The Hellgate Static
March 2023

Hellgate Amateur Radio Club
P.O. Box 3811, Missoula, MT 59806-3811
Web: www.w7px.org

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Coming Events

Mar	13	Testing, Meeting
Mar	17	St. Patricks Day
Apr	09	Easter Sunday
Apr	10	Testing, Meeting
Apr	18	Tax Day
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Officers:

President: Eric Sedgwick, NZ7S
Vice-President: David Herzberg, K7MTD
Treasurer: Dick Walton W7XT
Secretary: Mike Leary, K7MSO

Standing Committees:

Emergency Coordinator: trustee@w7px.org
QSLs, Awards: trustee@w7px.org
Webmaster: webmaster@w7px.org
Asst Webmaster: editor@w7px.org
Radio License Exams Contact VE:
harc.ve.testing@gmail.com
Static Editor: editor@w7px.org

Repeater Advisory Committee:

David Herzberg, K7MTD (Chair)
Tom Hellem, K0SN, Dec 2021 for (22/23)
Tom Mc Ginley, K7QA, Dec 2022 for (23/24)
Paul Shuey, N7PAS, Dec 2022 for (23 - 1Yr)
Gary Duncan, KG7WYQ, Dec 2022 for (23/24)

TAC – Board +T.H. and P.S.

HF Committee

President: NZ7S
Members: K0SN, K7QA, W7XT.

HARC March Meeting

Program: ???
by ???.

We are having in-person monthly meetings and live in person online testing. The testing and meeting are on the 2nd Monday of each Month

Meetings will be held at The Church of Jesus Christ of Latter Day Saints, 3026 South Avenue West, across the street from Big Sky High School. Use the North entrance as all others will be locked.

Testing will begin promptly at 5:30PM, and end at 6:30PM.

Meeting area will be set up between 6:30-7:00PM and meeting will begin at 7:00PM (Business & Program).

Cleanup will be done from the end of the program until done. Volunteers may assist.

Published: 28 Feb 2023 @10:20 PM by N7PAS

February Meeting Testing Results

Congratulations to:

1. On one signed up, Testing was canceled

HARC Meeting 13 February 2023 Minutes

1. Attendance: Bill Reese, KJ7PCR, Paul Shuey, N7PAS, Dean Pond, N7DLP, David Kelly, KK7JXZ, Gary Duncan KG7WYQ, Tom Hellem K0SN, Jim Ramsey KJ7YHG, Mike Leary, K7MSO, Jesse Seaton, KK7GVD, Dick Walton, W7XT, Eric Sedgwick, NZ7S,David Herzberg, K7MTD, Niles Levthold KK7JYA

2. Last meetings minutes – 1ST N7PAS, 2ND KK7GVD, approved

3. Tres Rep:
   - Need to invest some of the club's funds to help us fight inflation.
   - Checking / savings accounts do not do this for us.
   - Money Market account with Edward Jones Current 3.75%.
   - Certificate of Deposit for 1 yr: 4.7%
   - No account management fees.
   - Club needs Corporate Resolution to speak to this for the club.
   - Club board needs to adapt resolution.
   - Club officers will meet after tonight's meeting
   - This necessitates better club accounting, which will cost the club money for software and future Club Treasures training time.
4. New! Treasury Advisory Committee (TAC – NZ7S likes this abbrev).
   Members, Club Officers + K0SN, and N7PAS.

5. HF Committee reinstated by President, NZ7S. Members, K0SN, K7QA, W7XT.

6. HF Committee – W7XT requests Life Membership for Steve Flood for excellent service to the club when he renovates equipment donated to the club. N7PAS responded with Club Constitution requirement that Life Members cannot constitute more than 10% of members in good standing. But W7XT did not have an updated list of members in good standing so the conversation moved on…

7. Constitution and By-Laws Committee (Board + 2)
   Chair: NZ7S
   N7PAS, List Changes at March meeting

8. The Club VP, David K7MTD, will be the point of contact for presentations for each meeting.

9. Net Control Operators:
   08 Mar K7MSO
   15 Mar N7DLP
   22 Mar K7MTD
   29 Mar N7PAS

After the meeting adjourned KG7WYQ gave a presentation on the 'Three Words' location system and phone app.

Secretary: K7MSO

Volunteers on the Air VOTA

Here is a video by our very own Northwest Division Director, Mike Ritz W7VO. In this video, Mike will explain all the details of this exciting year long event.
https://www.google.com/url?q=https://youtu.be/J2jq3yolL8E&sa=D&source=editors&ust=1673821861877018&usg=AOvVaw1EgnVHOM74hFNZv2pT9gXN

I hope all of you take part in this exciting ARRL event.

ARRL Montana Section
Section Manager: Paul Edward Stiles, KF7SOJ
kf7soj@arrl.org

DUES REMINDER:

Dues for 2023 are due in January. They are NOW overdue.
The current amount is $25.00 per person and $5.00 for each additional family member.
1 year free members, your payment will be due the month you earned your license and will be prorated to the end of 2023.
Dues may be sent to Hellgate Amateur Radio Club, P.O. Box 3811, Missoula, MT 59806-3811
Please send your payment in NOW to keep from being dropped from the newsletter.

Harc Inventory

ITEM	MAKE	MODEL	CONDITION	Location	Remarks
Triband Beam	Hy-Gain		Few Missing parts	K0SN	
Tuner	Signal Corps	BC939B	Parts only	K0SN	parts only, no cabinet
SWR Bridge, Forward Pwr Mtr	Heathkit	HM-2102	Works	K7QA	
Reflected Pwr Mtr	Heathkit	HM-15	Works	K7QA	
Mobile Tuning Mtr	Heathkit	PM-2	Untested	K7QA	
Speaker w/volume control	Yaesu		Untested	K7QA	
Trap Vertical	Hygain	14AVQ	Clean, untested	K7QA	
Speaker + Power Supply	Drake	MS-4 + AC4	Not tested	K7QA	in one cabinet
1993 ARRL Handbook			like new	K7QA	
Transceiver	Kenwood	TS-450S	Excellent	K7QA	
Transceiver-2 mtr	Kenwood	TR-7400A	Works	K7QA	
2 Mtr Hand Held Transceiver	Realistic	HTX-202	Error Code	K7QA	
Voice Keyer	MFJ	MFJ-432	untested	KGVO	
Keyer-Semiautomatic	unknown		fair	KGVO	
Rotor Control	Hygain	DCU-1	untested	KGVO	
Peter Dahl Swgng Choke		new	new	KGVO	
Peter Dahl 9 HY @ 1.5A		new	new	KGVO	66 pounds/pick up only
Peter Dahl 40 HY @ .6 A		new	new	KGVO	
Peter Dahl 10 HY @ 1 A		new	new	KGVO	
Transceiver	Kenwood	TS-940	Won't key on CW	KGVO	
VHF radio + mic	Yaesu	FT-720R	?	KGVO	
AC Power Supply	Heath Kit	HP-23-A	works	KGVO	for the HW-101
SSB Transceiver	Heath Kit	HW-101	needs repair	KGVO	
HF Transceiver+Manual	Kenwood	TS-520	non-working	KGVO	
Transmitter	Meissner	9-1160 tube	good	KGVO	was in use
Receiver	Hallicrafters	SX-100	fair	KGVO	
Receiver		SX28	very good	KGVO	
Receiver	Signal Corps	R-392/URR	fair	KGVO	Stromberg Carlson
Transceiver	Collins	RT-91ARC-2		KGVO	Aircraft Military
Transceiver	Heathkit	SB102	good	KGVO	W/ matching spkr. &p.s.
Voice Synthesizer	Icom	UT-102		NZ7S	
RTTY CW	MFJ		?	NZ7S	
Telescoping Mast	MFJ	MFJ-1910	new		
Transceivers, qty-2	Kenwood	220-225 mhz	?	NZ7S	
Antenna Tuner	Icom	AH-4		NZ7S	
Antenna Tuner+manual	MFJ	MFJ-934		NZ7S	

Many electronic parts for amps, tuners, other projects, too numerous to list

Electronics 101.1: Electricity basics

In the first instalment of this series, we will get familiar with what electricity is, some terms, some rules, and a few basic components

Dave Astels

daveastels.com

My career started in the 8-bit days, with the Z80 and 6502, and I've been working with computers ever since. I do some writing at **daveastels.com** and **learn.adafruit.com**

YOU'LL NEED

- **Solderless breadboard**
- **5 V power supply** or battery pack that can be connected to the breadboard
- **LED**
- **Resistors of various values**
- **Breadboard-friendly variable resistor**
- **Digital multimeter** required to do the measurements in some of the exercises

Electricity is fascinating. Most of our technology relies on it: computers, lights, appliances, and even cars, as more and more are hybrid or electric. It follows some well-defined rules, which is what makes it so very useful.

According to Wikipedia, electricity is 'the set of physical phenomena associated with the presence and motion of electric charge'. And what's electric charge? That's the shortage or excess of electrons.

Let's go back (or forward, depending on where you are in life) to high school science and the atom. An atom is, at a very simplified level, a nucleus surrounded by a number of electrons. The nucleus is (again, viewing it simply) made up of neutrons and protons. Neutrons have no charge, but protons have a positive charge. Electrons have a negative charge. The negative charge on a single electron is the exact opposite of the positive charge on a single proton. The simplest atom, hydrogen, is made from a single proton and a single electron. The net charge of the atom is zero: the positive charge of the proton and the negative charge of the electron cancel – or balance – each other. An atom's electrons aren't just in an amorphous cloud around the nucleus: you can think of them as being arranged in layers around the nucleus... rather like an onion. Or perhaps an ogre. This is a very simplified visualisation of it, but it suffices for our purposes.

In a more complex atom, say copper, there are more protons, neutrons, and electrons, and the electrons are in more layers. By default, a copper atom has 29 protons and 35 neutrons in its nucleus, which is surrounded by 29 electrons. The way the electrons are distributed in their layers leaves the copper atom with a single electron in the outermost layer. This is represented in **Figure 1**. Without getting further into subatomic physics, let's just say that having that single electron in the outermost layer makes it easier to manipulate. When we put

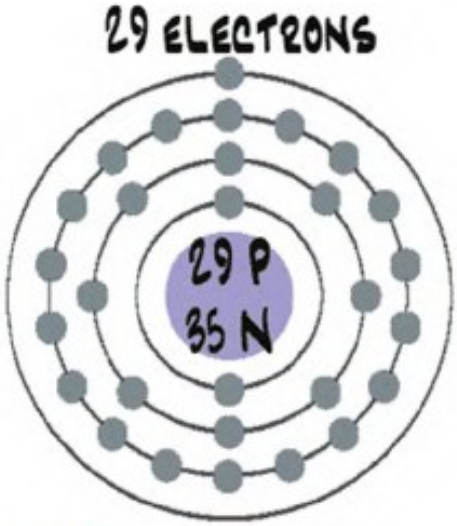


Figure 1
A very stylised representation of a copper atom, with its electron shell

a bunch of copper atoms together to make copper metal (e.g. a wire) it's easy to move those outermost electrons around inside the metal. Those electrons moving around is electricity. The amount of electrons moving over a period of time is called 'current'.

We started by talking about electrons and charge. Look back at the Wikipedia definition: 'presence and motion of electric charge'. Charge is measured in coulombs: 1 coulomb is approximately 6.242×10^{18} electrons. That's 6 242 000 000 000 000 000 electrons. They're very small. Actually, this would be -1 coulomb. +1 coulomb would be that many protons (or really, the net lack of that many electrons).

That's charge. Now let's consider moving charge, which is far more useful in general (unless your goal is to stick balloons to the wall). Consider some amount of charge moving through a wire. The

amount of charge that moves past a specific point (and thus through the wire) over a period of time is called 'current' (just like the current in a river) and is measured in amperes, generally just called amps. Specifically, one amp is equal to one coulomb flowing past a point in one second.

Another common term is voltage. You can think of voltage like water pressure; it's the pressure pushing the electrons (i.e. charge) through a material. The higher the voltage (measured in volts), the faster charge is pushed through, i.e. the higher the current.

The final term is resistance, measured in ohms. Resistance is just what it sounds like. It's a measure of how much a material resists the movement of electrons. We said that copper allows electrons to move freely. That's what makes it so common for wires, PCB traces, etc. We say that it is a good conductor. Glass, on the other hand, locks its electrons in place, not letting them move. It's an example of a good insulator. There are materials that are in between: they let electrons move, but not too freely. These are crucial to making electronics work. There's an interesting (and useful) relationship between voltage, current, and resistance called Ohm's Law (Georg Ohm was the fellow who explored and documented this relationship): the current (denoted I, in amps) flowing through a material is equal to the voltage across the material (denoted V, in volts) divided by the material's resistance (denoted R, in ohms). I = V/R. This equation is foundational and, as such, very handy.

> **You can think of voltage like water pressure;** it's the pressure pushing the electrons (i.e. charge) through a material

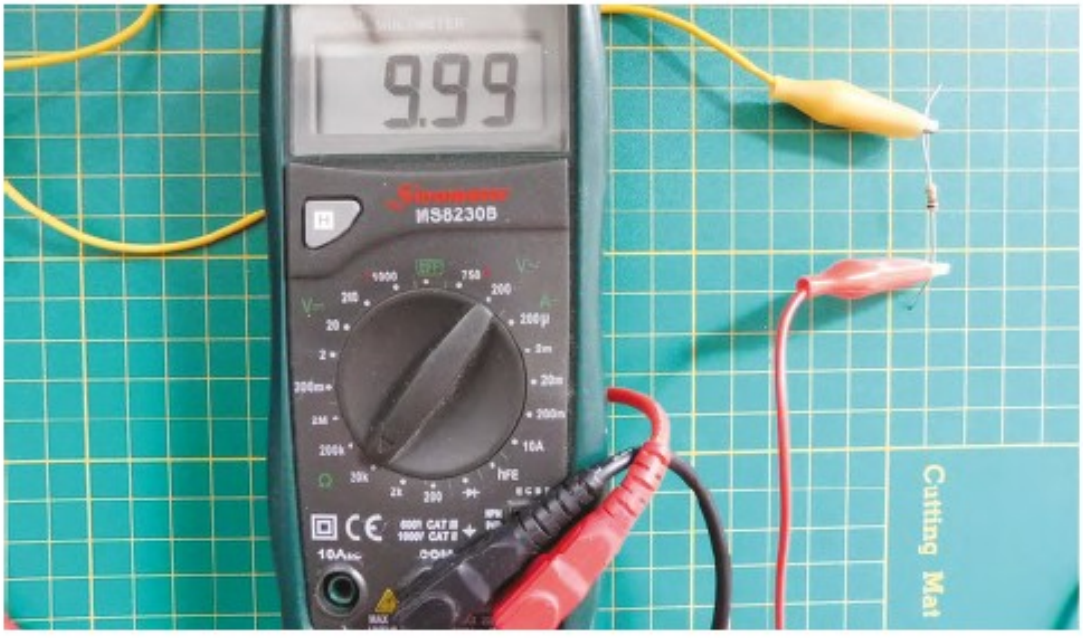
Figure 2
The colour spectrum

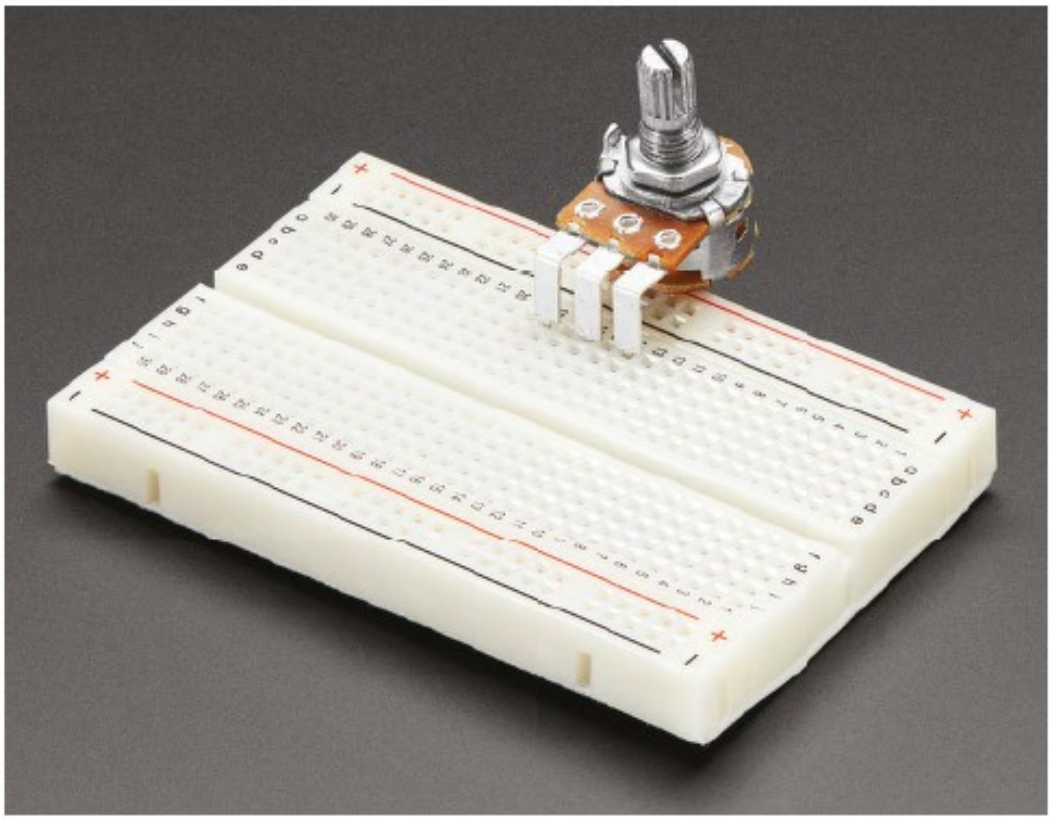
Figure 3
An LED with a current-limiting resistor

LIGHTING UP

There aren't many electronic devices that don't have at least one LED on them somewhere, especially not gadgety ones. If you look at a simple Arduino Uno, it has LEDs for power, Tx, Rx, and pin 13. The first program that most people try is one to blink an LED. ›

Below
A single 10 kΩ resistor reads almost 10000 ohms (no electrical component is perfect)





> **An LED will have a specific Vf** (f is for forward, as in 'forward voltage') that will be defined in its data sheet

LED stands for light-emitting diode. We'll come back to diodes in a later instalment; all we need to know right now is that a diode has to go the right way around. So that leaves 'light-emitting'. That simply means that it gives off light: it lights up. Specifically, it lights up when enough current flows through it. Be careful, though. Put too much current through it and it'll likely crack in two. Seriously, we've done it. Best case scenario, you'll get a bright pulse of light as it burns out. How much current do they like? 20 milliamps (20mA) is typical. Because an LED is a diode, i.e. a semiconductor (we'll look at these in more detail in a future instalment too), it defies Ohm's Law. How? It always has the same voltage across it, regardless of the current flowing through it. An LED will have a specific Vf (f is for forward, as in 'forward voltage') which will be defined in its data sheet. The voltage varies with the colour of light that the LED emits, but usually between 1.8V and 3.3V. Vf for red LEDs will typically be 1.8V, and for blue LEDs 3V–3.3V. As a rule, LEDs with a higher frequency colour will have a larger Vf. **Figure 2** shows the colour spectrum. Colours on the right end are lower in frequency and LEDs emitting those colours will have a lower Vf, while those on the left end have a higher frequency and a higher Vf.

So an LED will have a fixed Vf and a typical LED that we'll use likes about 20mA of current. An LED won't do anything to limit how much current is flowing through it. That's what we meant when we said it defies Ohm's Law.

If we took a blue LED and hooked it to a 3.3V power supply, it will shine happily. Do the same thing with a red LED, and it will blink and burn out. So how do we deal with that? How do we use 3.3V or 5V to

Above
Potentiometers can change resistance

Right
Resistor colour bands show the resistance. Online calculators can help you learn the values

make an LED light up without burning out? We simply limit the current flowing through it. And for that, we need a resistor and Ohm's Law.

GETTING PROTECTION

If we want to power a red LED from a 5V source, we know the following information: current has to be 20 mA, Vcc will be 5V, and the voltage across the LED will be 1.8V. Consider the circuit in **Figure 3**. The voltage across the resistor will be Vcc – Vf, i.e. 5 – 1.8 = 3.2V. We said the current through the LED should be 20 mA. Since there is only one path through the circuit that goes through the resistor as well as the LED, all current has to flow through both: whatever amount of current flows through the resistor has to flow through the LED, no more, no less. This is the crucial thing to realise. We can calculate the value of the resistance needed using Ohm's Law: R = V/I = 3.2V / 20 mA = 3.2V / 0.020A = 160 ohms.

The resistor should have a value of 160 ohms to allow 20 mA of current to flow through the LED. Knowing that the 20 mA and 1.8V values are approximate and that resistors are not exact (+/- 5 or 10 percent are the most common), we chose a slightly higher-value resistor. Considering common resistor values, go with 180 ohm or 220 ohm. A higher-value resistor will allow slightly less current through, which might result in a slightly dimmer light. Try it and see. For practical purposes, simply using a 220 ohm resistor usually works fine.

PARALLEL LINES

In the previous section we connected a resistor and an LED end to end. That's called a series circuit. If we connected them side by side it would be a parallel circuit. Consider the circuits in **Figure 4**.

Below
A multimeter can read voltage, ampage, and resistance

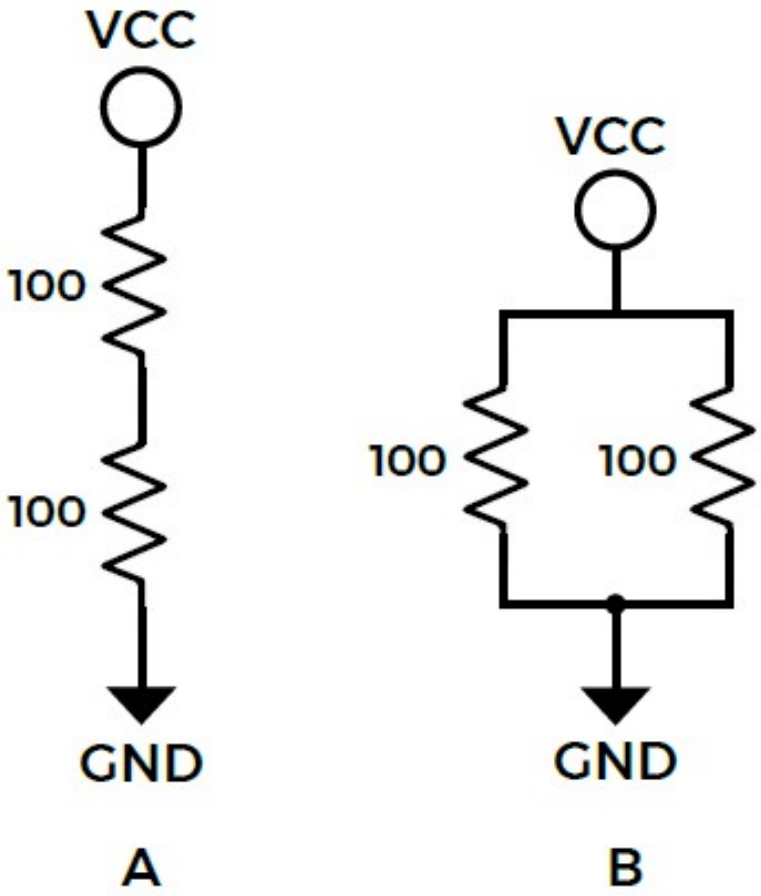


Figure 4
A – series circuit
B – parallel circuit

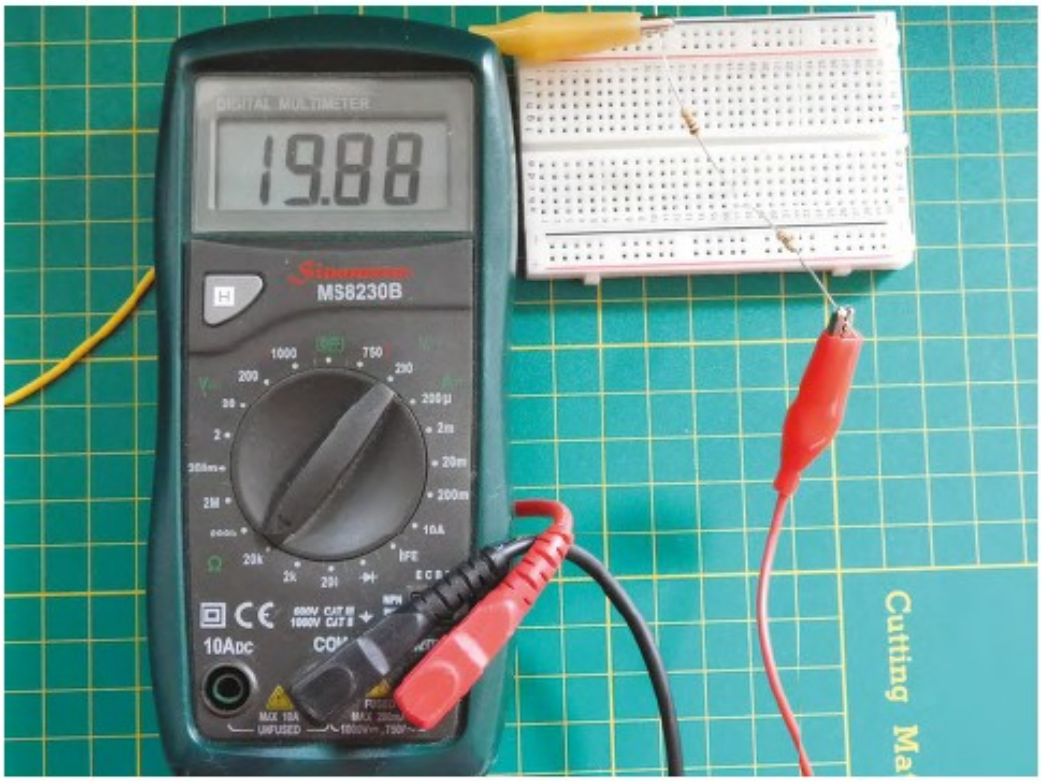
We'll use 5V for Vcc. What is the total resistance between VCC and GND in each circuit? How much current is flowing through each circuit? What is the voltage across each resistor?

When resistors are connected in series, as in circuit A, the resistances are added. So the two 100 ohm resistors in series have a total resistance of 200 ohms.

When resistors are connected in parallel, as in circuit B, it's more complex. Each resistor provides a path for current to flow through. So we could use an indirect method to calculate the total resistance. Each resistor is 100 ohms, and has one end connected to 5V and the other to 0V (GND), so the voltage across each one is 5V. The current flowing through each one is 5V/100 ohms = 0.05A, or 50 mA. That flows through each resistor, so the total current is 100 mA, or 0.1 A. The total resistance is then R=V/I, R=5V/0.1A = 50 ohms. A more direct way is to use the equation 1/Rt = 1/R1 + 1/R2 + … + 1/Rn, where rT is the total resistance, and R1, R2, etc. are the values of the individual resistors that are in parallel. Using this, 1/Rt = 1/100 + 1/100 = 2/100 = 1/50. So Rt = 50. This is a quicker way to do it, and only involves the resistor values. →

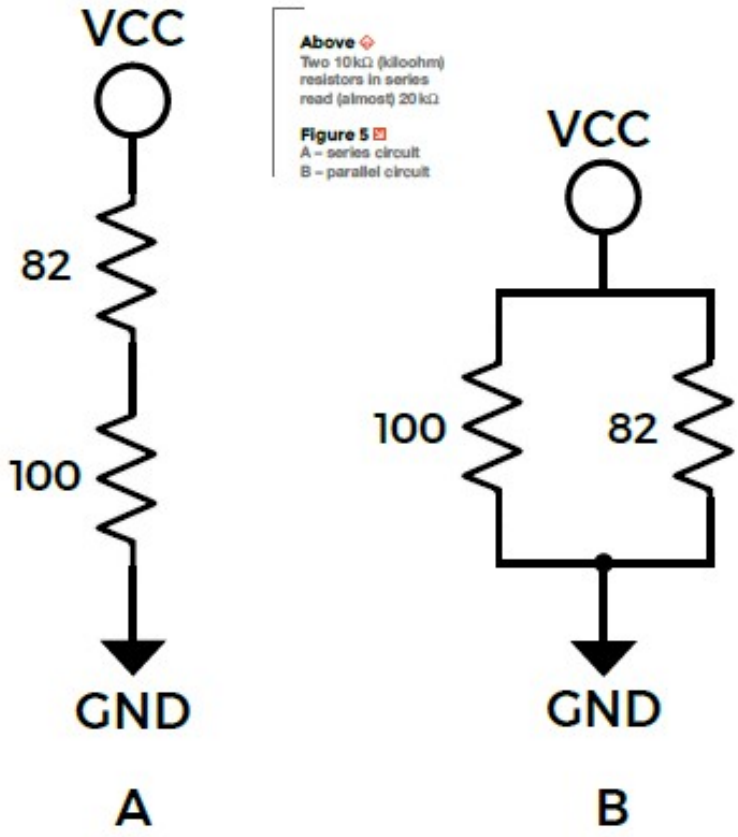
CHALLENGE

Calculate the resistances, voltages, and currents in the circuits shown in **Figure 6** (overleaf). Measure them to confirm your results. We'll work through it in the next instalment.



Above
Two 10kΩ (kiloohm) resistors in series read (almost) 20kΩ.

Figure 5
A – series circuit
B – parallel circuit



Now for current. We know that the series circuit has a total resistance of 200 ohms, so the current will be I = V/R = 5V/200 ohm = 0.025A = 25mA. For one 100 ohm resistor the current is 5V/100 ohm = 0.05A = 50mA. This is expected: if the resistance is lower, there is less 'resistance' to current flowing, so with the same voltage, more current will flow. We already computed the current for the parallel circuit: 100mA. This is higher because we know that each resistor has 50mA flowing through it. In a parallel circuit the currents are added.

The final question is what voltage is across each resistor. Let's look at the parallel circuit first. One end of each resistor is connected to 5V, and the other end of each is connected to 0V (GND). So clearly, the voltage across each one is 5V. In a series circuit it's different. We can use Ohm's Law because we've calculated the current flowing through each one (0.025A), and that current flows through both resistors. Each resistor is 100 ohm, so the voltage across each one will be V = IR = 0.025A × 100 ohm = 2.5V. This makes sense intuitively, since the resistors have the same value and the same current is flowing through both. If makes sense that the voltage across each would be equal, and half of the total. Remember that it's unlikely to be exactly half, due to the slop in the resistor values.

Let's do this one more time with unequal resistors. See **Figure 5**.

For the series circuit, we simply add the resistances: 100 ohm + 82 ohm = 182 ohm. The current is 5V/182 ohm = 0.0274725 A = 27.4725 mA. Because resistors are inexact, it's safe to call this 27.5 mA. The voltages are 100 ohm × 0.0275 A = 2.75 V across the 100 ohm, and 82 ohm × 0.275 = 2.25 V. The voltages always have to add up, accepting rounding errors. Relative to ground, the voltage at the point between the resistors is 2.75 V. What will happen if we make the top resistor smaller (i.e. have a lower resistance)? The total resistance goes down, the current goes up, so the voltage across the 100 ohm resistor goes up. This is what's generally called a voltage divider.

For the parallel circuit we can use 1/Rt = 1/100 + 1/82 = 82/8200 + 100/8200 = 182/8200 = 1/45, so Rt = 45 ohm. The total current is 5V/45 ohm = 0.111 A = 111 mA. For the individual resistors, the currents are 5V/100 ohm = 50 mA and 5V/82 ohm = 61 mA. Add these up and we have the total current of 111 mA. Parallel resistors act as a current divider.

I encourage you to create these little circuits on a breadboard and measure the resistances, voltages, and currents for yourself.

RESISTORS IN SERIES FORM A VOLTAGE DIVIDER, RESISTORS IN PARALLEL FORM A CURRENT DIVIDER

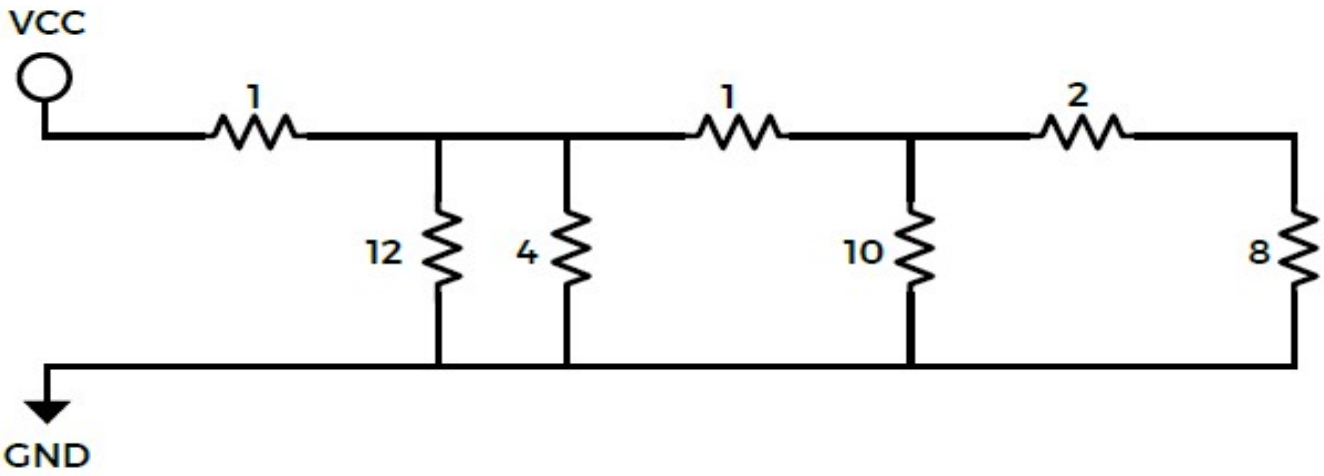
Consider what happens if we replace the resistor connected to Vcc in a series circuit with a variable resistor. The voltage between the resistors will vary as the value of the resistor does. As the resistance goes down, the voltage goes up. The reverse is true as well: as the resistance goes up, the voltage goes down.

One use of this is to replace the variable resistor with a photoresistor. A photoresistor is a resistor whose value depends on how much light is shining on it (i.e. how many photons are hitting it, to be precise). More light = lower resistance. Now the voltage divider can be used to measure the strength of light. All you need to do is connect the point between the resistors to an analogue input and read it.

We've had a brief look at the basic concepts of electricity: charge, current, voltage, and resistance. We've also had a closer look at resistors and ways of combining them. We finished with a practical example of a series resistor circuit being used to measure light. □

Above
Two 10kΩ resistors in parallel read (almost) 5kΩ

Figure 6
Combined parallel and series circuits



HELLGATE AMATEUR RADIO CLUB

AGENDA – 13 Mar 2023 meeting

Introductions. Please make sure you sign the attendance sheet

Last meeting minutes: Motion to approve minutes: 1St _____ 2nd _____
Discussion _____ Vote: P/F/T___

Treasurer's report:_____
Motion to approve report: 1St _____ 2nd _____ Discussion _____ Vote: P/F/T ____

Repeater Advisory Committee Report: _____
_____
_____
Motion to approve report: 1St _____ 2nd _____ Discussion _____ Vote: P/F/T ____

Events for 2023:

Mar 13 Testing, Meeting
Mar 17 St. Patricks Day
Apr 09 Easter Sunday
Apr 10 Testing, Meeting

HARC Social Net every Saturday morning @ 9:00 AM on 147.040 Repeater – Buy/Sell at end.

HARC Discussion List

1. _____

2. _____

VHF Net Control Station assignments:

Mar 1	_N7PAS	Backup	Apr 5	N7PAS	
Mar 8	_K7MSO	Backup	Apr 12	_____	
Mar 15	_N7DLP	Backup	Apr 19	_____	
Mar 22	_K7MTD	Backup	Apr 26	_____	
Mar 29	_NZ7S	Backup	___ __	_____	

Reminder: Backup is always the next person in line as the net control.

Good and Welfare. _____
_____

***** Next Club meeting: Apr 10**
Motion to Adjourn: 1St _____ 2nd _____ Vote: P/F/T

Program: None,
If anyone wants to volunteer please show up prepared and let Dave know

March 2023

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
26	27	28	1	2	3	4
			ERC NET 7:30 On 146.900-88.5T BARC NET 8:15 On 146.720-203.5T HARC NET 9:00 On 147.040+No Tone			HARC Social Net 9:00Am on 147.040 Repeater
5	6	7	8	9	10	11
			ERC NET 7:30 On 146.900-88.5T BARC NET 8:15 On 146.720-203.5T HARC NET 9:00 On 147.040+No Tone			HARC Social Net 9:00Am on 147.040 Repeater
12	13	14	15	16	17	18
	HARC Testing 5:30 & Meeting 7:00 PM		ERC NET 7:30 On 146.900-88.5T BARC NET 8:15 On 146.720-203.5T HARC NET 9:00 On 147.040+No Tone		St. Patrick's Day	HARC Social Net 9:00Am on 147.040 Repeater
19	20	21	22	23	24	25
			ERC NET 7:30 On 146.900-88.5T BARC NET 8:15 On 146.720-203.5T HARC NET 9:00 On 147.040+No Tone			HARC Social Net 9:00Am on 147.040 Repeater
26	27	28	29	30	31	1
			ERC NET 7:30 On 146.900-88.5T BARC NET 8:15 On 146.720-203.5T HARC NET 9:00 On 147.040+No Tone			