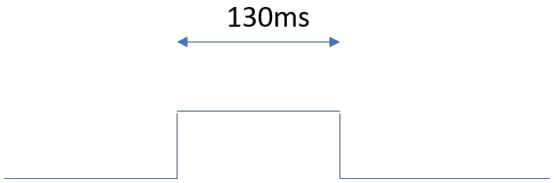
TEST Examples

Digital test example:

Q1. How can you program a pin as an input?

Q2. Write a line to read the state of a pin and display the result

Q3) Generate this signal:



A sensor gives humidity information as follow:

1% humidity ↔ 10mV

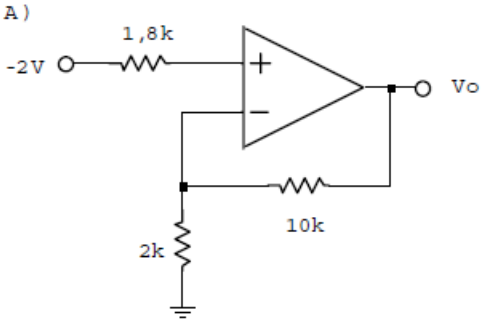
Q4) explain how you will connect the sensor to your board

Q5) Write a program to display the humidity level

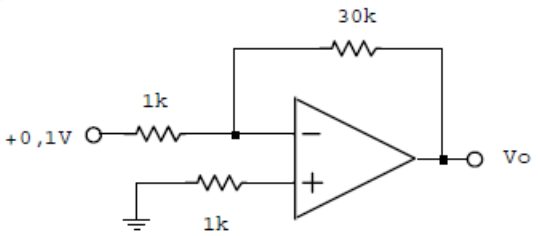
Analog test exemple:

Assuming ideal op amps, determine Vo for each and every circuit shown below.

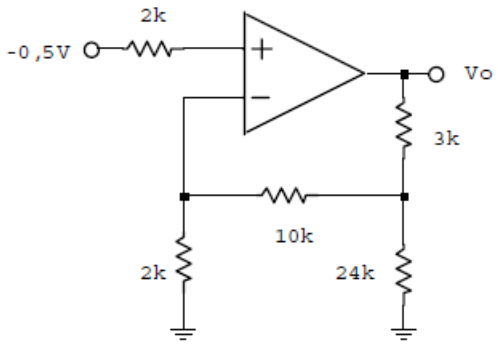
A)



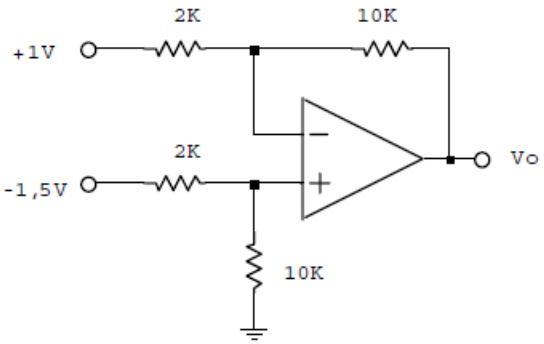
B)



C)



D)



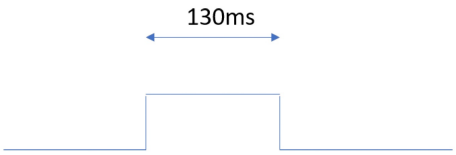
Q1. How can you program a pin as an input?

```
void setup(){
  pinMode(Num_Pin, INPUT);
}
void loop(){
  //main program
}
```

Q2. Write a line to read the state of a pin and display the result

```
void setup(){
  pinMode(inputPin, INPUT);
  Serial.begin(9600);
}
void loop(){
  int pinState = digitalRead(inputPin);
  Serial.println(pinState);
  delay(1000);
}
```

Q3) Generate this signal:




```
void setup(){
  pinMode(outputPin, OUTPUT);
}
void loop(){
  digitalWrite(outputPin, High);
  delay(130);
  digitalWrite(outputPin, Low);
  delay(1000);
}
```

```
void setup(){
  pinMode(Num, output);
}
void loop(){
  digitalWrite(Num, High)
  delay(130);
  delay(1000);
```

Low

digitalWrite(__,__)
写引脚状态

1% humidity ↔ 10mV

Q4) explain how you will connect the sensor to your board

Q5) Write a program to display the humidity level

Vcc 5V
GND out GND in

```
void setup(){
  serial.begin(9600);
}
void loop(){
```

4) sensor board
1° Vcc → 5V
2° GND → ground
3° output pin → input pin

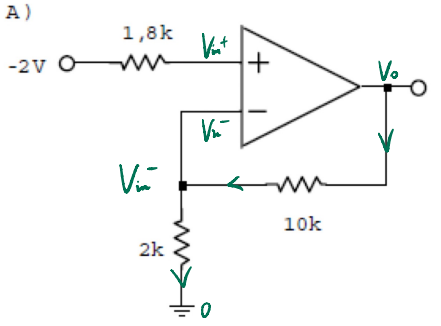
5)
```
const int sensorPin = _ ;
void setup(){
  Serial.begin(9600);
}
void loop(){
  int sensorValue = analogRead(sensorPin);
  float humidity = sensorValue * 0.1;

  Serial.print("humidity: ");
  Serial.Print(humidity);
  Serial.println("%");

  delay(1000);
}
```

初始化通信

虛短：$V_{in}^+ = V_{in}^-$

虛斷：$I_{in}^+ = I_{in}^- = 0$

A)



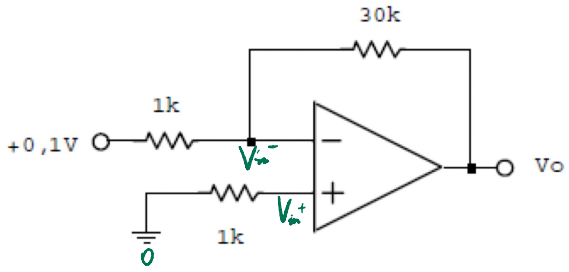
$$\begin{cases} \frac{V_o - V_{in}^-}{10k} = \frac{V_{in}^- - 0}{2k} \\ V_{in}^+ = -2V = V_{in}^- \end{cases}$$

$$\frac{V_o - (-2V)}{10} = \frac{(-2V) - 0}{2}$$

$$V_o + 2V = -10V$$

$$V_o = -12V$$

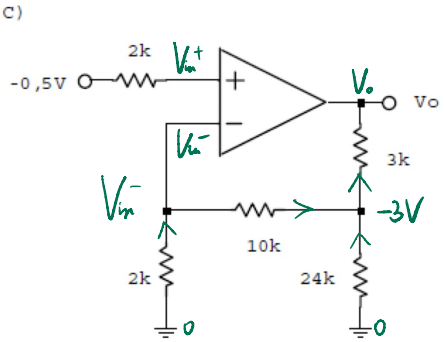
B)



$$\begin{cases} \frac{0.1 - V_{in}^-}{1k} = \frac{V_{in}^- - V_o}{30k} \\ V_{in}^+ = 0 = V_{in}^- \end{cases}$$

$$\frac{0.1V}{1k} = \frac{-V_o}{30k} \Rightarrow V_o = -3V$$

C)



$$V_{in}^+ = -0.5V = V_{in}^-$$

$$I = \frac{V_{in}^- - 0}{2k} = \frac{-0.5}{2k}$$

$$\frac{V_1 - (-0.5)}{10k\,5} = I = \frac{-0.5}{2k}$$

$$\therefore V_1 = -2.5 - 0.5 = -3$$

$$\frac{V_{in}^- - V_1}{10} + \frac{0 - V_1}{24} = \frac{V_1 - V_o}{3}$$

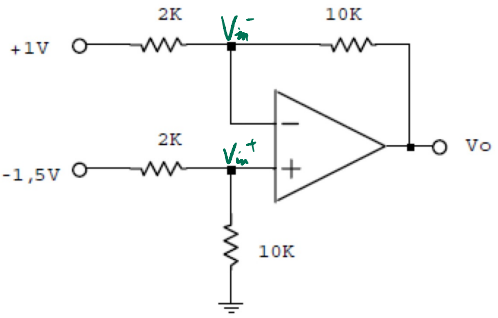
$$\frac{1}{4} + \frac{3}{8} = \frac{-3 - V_o}{3}$$

$$\frac{3}{8} = \frac{-3 - V_o}{3}$$

$$-3 - V_o = \frac{9}{8}$$

$$V_o = -3 - \frac{9}{8} = -3 - 1.125 = -4.125V$$

D)



$$\frac{1V - V_{in}^-}{2k} = \frac{V_{in}^- - V_o}{5\,10k}$$

$$5 - 5V_{in}^- = V_{in}^- - V_o$$

$$V_o = 6V_{in}^- - 5$$

$$= -12.5V$$

$$\frac{-1.5V - V_{in}^+}{2k} = \frac{V_{in}^+ - 0}{5\,10k}$$

$$-7.5 - 5V_{in}^+ = V_{in}^+$$

$$6V_{in}^+ = -7.5$$

$$V_{in}^+ = -1.25V$$