

Have you stocked up on bulk kits recently? They never expire and you can use them on any kind of oil. Sample your lawn mower! Your motorcycle! Your chain saw! Or just stick with your vehicle. Right now they're a screamin' deal. The price will be going up in October, so if you fancy saving a few bucks, now is the time to do it!  
<http://www.blackstone-labs.com/order-now.php>

## Better Mileage with Synthetic?

By Amanda Callahan

One afternoon a customer emailed us and said he gets better mileage when he's using synthetic oil. To be honest, we were skeptical. If you've been with us long enough, you know we generally think that oil type doesn't matter. Use Oil A for 5,000 miles and do a sample to check your metals, then use Oil B for the same miles and resample. Most people will find that their engine wears just the same regardless of oil brand. But here is an idea we hadn't tested--is fuel economy affected by your choice of oil? We decided to try and find out.

### Designing the Experiment

When we first started talking about a fuel economy experiment, we came up with a lot of questions. How will we know how much fuel we're actually using? How will we take into account tire pressure and other things that can affect fuel economy? Do we need to take into consideration the natural expansion of gas at different temperatures?

We eventually decided on the following plan. It's probably not scientific enough for a MythBusters special, but it's about as good as we could get without installing special pumps and meters, and it should be repeatable if you want to give it a shot in your own vehicle.

Counting miles was the easy part--we just recorded miles at every gas fill-up. Figuring the "per-gallon" was a little trickier, since we don't really have an accurate way to measure fuel consumption. In an episode of MythBusters where they were doing something that involved calculating miles/gallon, they took an old clunker, removed the hood, and rigged up a container that measured fuel consumption to the milliliter. That's a little more involved than we wanted to get, especially since our guinea pigs are analysts Amanda and Alex's daily driver vehicles.

We ended up recording the number of gallons needed to fill up at the pump. We decided to resist the urge to "top-off" the tank when filling and just stop pumping whenever the pump stopped. Is this a perfect measure of fuel usage? Certainly not. Every pump could be a little different in its stopping point depending on the day, the pump, the volume/speed of fuel dispensed, ambient temperature, and so on...but these things are impossible to control in the real world.

We decided to do ten gas fill-ups on each type of oil. With ten fill-ups, we'd have enough data to take into account some of those variables mentioned above that we can't control. We also made a note to monitor tire pressure, though that varied so little that we thought it negligible.

### Royal Purple vs. Quaker State

Amanda started with Quaker State Advanced Durability 5W/20. The price at O'Reilly Auto Parts was \$5.29/quart or \$23.99 for a handy 5-quart bottle, which is just perfect for her Kia, which takes 4.8 quarts of oil. She ran that oil in her car from May to June 2013. In ten gasoline fill-ups, she ran 3,703.7 miles and used 131.858 gallons, for a fuel economy of 28.09 miles/gallon.

She decided that 3,703.7 miles was too early to change her oil, so she kept running that oil for a total of 6,333 miles and changed the oil on July 27, 2013. Her wear numbers looked good. (We didn't have enough space in this newsletter to show the report, but we'll send it to you if you want to see it.)

On to the synthetic! Royal Purple 5W/20 costs \$9.79/quart at O'Reilly Auto Parts and does not come in a handy 5-quart jug, so we ended up paying \$48.95 for oil on this oil change. Amanda ran this oil from the end of July until October, going 3,829.2 miles and

using 137.002 gallons of fuel, for a final fuel economy of 27.95 miles/gallon, a decrease of 0.5% compared to the Quaker State conventional.

Oil	Price/5 gal.	Miles	Gals.	MPG
Quak. State 5W/20	\$23.99	3703.70	131.89	28.08
Royal Pur. 5W/20	\$48.95	3829.20	137.00	27.95

Amanda ran the Royal Purple a total of 14,277 miles before changing it (we're all for getting our money's worth out of an oil change!), and ended up with only a few ppm more wear than usual.

The two oils are very close in terms of fuel economy, with the conventional Quaker State slightly edging out the more expensive Royal Purple. But in the spring of that year she was doing a little more highway driving than in the fall, with a few trips between Illinois and Green Bay, Wisconsin, and so on. Even so, the added cost for the oil itself almost certainly defeats any slight improvement in MPG she might have gotten. So let's look at Alex's numbers.

#### Mobil 1 vs. Mobil Super and Advance Auto Parts 5W/30

Alex spent \$34.85 for five quarts of Mobil 1 Advanced Fuel Economy 0W/30 at Wal-Mart and ran the oil from January 2013 to May 2013. He traveled 3,061.1 miles, used 91.3 gallons of gas and ended up with a fuel economy of 33.53 miles/gallon.

Then he bought five quarts of Mobil Super 5W/30 conventional oil for \$18.10 and ran 3,234.9 miles on 92.0 gallons of fuel from June to October 2013, for an average fuel economy of 35.16 miles/gallon--a difference of 4.9% in favor of the conventional oil.

Alex did note that his engine tends to get better fuel economy in general in the warmer months than the colder months, so he repeated the experiment again the following year, using Advance Auto Parts 5W/30 conventional oil from February to March 2014, getting 32.93 MPG. He then ran Mobil 1 Advanced Fuel Economy 0W/30 from May to August, getting an average fuel economy of 34.46 miles/gallon. In this case, Mobil 1 did beat the conventional oil, but his mileage still wasn't as good as on the original run of Mobil Super 5W/30 conventional, and the added cost of the oil negates any extra miles-per-gallon. Alex did note that on synthetic oil his engine seemed to burn less oil, but since that wasn't the point of the experiment, we didn't get too deep into trying to quantify that.

Oil	Price/5 gal.	Miles	Gals.	MPG
Mobil1 AFE 0W/30	\$34.85	3061.10	91.30	33.53
Mob Super 5W/30	\$18.10	3234.90	92.00	35.16

#### Synthetic or Conventional?

So...which oil to choose? We get asked this question hundreds of times a year on the phone, in e-mails, and written on oil slips. And honestly, from a wear standpoint, we don't find a lot of difference between conventional and synthetic oils. Some engines may run better on one than the other, or maybe you find that your engine uses less oil on one or the other, but these things are hard to quantify from our end. There are so many factors that affect how your engine wears, what kind of mileage you get, and how long your engine will last that we could never issue a blanket one-size-fits-all statement saying "You should use X."

We did not find that synthetic oil gave us better fuel economy, but that doesn't mean that you won't. Feel free to try this experiment at home and let us know what you find. Or, if you're not experimentally-inclined and you're wavering about what oil to use, feel free to use whatever fits your wallet. Any API-certified oil is going to be quality oil, and your engine should be happy with whatever you choose.

For many years during the 1950s and 1960s my grandfather Bill Stark worked at the Dana Axle plant here in Fort Wayne as a production shift supervisor.

One year he bought a new Buick, and after a few months of driving started to brag to the workers on his line about how good of gas mileage he was getting (16 mpg!). But that was just the start. Over the next few months, the mileage just kept getting better and better. What was originally 16 mpg went up to 20 mpg, then up to 25 mpg, then 30 mpg and so on. When it reached 40 mpg, he started to get embarrassed and quit talking about it. Then, just as soon as he got used to the excellent mileage, it started dropping. From 40 down to 30, down to 20, then 10 and finally down to 5 mpg! Understandably, Bill was distraught; started swearing up and down about that worthless Buick and the SOB's at the dealership to anyone who would listen.

It wasn't until he started talking about taking it in to be looked at that his guys finally fessed up. While Bill was hard at work making sure the axles went out the door on time, his guys were going out to the parking lot and, at first, adding gas to his tank a little at a time, then later on siphoning out a little at a time!

Now I know why locking gas caps were invented.

--Ryan Stark

SUMMARY	
Oil	MPG
Quaker State 5W/20	28.08
Royal Purple 5W/20	27.95
Mobil 1 0W/30 (1st)	33.53
Mobil Super 5W/30	35.16
Adv. Auto 5W/30	32.93
Mobil 1 0W/30 (2nd)	34.46

## Report of the Month

This 2000 Jeep Wrangler has some serious issues. Can you tell what's going on?

To learn more about where the elements are coming from, [click here](#).

ELEMENTS IN PARTS PER MILLION	MI/HR on Oil	7,247	UNIT/ LOCATION AVERAGES					UNIVERSAL AVERAGES
	MI/HR on Unit	300,834						
	Sample Date	9/4/15						
	ALUMINUM	436						4
	CHROME	18						1
	IRON	3135						26
	COPPER	33						4
	LEAD	737						3
	TIN	11						1
	MOLYBDENUM	91						71
	NICKEL	8						1
	POTASSIUM	16750						3
	BORON	12						46
	SILICON	250						12
	SODIUM	2172						46
CALCIUM	2364						2037	
MAGNESIUM	1018						148	
PHOSPHORUS	1338						732	
ZINC	1415						872	
BARIUM	18						0	

Values  
Should Be\*

PROPERTIES	SUS Viscosity @210°F	100.9	65-78				
	cSt Viscosity @ 100°C	20.58	11.6-15.3				
	Flashpoint in °F	390	>375				
	Fuel %	<0.5	<2.0				
	Antifreeze %	4.34	0.0				
	Water %	0.0	0.0				
	Insolubles %	20.0	<0.6				
	TBN	24.0	>1.0				

The very high levels of potassium and sodium are a dead giveaway here; this Jeep has a major anti-freeze problem. That's a common weakness of these 4.0L engines -- antifreeze tends to strike around 100,000 miles, but once the problem is fixed it can be quite a while before the issue reappears. That's what you're seeing here. The head gasket is allowing coolant into the oil supply, which does several bad things. Coolant destroys the oil's ability to lubricate, causing poor wear throughout the engine but especially at the bearings (copper, lead, tin) and shafts (iron). It also thickens the viscosity and causes sludge (insolubles) to form so the oil doesn't circulate as freely. Note the very high TBN -- excessive antifreeze contamination throws off a TBN reading. This engine needs help, pronto!