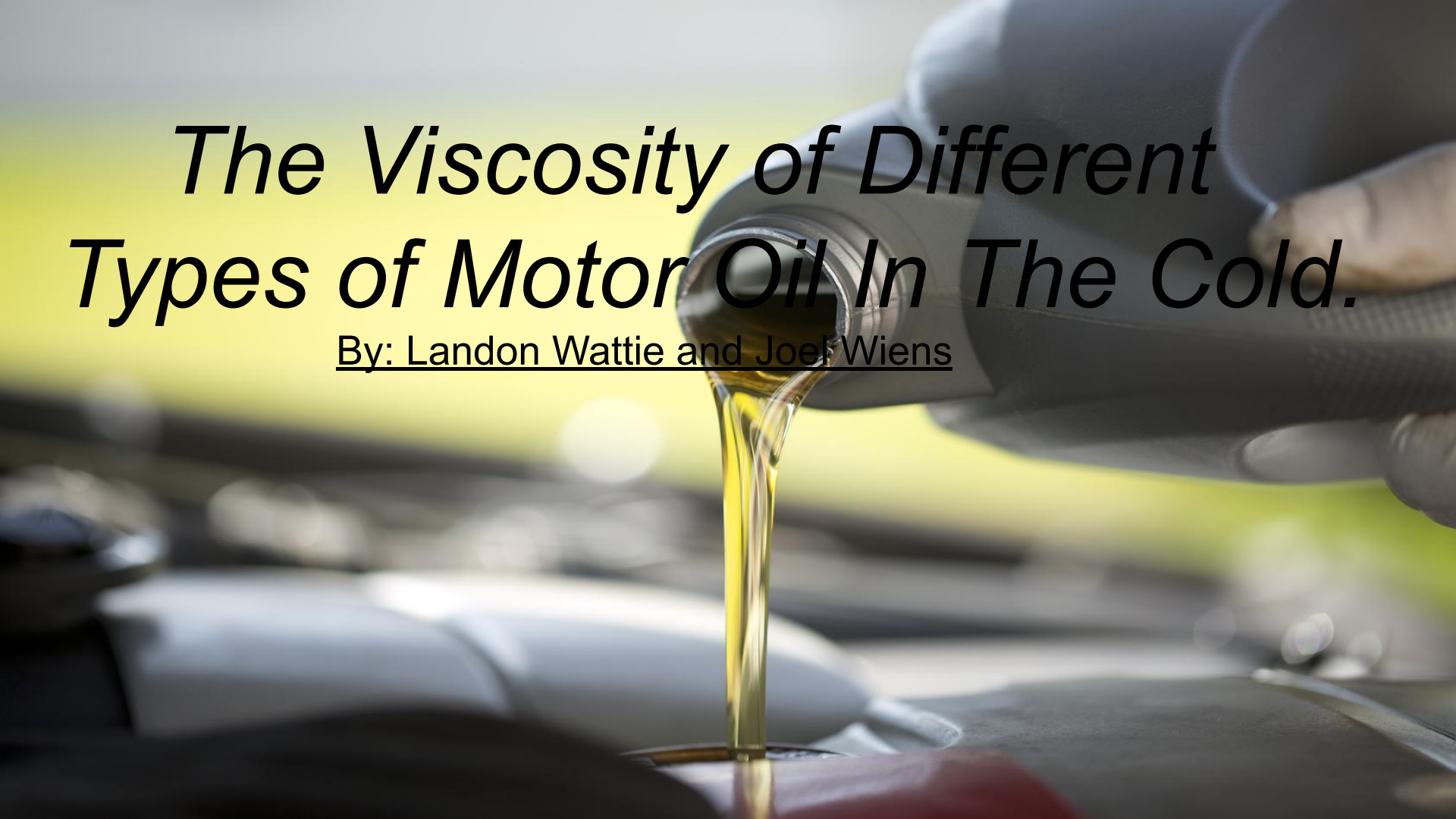

The Viscosity of Different Types of Motor Oil In The Cold.

By: Landon Wattie and Joel Wiens

Dates we met:

Feb. 5 - (At School) CYSF registered their projects
Feb. 6 - (At School) We received a copy of our Scientific Method Graphic Organizer (this slide deck)

Feb 12 - (At School) Is the first day we have Officially logged today we decided on our official project and started doing background research.

Feb 18 - (At School) We are still working on our background research

Feb 19 - (At School) We slightly changed our project to seeing which oil is best in cold weather Conventional, Synthetic blend, Full Synthetic. We started filling in our slides.

Feb 20 - (At School) we finished our hypothesis.

Feb 21 - (At school) Put our materials list together.

Dates we met:

Feb 21 - (At Landon's House) Got a bunch of slides done.

Feb 24 - (At School) Did a bunch of background research.

Feb 26 - (At School) We built a mini trifold for organization.

Feb 26 - (At Joel’s House) We did the experiment.

Feb 28 - (At Joel's House) We imputed data into our slides from our experiment.

March 3 - (At School) We proof read some slides.

March 4 - (At school) We proof read slides and made them spic span and put a few more things on our Variables.

March 5 - (At school) We proof read slides and made sure everything is perfect.

March 5 - (At Joel’s House) We built our trifold.

Why we chose this topic and who would be interested in our research?

We chose viscosity of motor oil in cold climates for our science project because we are really interested in cars and engines. We wanted to learn about the viscosity of motor oil because we thought it would be interesting to find out how motor oil flows through the engine when its cold. We also wanted to see what would happen if we made the motor oil cold.

We think car engineers would be interested in our research, because they make cars and they could improve what motor oil they put in cars to help them run better in cold climates.

Problem:

How does the viscosity of motor oil change when it is cold? Between 5W-30 synthetic motor oil and 5W-30 conventional motor oil, what motor oil works better in the cold?

Hypothesis:

We think the 5W-30 synthetic motor oil will have the lowest viscosity and the 5W-30 conventional motor oil will have the highest viscosity when it is cooled down. We think making the motor oil cold will make the viscosity higher in both the 5W-30 synthetic motor oil and the 5W-30 conventional motor oil. The synthetic motor oil will still have the lowest viscosity because there is wax in the 5W-30 conventional motor oil. When the wax in the motor oil gets cold it makes the motor oil thicker. 5W-30 synthetic motor oil does not have wax in it, so it will not get as thick.

Background Research:

5W-30 synthetic motor oil has a lower viscosity than 5W-30 conventional motor oil. Typically 5W-30 or 0W-30 synthetic motor oil is the best for harsh cold climates. The W in 5W-30 stands for Winter or cold temperature performance. Synthetic motor oil molecules are similar in shape with fewer impurities then conventional motor oil molecules. Overall, synthetic motor oil has a better extreme high temperature and low temperature performance. Synthetic motor oils are generally formulated with higher performing additives.

Background Research:

If your motor oil temperature is too low it tends to become dirty easily because it doesn't get the opportunity to burn off the dirt which can lead to small losses of power at best and early engine wear at the worst, particularly to your Pistons/Bores and Bearings. Motor oil can’t naturally freeze on earth, because earth does not naturally have the low temperatures that motor oil needs to freeze. The temperature that motor oil starts freezes at is -30 ℃ for conventional motor oil and -40 ℃ for synthetic motor oil. The temperature that motor oil fully freezes at is -195 ℃. The motor oil does get thicker as it cools, becoming more viscous and its ability to circulate and lubricate while cold. Conventional motor oil has wax in which makes it thicken quickly in cold weather.

Experts We Interviewed:

An Expert we interviewed is Mr. Lowell Wattie he owns Pacesetter Equipment,(Pacesetter Equipment Heavy Equipment Rentals & Sales | Alberta | Pacesetter Equipment LTD.) and has a vintage car collection. Mr. Wattie's Company (Pacesetter Equipment) is a big consumer for motor oil. He said motor oil in an engine helps clean and lubricate the engine there for how the oil is affected by cold weather and can impact the motor oil's effectiveness inside the engine. If the oil is cold the ability for it to flow throughout the engine can be limited. Pacesetter Equipment uses a 5W-40 full synthetic motor oil to limit excessive wear particularly in cold weather. When his machinery is not running on a cold winter night all the oil drains into the oil pan. The next time when it is started the synthetic oil flows quicker allowing better lubrication faster. This makes sense with our testing which comes later in our project.

Experts We Interviewed:

Another Expert we interviewed was Mr. Mark Rhodenizer who is the owner of New Age Motors and New Age Oilfield.(New Age Motors Top Automotive Repair in Leduc - Book Your Service Today!) We asked Mark the following question and he responded by email. For 5W-30 Conventional vs 5W-30 Synthetic Motor oil what do you recommend to you customers during cold weather and why? Mark responded the following.

“When we have customers in for oil services, we always push for the better oil (synthetic) and this is due to our colder climates we have here in Alberta (and even Saskatchewan, Manitoba, and Ontario). Synthetic oil is the better choice vs conventional all day long. It ensures easier starts in winter, better engine protection, and longer-lasting performance. It also has great properties in extreme hot weather conditions; however, we do not really see too much of this in Canada, not like the southern countries. Below you will find the comparisons for Synthetic vs Conventional Oil in hot and cold weather conditions to back up our recommendations.

Experts We Interviewed:

Cold Weather Performance Comparison

Synthetic oil has a lower pour point, so it flows better at extremely low temperatures. This ensures easier cold starts and better engine protection in winter.

Conventional oil thickens in the cold, making it harder for your engine to circulate oil immediately after starting. On big rigs when you have gallons of this oil, it is really hard on your starter to gain the rpm to turn over and drains your battery faster as there is a larger power draw.

High Temperature Performance Comparison

Synthetic oil resists breakdown at high temperatures, reducing engine wear during summer heat or long highway drives, especially under engine load.

Conventional oil can degrade faster under high heat, leading to sludge buildup and reduced engine protection.

Experts We Interviewed:

When we use Synthetic oil, we extend the oil change intervals. Here is an example. On our pickup trucks we would do an oil service in 5000km with conventional, where with Synthetic, we push to 8000 kms on the gas engines and 10,000 on the diesel pickup trucks. On the Big rigs, we went from 250 hour to 300 hrs for each oil service.

Conventional oil is much cheaper than full synthetic, so some people will opt to the cheaper oil because of their budget regardless of the benefits.”

Variables

Manipulated variable:

The temperature of the motor oil when we are doing the fridge and freezer test.

Variables

Controlled Variable:

Using the same size/weight ball bearings.

Same measuring equipment for all testing.

Using the same 5W-30 Synthetic and Conventional motor oil for all testing.

Using the same testing method.

Using the same camera for observations.

Same people testing.

Variables

Responding Variable:

The speed at which the ball bearing drops through the graduated cylinder which determines the viscosity of the motor oil.

Conventional Motor Oil Procedure:

Start with conventional motor oil at room temperature. Measure the amount of oil into graduated cylinders. Measure room temperature. Get the ball bearing and drop it into the graduated cylinder and measure the time the for the ball bearing to drop to the bottom of the graduated cylinder. Keep track of the time on a table.

Start with conventional motor oil at fridge temperature. Measure the amount of oil into graduated cylinders. Measure fridge temperature. Get the ball bearing and drop it into the graduated cylinder and measure the time the for the ball bearing to drop to the bottom of the graduated cylinder. Keep track of the time on a table and repeat three times.

Start with conventional motor oil at freezing temperature. Measure the amount of oil into graduated cylinders. Measure freezing temperature. Get the ball bearing and drop it into the graduated cylinder and measure the time the for the ball bearing to drop to the bottom of the graduated cylinder. Keep track of the time on a table and repeat three times.

Synthetic Motor Oil Procedure:

Start with Synthetic motor oil at room temperature measure the amount of oil into graduated cylinders. Measure room temperature. Get the ball bearing and drop it into the graduated cylinder and measure the time the for the ball bearing to drop to the bottom of the graduated cylinder. Keep track of the time on a table.

Start with Synthetic motor oil at fridge temperature measure the amount of oil into graduated cylinders. Measure fridge temperature. Get the ball bearing and drop it into the graduated cylinder and measure the time the for the ball bearing to drop to the bottom of the graduated cylinder. Keep track of the time on a table and repeat three times.

Start with Synthetic motor oil at freezing temperature measure the amount of oil into graduated cylinders. Measure freezing temperature. Get the ball bearing and drop it into the graduated cylinder and measure the time the for the ball bearing to drop to the bottom of the graduated cylinder. Keep track of the time on a table and repeat three times.

Materials:

- 5W-30 Pennzoil synthetic motor oil 5L
- 5W-30 Pennzoil conventional motor oil 5L
- Graduated Cylinder to do the drop test X10
- Ball bearings
- Freezer
- Fridge
- Jugs X4
- Thermometer
- Timer Watch/Phone
- Pictures (Phone)
- Computer (to write down results)
- Scale
- Funnel X2

Observations

- Synthetic motor oil was a darker color than the conventional motor oil at all temperatures.
- When we poured out the motor oil when it was at freezer temperature it was a cloudy color.
- Not all of the graduated cylinders weighed the same.
- We noticed that the ball bearings warmed up in our hands which could maybe mean that it moves through the oil faster.
- When the oil came out of the freezer and it was poured it was goopy and looked like honey.

Data:

Oil Type	Control Temp	Control Weight	Control Drop Speed
Synthetic	21.4℃	84g	3.06 sec
Conventional	21.5℃	84g	3.91 sec

Data:

Oil Type	Fridge Temp	Fridge Weight	Fridge Drop Speed	Freezer Temp	Freezer Weight	Freezer Drop Speed
Synthetic	9.6 ℃	84g	4.35 sec	- 8.9 ℃	85g	9.21 sec
Synthetic	9.6 ℃	84g	4.14 sec	- 8.9 ℃	84g	9.13 sec
Synthetic	9.6 ℃	84g	5.40 sec	- 8.9 ℃	84g	11.41 sec
Synthetic Average	9.6 ℃	84g	4.63 sec	- 8.9 ℃	84g	9.92 sec
Conventional	8.9 ℃	84g	4.59 sec	- 10.6 ℃	85g	13.34 sec
Conventional	8.9 ℃	84g	4.72 sec	- 10.6 ℃	85g	11.21 sec
Conventional	8.9 ℃	84g	4.82 sec	- 10.6 ℃	85g	13.32 sec
Conventio	8.9 ℃	84g	4.71 sec	- 10.6 ℃	85g	12.62 sec

Results/Conclusion:

What happened? The two motor oils had a much higher viscosity when they were cooled down than when they were at a controlled/room temperature.

Why do we think it happened? 5W-30 conventional motor oil had a higher viscosity because it has wax in it so it becomes thicker when cooled compared to 5W-30 synthetic motor oil.

What did we learn? We learned the colder the temperature the higher the viscosity of the motor oil. We figured out the synthetic 5W-30 works better than conventional 5W-30 motor oil in cold weather like our hypothesis.

Sources of Error:

- The graduated cylinders were not the same weight before the oil was poured.
- Not being able to pour the exact same amount of motor oil into each of the graduated cylinders.
- The time it took to pour the oil into the graduated cylinders for each trial (The motor oil could warm up).
- Human error for starting and stopping the timer.

Applications/Extensions:

Knowing this information is beneficial because when conventional motor oil is used in climates below zero degrees celsius, it takes significantly more time for the oil to move through the engine when the engine is cold started. This can cause faster engine wear. Also this helps people to know what motor oil is best for their car in cold climates. The reason you would want to know this is because if you use a motor oil that is not the right type for you car in the winter it could cause small to extreme amount of motor damage and parts can get really expensive and hard to find.

Thank you.

- Thank you to Mark Rhodenizer for being an expert
- Thank you to Lowell Wattie for being another expert
- Thank you to Mrs Sanders for being a judge and putting in so much effort
- Thank you to all of the judges
- Thank you to teachers and staff

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REDESIGNED FOR MODERN TURBOCHARGED ENGINES
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HUILE MOTEUR
MÉLANGE SYNTHÉTIQUE 5L
PENNZOIL


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PLATINUM® EURO LX
FULL SYNTHETIC
0W-30
MOTOR OIL
PENNZOIL
PENNZOIL
PLATINUM® EURO LX
FULL SYNTHETIC
SAE 0W-30
MOTOR OIL
PENNZOIL


PENNZOIL
SAE 5W-30
FOR GASOLINE ENGINES
MOTOR OIL
PENNZOIL
SAE 5W-30
Keeps your engine clean and responsive
FOR GASOLINE ENGINES
MOTOR OIL 1 QT 946 mL

5W-30 Conventional Control temp drop speed

5W-30 Conventional fridge drop speed