room
   2. Preferably do the experiments on the same day

**Method**

1. Set up Arduino circuit as per circuit design.
2. Check the temperature of PDMS.
3. Run a control with no PID settings (i.e., PWM:255 < 30, PWM:0 >= 30) to increase temperature 5°C (e.g., temp = 20°C then run to 25°C) for 5mins.
4. Record temperature and PWM every second.
5. Graph results.
6. Adjust PID settings accordingly.
7. Wait till the temperature of PDMS settles to a consistent temperature for 1min.
8. Run a test with adjusted PID settings for 5mins.
9. Repeat steps 4-8 until adjusting PID settings does not improve the result.
10. Run optimal PID settings to a temperature of 65°C.
11. Repeat steps 4-8 until adjusting PID settings does not improve the result.