Pre-Lab

Using the Datasheet for the LED Fill out the Voltage and luminous intensity in the table below.
HALP: Reading_Datasheets.PDF (Answers are at the bottom of this document as well)

Use this table if you want to use the LEDs at 20mA.

	RED	BLUE	GREEN
Current	20 mA	20 mA	20 mA
Voltage at current	V	V	V
Delta V at 5V	V	V	V
V=I*R: R=V/I	Ω	Ω	Ω
luminous intensity	mcd	mcd	mcd

-------ADVANCED-------

Use this table if you want the max brightness from your LEDs. (or custom brightness)

	RED	BLUE	GREEN
Max current	mA	mA	mA
Voltage at max current	V	V	V
Delta V at 5V	V	V	V
V=I*R: R=V/I	Ω	Ω	Ω
luminous intensity at 20mA	mcd	mcd	mcd
Relative luminous intensity at max current			
luminous intensity at your current	mcd	mcd	mcd

Unlike resistors, LEDs do not have a linear relation between voltage an current. You approximate a LED as having a constant voltage drop, as obtained from the spec sheet. When we subtract this from the 5V power supplied, we will obtain the voltage drop across the resistor.

Subtract the voltage from 5V and place the result in the Delta V field of the table.

Because we know the voltage across the resistor (calculated in the last step) and the current we want to flow into the LED (from the spec sheet) we can use Ohm's law to calculate the resistance.

Divide the Delta Voltage by the current to get the resistance you want in your resistor and place the result in the resistance field of the table.

Thought for food

I would recommend trying to answer these questions, as they will increase your understanding, but they are by no means required. **Questions marked with an asterisk are much more difficult, you should skip these unless you are interested in them.**

Using 20mA, what percentage of power is distributed to the LED?

Red:

Blue:

Green:

*Using 20mA current, how much light is typically put out by your LED in luminous flux?
(Help: Light, LEDs, and Human perception.pdf)

Red:

Blue:

Green:

Total:

At 20mA current, how much power is consumed by the LED?

Red:

Blue:

Green:

Total:

At 20mA current, what is the luminous efficacy of the LED?
(Help: How many lumens per watt are generated by the LED?)

Red:

Blue:

Green:

Total:

How does this compare to different lighting sources?
(Help: Light, LEDs, and Human perception.pdf)

What is the peak wavelength of each LED?

Red:

Blue:

Green:

*What is the theoretical maximum luminous efficacy of each LED?
(Help: Assume all light is generated at the peak wavelength, this will give you an answer that is close enough. If you try to make it more complicated it will be counted as wrong.)

Red:

Blue:

Green:

If you include the power lost to the resistors, what is the luminous efficacy of the LED?

Red:

Blue:

Green:

Total:

How might you improve efficacy?

ANSWERS

Use this table if you want the maximum brightness from your LEDs

	RED	BLUE	GREEN
Max current	30 mA	30 mA	25 mA
Voltage at max current	1.95 V	3.5 V	3.4 V
Delta V at 5V	3.05 V	1.5 V	1.6 V
V=I*R: R=V/I	102Ω	50 Ω	64 Ω
luminous intensity at 20mA	1300 mcd	1100 mcd	1700 mcd
Relative luminous intensity at max current	1.5	1.5	1.25
luminous intensity at your current	1950	1650	2125

Use this table if you want to use the LEDs at 20mA.

	RED	BLUE	GREEN
Current	20 mA	20 mA	20 mA
Voltage at current	1.9 V	3.3 V	3.3 V
Delta V at 5V	3.1 V	1.7 V	1.7 V
V=I*R: R=V/I	155 Ω	85 Ω	85 Ω
luminous intensity	1300 mcd	1100 mcd	1700 mcd

Thought for food

Using 20mA, what percentage of power is distributed to the LED?

Current is the same for the LED and resistor, so total power is 5V*20mA
Power to LED is V_{subLED}*20mA so percentage power to led is V_{subLED}/5V
5 is half of 10, so just multiply by 2
Red: 1.9/5= 38%
Blue: 3.3/5= 66%
Green: 3.3/5= 66%

*Using 20mA current, how much light is typically put out by your LED in luminous flux?
(Help: Light, LEDs, and Human perception.pdf)
I'm just going to approx because I am reading a chat anyway. (.95=.15+.3+.5 | .8=.3+.5 | .5)
20/40/60->.111/.222/.333
.15*(.111*p)^2 + .3*(.222*p)^2 + .5*(.333*p)^2= .711 relative sr
lumen = cd*sr

Red:1300mcd * .7sr= .9 lm
Blue:1100mcd * .7sr = .77 lm
Green:1700mcd * .7sr =1.19 lm
Total = 2.86 lm

At 20mA current, how much power is consumed by the LED?
5V * 20mA= 100mW
Red: 38mW
Blue: 66mW
Green: 66mW
Total: 170mW

At 20mA current, what is the luminous efficacy of the LED?
(Help: How many lumens per watt are generated by the LED?)
Red: 23.7 lm/W
Blue: 11.7 lm/W
Green: 18.0 lm/W
Total: 16.8 lm/W

How does this compare to different lighting sources?
About the same as a 100W incandescent
Much less than a good LED

What is the peak wavelength of each LED?
Red: 640nm
Blue:461nm
Green: 515nm

*What is the theoretical maximum luminous efficacy of each LED?
(Help: Assume all light is generated at the peak wavelength, this will give you an answer that is close enough. If you try to make it more complicated it will be counted as wrong.)

Red:
Blue:
Green:

If you include the power lost to the resistors, what is the luminous efficacy of the LED?
Red:
Blue:
Green:

How might you improve efficacy?
Don't have resistors, use green light, use less shitty LEDs, operate at different current, blah blah blah