Electronics HW4(a)

1.
(a) AND gate

(b) NOT gate

(c) OR gate

2. You could obtain these voltages experimentally using a series of switches arranged in parallel with a power supply. Switches that are set to ON would provide a high voltage input for logic gate while closed switches would provide 0V input for the OFF logic state.

(Any similar explanation or diagram is acceptable.)

3.

OR

INPUT		OUTPUT
A	B	F
0	0	**0**
0	1	**1**
1	0	**1**
1	1	**1**

AND

INPUT		OUTPUT
A	B	F
0	0	**0**
0	1	**0**
1	0	**0**
1	1	**1**

NOT

INPUT	OUTPUT
0	**1**
1	**0**

4.

(a) At low temperatures, the voltage at X is 4V.

Working:

Resistance of resistor = R_1 (= 200Ω)
Resistance of thermistor = R_2 (= 800Ω)

Voltage across resistor = V_1
Voltage across thermistor = V_2

$$\frac{R_1}{R_2} = \frac{V_1}{V_2}$$

$$\frac{200\Omega}{800\Omega} = \frac{V_1}{V_2}$$

$$\frac{1}{4} = \frac{V_1}{V_2}$$

$$V_2 = 4V_1$$

$$V_1 + V_2 = 5V$$

$$V_1 + 4V_1 = 5V$$

$$5V_1 = 5V$$

$$V_1 = 1V$$

$$V_1 + V_2 = 5V$$

$$1V + V_2 = 5V$$

$$V_2 = 5V - 1V$$

$$V_2 = 4V$$

(b) This is logic level 1.

(c) Point Y is at logic level 0.

(d) The transistor is off.

(e) At the critical temperature, the voltage at point X is 0.45V.

Working:

Use same symbols as part (a) above

Resistance of resistor = R_1 (= 200Ω)
Resistance of thermistor = R_2 (= 20Ω)

Voltage across resistor = V_1
Voltage across thermistor = V_2

$$\frac{R_1}{R_2} = \frac{V_1}{V_2}$$
$$\frac{200\Omega}{20\Omega} = \frac{V_1}{V_2}$$
$$10 = \frac{V_1}{V_2}$$
$$V_1 = 10V_2$$

$$V_1 + V_2 = 5V$$
$$10V_2 + V_2 = 5V$$
$$11V_2 = 5V$$
$$V_2 = \frac{5V}{11}$$
$$V_2 = 0.45V$$

(f) The logic level at point Y is 1.

(g) When the logic level at Y is 1, the voltage at the transistor base is high enough to turn the transistor on. The transistor then switches on the motor to open the windows.