PowerStream car battery questions and answers

www.powerstream.com/car-battery-faq.htm

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Q: What is the car battery charging voltage? What voltage is required to charge it?

A: A 12V car battery can be charged over a range of voltages. It needs at least 12.9 volts to charge, but at this voltage the charge rate is very slow. A car battery can be charged safely at high voltages as long as the battery is not fully charged. So alternator voltages and car battery chargers voltages can go over 15V safely, as long as the battery is monitored to make sure that it isn't overcharged. These higher voltages allow the battery to be charged faster. But if you want to leave the battery on the charger to keep it topped off, a float voltage of 13.6V to 13.8V is usually used. For more information on charging lead acid batteries look here.

Q: What is the 12V car battery voltage range as it is charging and discharging?

A: Car battery voltage will change depending on its condition. When the engine is off the battery open circuit voltage is 12.9 volts. A freshly charged battery, either by alternator or charger, can measure higher voltage than that by accumulating non-chemical charge on the plates like a capacitor, so it might have to sit for a while or be discharged a little to get to that voltage. As the battery discharges the voltage will sag down to 10 volts or lower. If the battery stays above 11.8 volts it will generally still start the vehicle.

Q: Can a car battery freeze when it gets too cold?

A: When a lead acid battery is fully charged the electrolyte is sulfuric acid with a freezing point of below -40°C. When the battery is fully discharged all the sulfate ions are consumed and the electrolyte is mostly pure water with a freezing point of zero degrees C. So it is not unusual to go out to a car that has a dead battery in the mid winter and find that the battery won't accept any charge current. It needs to warm up before it can be charged, and then it won't freeze again until it is discharged.

Q: How long does it take to recharge the battery after starting the engine?

A: Not very long. This is not too hard to estimate. Typical car batteries are rated for cold cranking amps, and the one I use has 800 CCA. So being very very conservative lets assume that it takes 800 amps to start the car. I have three cars, 17 years old, 14 years old, and 22 years old, they all start in less than 3 seconds, but to be conservative let's assume 10 seconds. So 10 seconds times 800 amps is 8000 amp-seconds (8000 coulombs for you physicists) or 2.2 amp-hours. If the alternator is sourcing 80 amps, this will be replaced in 99 seconds.

A more accurate calculation would be 200 amps for 3 seconds, which would be replaced in less than 8 seconds.

Q: Why does driving short distances flatten my battery?

A: Well, it does a number on my battery. I have a 5 mile commute to work, and in the winter I have the headlights, the seat heater, the heater fans and pump and the rear window defroster going continuously in the morning and in the evening. Not to mention the radio blasting. And of course the battery is cold, in the bottom of the trunk, so it will charge slower. This doesn't give the battery much of a chance to charge or overcharge to de-stratify the acid with a few bubbles. In my Jaguar the windows slide down half an inch when the door opens to avoid the top seal. When the battery voltage gets low the car lets me know by not raising the windows back up when the door closes. I bought a new battery last spring, and by December the windows are giving me trouble.

As the days lengthen and I don't use the headlights as much the car battery charge eventually fills up.

Q: Should I add water to the battery before or after I charge it?

A: Add the water before you charge. The charging process will create bubbles that help mix the acid. The charging process, even with a completely out of control battery charger, will not consume much water during one charge. I should also mention that modern charging systems with accurate voltage regulations will not consume any appreciable water, and of course the sealed batteries recycle their water, so you can't replace it.

Q: What is the liquid inside a car battery?

A: The battery electrolyte is a mixture of water and sufuric acid. The concentration of the acid depends on the state of charge of the battery, the more discharged the less sulfuric acid.

Q: How much water should be in a car battery?

A: There should be an indication in the battery, as you fill up a cell the fluid will raise to that level, then stop. Usually it is a cup with a hole in it inside the fill port. Just fill it up until it is at the level indicated.

Q: Should I add battery acid or distilled water?

A: The thing that is consumed is water, so replace it with water. If someone dumped all the acid out of the battery when it was fully charged, replace the acid. If they dumped out all the acid when it was fully discharged you may be able to get away with just replacing it with water, since the acid will be re-created during the charging process. Of course this battery spillage problem is very rare, and you might just want to buy a new battery.

Q: At what voltage is a car battery fully discharged?

A: A car battery can be considered to be empty when it is less than 10V. There is very little energy available between 10V and 0V, and the battery is damaged when discharged below 10V.

Q: Can a car battery charge another car's battery by itself?

A: A car battery does not have enough voltage to charge another car's battery by itself. To charge the car engine must be running. To explain further, the open circuit voltage of 12.9 volts is not enough to move the chemistry even in a fully discharged battery. You need to be above 12.9 to start the chemistry moving at all, and up at 13.5V to charge at a significant rate.

Q: Can a car battery recharge itself?

A: This seems like an odd question, but the answer is "sometimes." For example, you have been putting the battery under strain, such as trying to start my old 1959 Alfa Romeo for ten minutes until the starter wouldn't turn any more. Waiting 20 minutes will let the reaction products diffuse away from the plates and the battery will crank away for a while longer, which might give the impression that it recharged itself.

Q: What is the car cigarette lighter voltage?

A: The cigarette lighter or power point socket in a car is usually connected directly to the battery/alternator circuit, with a fuse protecting it. So when the engine is not running the voltage ranges between 12.9V and 10V as the battery discharges. When the engine is running the voltage is typically between 13.6 and 14.4 volts, depending on the alternator's load curve and the state of charge of the battery. Some cars can get up to 15V under normal operation.

Q: How much current can I draw from a car cigarette lighter?

It depends on the car. You can check on the fuse for the car lighter to find the upper end for your particular vehicle. There is an unofficial standard that the power point socket should supply at least 8 amps, but many cars supply 25 to 30 amps to the socket. This will allow 300-350 watts to be safely drawn.

Q: How much does a car battery weigh? How many amp-hours does a car battery contain?

A: A car battery's weight depends on the size of the battery, but is typically between 30 and 50 lbs, with most running around 41 lbs (14 kg to 22 kg). Here are some rough estimates of battery weights , cold cranking amps, and Amp Hour capacities of starting, light and ignition (SLI) car batteries.

BCI Group	Car battery weight in lbs	Car battery weight in kg	Typical AH Capacity	Typical CCA
1	33.5	15	100	650
2	36.5	17	60	780
3EE	43	20	54	400
4	47	21	125	975
4D	97	44	115	950
7D	60	27	156	950
8D	130	59	130	59
24F	40	18	55	650
31	55	25	80	800
22F	30	13	35	425
24	39	17	55	650
25	31	14	45	600
26	25	11	45	540
35	31	14	45	600
41	37	17	64	675
42	29	13	40	475
55	33	15	52	590
56	33	15	52	585
58	32	14	53	580
62	33	15	52	590
65	39	18	55	675
75	35	16	60	700
86	32	15	47	570

Q: What is the car battery discharge rate?

The chart above lists maximum discharge rates at cold temperatures. The temperature is 0°F or -17.8°C, and the criterion is that the battery be able to deliver current at the CCA rate for 30 seconds with a voltage sag to 1.2V per cell (7.2V for a 12V battery). The battery's internal resistance goes down 30% as it warms from -17.8°C to 30°C, and the discharge current so a battery with 700CCA should be able to source over 900 amps for 30 seconds at 30°C. This would be a power of around 10,000 watts.

Q: What is the car battery charging current?

A: A car battery can be charged an any rate from zero to hundreds of amps. They are designed to discharge at high current, so they can also be charged at high current. Modern car battery chargers have high voltage precision, which makes them safe to use at just about any current that you can afford to buy. If you are sizing a charger for float charging, anything above 100mA should work fine.

Q: What about charging a sealed car battery?

A: Sealed car batteries are the same chemistry as the flooded car batteries, but their construction makes them less prone to water loss because any gasses can be recombined before venting. So a sealed car battery can be charged with the same chargers as flooded batteries, except for the ancient chargers that have poor voltage control.

Q: How long does it take to charge a 12V car battery from flat?

A: Charging time depends on the battery and the charger. For a battery being charged by the car's alternator it can take an hour of driving to get it fully charged. Car batteries range from 40AH to 110AH, and alternators range from 45 amps to 200 amps. If you are using a battery charger, a 10 amp charger will take 4 to 11 hours to fully charge the battery, a 2 amp charger will take 2-4 days. Of course you don't have to get the battery to full charge to get it to start the car.

Q: Can I use a car battery charger as a power supply?

A: Older car battery chargers can be used as power supplies, but the newer ones have a safety feature. This prevents the battery from supplying voltage unless it detects the presence of a battery on the leads. In other words, some minimum voltage must be supplied externally to the leads in order for the charger to turn on. You can see that this prevents high current sparks from the alligator clips shorting, but it prevents you from charging a totally dead battery, and it prevents you from using the charger as a power supply to run a car stereo in your house, for example. For more details see "how to use a battery charger".

Q: Should I disconnect a car battery before charging?

A: It isn't necessary to disconnect a battery before charging. Any drain while the car is turned off will be minimal. The charger's voltage won't be high enough to do any damage to the car. It is important not to remove the car's cable from the battery terminal while the alternator is going, it could cause a voltage spike called a "load dump" surge.

Q: What is a typical self-discharge rate for a car battery?

A: Any battery will eventually discharge itself. A flooded car battery discharge rate is about 1% per day at room temperature, 0.25% per day at 10 °C (50 °F) and 1.5% per day at 30 °C (86 °F). This self discharge percentage is the percentage of the remaining capacity, so a flooded lead acid battery will still have 50% of its capacity remaining after 6 months. Low-maintenance and sealed batteries have lower discharge rates of less that 0.5% per day and calcium-lead batteries can have a self discharge of less than 2% per month.

Do you need to charge a new car battery?

A: A new car battery has plenty of charge to run the car, but it won't hurt the battery to put it on a charger. If you are storing the car battery you should put it on a float charger, or charge it every 2-months to keep it from sulfating.

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