Basic circuit:
1. Turn on the Raspberry pi (Rpi)
2. Connect one of the 5V pins on the Rpi to the + column on the breadboard
3. Connect one of the ground pins on the Rpi to the - column on the breadboard
4. Run a connector from the + column to one row on the main part of the breadboard
5. Run a connector from the - column to a different (but close) row on the main part of the breadboard
6. If we connected a 1Ω resistor between these two rows - so that it is in a closed loop with the 5V supply from the Rpi, how much current would this circuit attempt to draw across the resistor?

5V = I 1Ω I = 5A

a. The Rpi adaptor provides 5V and up to 2 Amps, is this current sufficient?

No, because you need 5 Amps and the Rpi adaptor only provides 2 Amps.

b. What do you think might happen? Please don't actually do this.

It might blow up.

7. Connect a resistor of more than at least 100Ω (Why might this be enough resistance?)
a. If you have a multi-meter able to measure current evaluate the current across the resistor, is it what you expected?

197mA and it wasn't what we expected (15.6mA)

i. NOTE: to measure current, you have to put the meter in series with the rest of the circuit – it cannot measure current like it would voltage (connecting leads to +/- side of a component) – the current has to run through the meter

LED in a circuit:
1. Add an LED to your circuit
a. Put it in series with the resistor and move the +/- connectors to the RPi 5V supply as needed
i. How does the diode need to be oriented? Which wire on the LED goes to the +5V side and which goes to the GND connector?
The plus needs to go on the plus side and the negative needs to go on the negative side. The orientation of the longer side of the LED is positive while the other is negative. The longer side of the LED goes on the +5V side and the shorter is on the GND connector.

b. What is the voltage drop across the resistor? Was this what you expected?
3V it was not what we expected because the current was off.
c. What is the voltage drop across the LED?
1.975V, it was what we expected because the box says 2V.

2. Try removing the resistor from the circuit, keeping the circuit closed - the LED is just in series with the 5V supply.
a. What do you think will happen to the LED brightness?
It will get brighter.

3. Try including resistors of different values - how does LED brightness change vs resistor Strength?
As the resistor decreases the brightness increases.
a. Do the voltage drops across the resistors and LED change?
Yes it does change as the resistor changes.

4. Using the configuration with the highest LED brightness now move the 5V connection on the RPi to one of the 3.3V pins.

a. What do you expect to happen to the LED brightness?
It becomes less bright with lower voltage.

5. Add a step-up circuit components to increase your RPi voltage from 5V to 10V but do not close your circuit yet

a. Using the dimmest configuration for the LED explored previously (meaning select the appropriate resistor from those you tried previously) now
b. How will the LED brightness change?
LED brightness will increase because voltage increases
6. How would you quantify the LED brightness changes?
2 times as bright.
P = IV 2P = 2IV
7. Do any of these results change with different color LEDs? Specifically do any voltage drop values change, is the relative brightness similar for different color LEDs, etc.
Yes the voltage drop values change, yes the brightness is similar with different color LEDs.

Photo-diode:
1. Replace the LED with a photo-diode (remove the step-up component as well if you had one included previously)
a. NOTE: photo-diodes operate in reverse bias mode so you will need to orient the diode accordingly
2. What is the voltage across the resistor when you simply connect the 5V supply to close this circuit?
5mV
3. What happens if you cover the photo-diode? What happens if you change the +connector to go to the 3.3V pin on the Rpi?
If you cover the photo-diode it goes from 5mV to 1mV. It's the same 5mV to 1mV for the 3.3V pin.
a. What is the dark current for this photo-diode? (Use the voltage across the

resistor to determine diode current)
0.0179mA
b. Is 5V enough supply voltage to see a signal from this diode? Is 3.3V?
Both are good enough.
c. What happens if you attach the step-up circuit component to increase the supply up to 10V?
Voltage turns into 5mV.
4. What are the dark current and saturation current for the photo-diode?
The dark current is 0.0179mA and the saturation current is 0.0893mA