



LIQUID ENGINEERING: THE CASTROL GUIDE TO AUTOMOTIVE LUBRICATION



IT'S MORE THAN JUST OIL.
IT'S LIQUID ENGINEERING.™



Dear Educator:

Today's cutting-edge automotive technology has created a pressing need for a new generation of well-educated drivers and automotive technicians who understand the many aspects of automotive lubrication and overall maintenance.

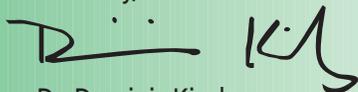
To assist you in presenting these important topics to students, the curriculum specialists at Young Minds Inspired (YMI), in cooperation with BP Lubricants USA Inc. – maker of premium-quality Castrol motor oils – are pleased to bring you this free educational program, **Liquid Engineering: The Castrol Guide to Automotive Lubrication**. Today's vehicle engines face serious demands, which can break down a motor oil's effectiveness and power to protect against wear. That's why it's so important for student drivers and automotive mechanics students to understand the necessity for motor oil maintenance and to learn how to put the major concepts and procedures of automotive lubrication into practice as tomorrow's drivers and auto technicians.

This free program is designed for use by students in both driver education and automotive mechanics classes, and includes this teacher's guide, a DVD, reproducible activities, a wall poster, and take-home booklets. The materials outline the composition and function of motor oil; instruct students on how to identify different motor oil types and grades; explain the science and benefits of synthetic motor oils; review other fluids vital to safe and reliable vehicle operation; and stress the importance of observing safety precautions while changing and disposing of a vehicle's motor oil.

We encourage you to share this timely program with other instructors in your school. Although the materials are copyrighted, you have permission to duplicate all reproducible components of the program for educational purposes.

And please take a moment to fill out and return the enclosed reply card, so that you will remain eligible to receive free YMI educational programs in the future. Your comments help assure that our teaching materials continue to make a difference in the classroom, and we look forward to hearing from you.

Sincerely,



Dr. Dominic Kinsley
Editor in Chief

Introduction

Liquid Engineering: The Castrol Guide to Automotive Lubrication is an educational program designed to offer students in driver education and automotive mechanics classes an opportunity to learn and/or reinforce their knowledge of motor oil's critical role in engine protection and performance. This free program has been created and provided to educators by YMI in cooperation with BP Lubricants USA Inc., maker of Castrol premium-quality motor oils.



Visit www.thecastrolstore.com/education to order free key chains for your students. Limit 30 per teacher. Offer good while supplies last. Enter promo code: CASTROLEDU



Target Audience

This program is designed for use with students in driver education classes in high school and private driving schools as well as students in automotive mechanics classes in high schools and vocational-technical institutions.

Program Objectives

Liquid Engineering: The Castrol Guide to Automotive Lubrication has been designed to fulfill the following objectives:

- To inform students of important facts and procedures concerning motor oil and its role in automotive maintenance.
- To introduce the fundamentals of motor oil function, composition, viscosity, formulation, performance classification, maintenance, and safety.
- To enable students to identify the different grades and uses of motor oil, and to choose the types of motor oil appropriate for particular vehicles and driving conditions.
- To highlight advances in motor oil technology, including synthetics, and the advantages of selecting a premium motor oil.
- To explore the role of transmission fluid, brake fluid, and other fluids vital to automotive performance.
- To build students' appreciation for precautions promoting personal and environmental safety when changing and disposing of used motor oil.

Program Components

- A specially produced Castrol **Liquid Engineering** classroom DVD for in-class use, containing comprehensive information on motor oil function, types, maintenance, and safety.
- This teacher's guide, which includes background information, presentation suggestions, answers for each classroom activity, and follow-up activities to enhance the learning experience.
- Five reproducible activity sheets containing activities designed to complement and reinforce lessons presented in the DVD.
- A full-color wall poster designed to be displayed in class as a motivational tool and a reminder of the program and its goals.
- Thirty copies of a take-home booklet containing helpful motor oil and car-care information.
- A reply card for your comments. Please return this card to remain eligible to receive free YMI programs in the future.

Using the Program Components

1. Photocopy the activity sheet pages to provide a complete set of activities for each student. Make a master copy of the teacher's guide and activity sheets to share with other teachers in your school or program.
2. Review the Castrol **Liquid Engineering** classroom DVD, which can be viewed all at once or in segments to correspond with the program's activities.
3. Display the poster in your classroom or shop to generate interest in the program; keep it on display as a long-term reminder of the importance of proper motor oil maintenance and safety.
4. Distribute the activity sheets to students, and conduct each activity at a pace that best suits your particular class. The activities are presented in a logical sequence to complement the segments of the DVD, but you can alter the order to fit your class plans.
5. Conclude the program by distributing the take-home booklets to students, encouraging them to share this information with their families, and to keep the booklet handy as a reference in their car, garage, or shop.

Classroom DVD

Produced with the cooperation of Castrol's team of automotive lubrication professionals, the Castrol **Liquid Engineering** classroom DVD is organized into five segments, each approximately 7 minutes long:

- Part One explains how oil flows through an automobile engine, its functions in the engine, and the importance of changing oil regularly, especially in vehicles operating under severe driving conditions.
- Part Two explains how motor oil is manufactured, the role of additives in motor oil performance, the need for different grades of motor oil, and how to interpret the information provided in the API donut.
- Part Three focuses on synthetic motor oil – its development, performance benefits, and myths associated with its use.
- Part Four reviews the role of transmission fluid, brake fluid, and other fluids vital to automotive performance.
- Part Five stresses the importance of safe and environmentally friendly motor oil changes and disposal.

You may choose to view the DVD in its entirety or one segment at a time, following each segment with its corresponding classroom activity. The DVD also features a variety of video extras, including Castrol's "Car Care Minutes," as well as digital versions of previous Castrol educational programs and classroom materials.

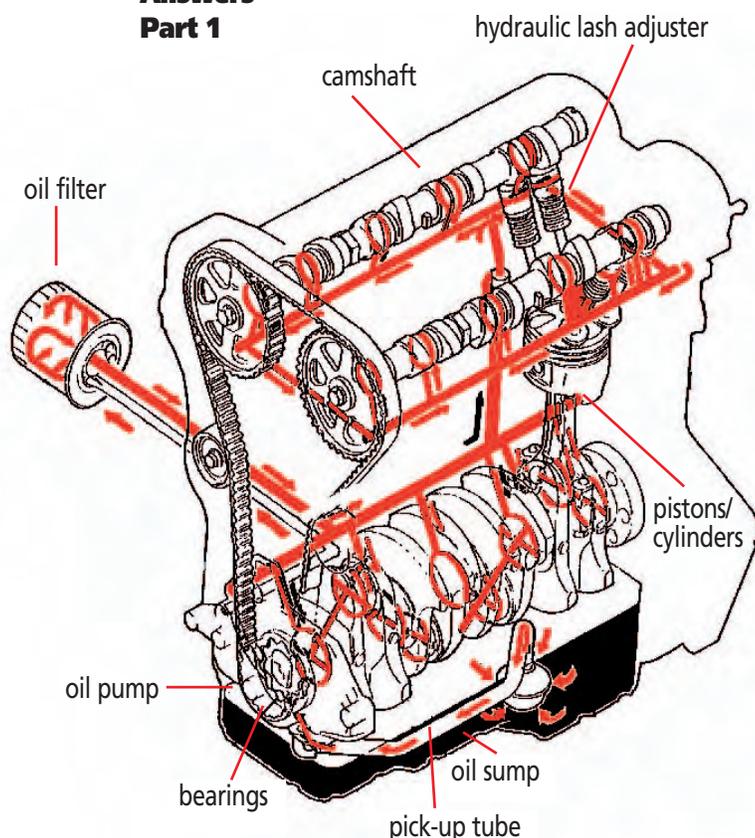
ACTIVITY 1

Know the Flow

This activity reinforces information presented in the first DVD segment. In Part 1 of the activity, students trace the flow of motor oil on a diagram of an automobile engine. Part 2 presents a multiple-choice quiz focusing on basic concepts and facts involved in the nature, composition, function, and classification of motor oil. Part 3 of the activity focuses on severe driving conditions with a checklist students use to assess their own driving habits as a basis for class discussion.

Answers

Part 1



Part 2

1-d The main functions of motor oil include lubricating and cooling engine parts, maintaining engine cleanliness, preventing wear, and reducing friction and sludge formation.

2-c Crude oil was created naturally over millions of years from prehistoric plant and animal remains.

3-a The approximate proportion of base oils to additives in most motor oil products is 85% to 15%.

4-b Crude oil consists of a mix of hydrogen and carbon molecules.

5-c Motor oil helps prevent excessive engine wear and extremely high engine temperatures by reducing friction between moving parts.

6-c The “heart” of an engine’s lubrication system is the oil pump.

7-c Under normal conditions, modern oil filters remove abrasives, but do not remove water or unburned contaminants.

8-b Motor oil’s sealing action plays a key role in the compression process.

9-b Combustibles are not added to motor oil.

10-c Dispersants help reduce the formation of deposits and sludge.

Follow-Up Activities

1. Have students research, copy or print out, and bring in diagrams of several different contemporary automobile engines – perhaps one from a hybrid, another from a sports car, and another from an SUV, etc. – to review in class and compare the designs, oil flow patterns, and lubrication requirements of the various engine and vehicle types.
2. Suggest that students look up the owner’s manual motor oil recommendations for their own or their family’s car, and find out what grade and type of oil is currently being used in the vehicle. Then have them look at whether the grade and type of oil they’re using is the best choice for the car, given their geographic location and their own or their family’s driving habits.

ACTIVITY 2

Right Choice, Right Time

Complementing the second segment of the DVD, this activity reinforces understanding of the information needed to choose an appropriate motor oil for one’s vehicle and driving conditions. In Part 1, students identify the function of common motor oil additives by matching them to specific driving situations. In Part 2, students practice interpreting the API donut by explaining its symbols and codes. Part 3 directs students to Castrol’s online “Car Care Minute” videos (which can also be viewed on the DVD), challenging them to work together to create in-class presentations in the same style, illustrating the need for changing a vehicle’s motor oil regularly, as well as for choosing the right oil for the job.

Answers

Part 1

1-c Viscosity improvers help the oil in Jen's 4x4 perform more efficiently in low temperatures and improve the vehicle's cold-weather starting.

2-a Antiwear agents help prolong the life of the engine in Tony's older, high-mileage sedan.

3-b Dispersants help prevent sludge formation in Steve's hard-working pick-up.

Part 2



Follow-Up Activities

1. Suggest that students go to a local department store, automotive supply store, or gas station, and take a close look at the various motor oil products. Have them look for the API donut and other industry symbols, as well as on-package information about different oil types, and report their findings in class.
2. Have students research and compile a list of API service ratings from past decades, and compare the basic requirements each rating had to meet with requirements for today's motor oils.

ACTIVITY 3 Liquid Engineering

Designed to follow the third segment of the DVD, this activity reinforces the information presented about the composition and benefits of synthetic motor oils, which are custom-designed from "man-made" base stocks and engineered for improved performance.

In Part 1 of the activity students are challenged to review the situations (and the myths), weigh the pros and cons of using synthetics in each case, then role-

play the situation in class with other students. Part 2 introduces students to the full range of Castrol oil products, and challenges them to match each product to a driver whose vehicle and driving habits make that product a good choice for long-term engine performance.

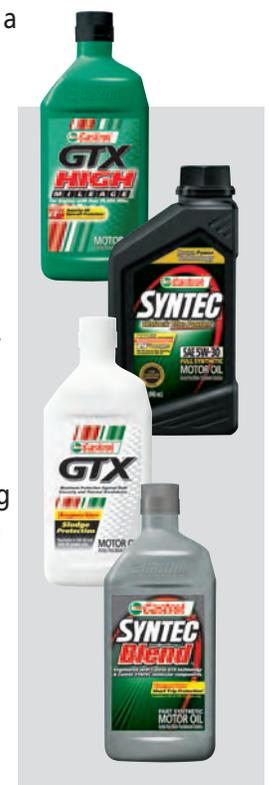
Answers

Part 1

1. Synthetic motor oils are not just for new cars. Quality synthetics can be used in older as well as new cars, including vehicles in which conventional oil was previously used. Synthetics are beneficial to the good health, long life, and top performance of old and new cars, so the owner of the older sports car has nothing to fear about choosing synthetic oil for his "baby."
2. Synthetic motor oils do not void a new car's warranty – in fact, synthetics meet or exceed every manufacturer's motor oil performance standards. And far from needing a break-in period with conventional motor oils before using synthetics, today's new cars can benefit from synthetics right from the start. In fact, many new cars now come with synthetic oil already in the engine. So the woman's brand-new SUV will take to synthetic oil just fine.
3. There's no harm at all in switching back and forth between conventional and synthetic motor oil. The two are completely compatible, and some products – like Castrol SYNTEC Blend – are a blend of conventional and synthetic oils.

Part 2

1. **Castrol GTX High Mileage** is a good choice for Joe's 12-year-old SUV, providing added protection for engines with over 75,000 miles of service.
2. **Castrol SYNTEC** is a good choice for Ben, giving him the maximum horsepower he's looking for in his new sports car.
3. **Castrol GTX** is a good choice for Christine's car, providing the sludge protection her engine needs in harsh driving conditions such as stop-and-go commuting in hot and humid conditions.
4. **Castrol SYNTEC Blend** is a good choice for Jill's delivery mini-van, with its special formulation to protect against the effects of short-trip driving.



Follow-Up Activities

1. Have students gather more information on modern motor oil technology by requesting brochures on various Castrol products from a local Castrol dealer, and by contacting local dealerships to identify auto manufacturers who have made the switch to synthetics in their new vehicles. Encourage students to share their findings in class, and assemble the information they gather in an informative classroom display.
2. Have students research and create a timeline of the history and development of synthetic oils—from their military applications in the 1930s to their high-performance role in passenger vehicles and on racetracks today.

ACTIVITY 4 You're the Expert!

Based on segment four of the DVD, this activity presents a simple quiz to reinforce understanding of the function of other automotive fluids vital to safe and reliable vehicle performance.

Answers

1-D; 2-C; 3-E; 4-B; 5-A.

Follow-Up Activities

1. Arrange a field trip to a local automotive or oil change center, to give students a firsthand look at how professional technicians check, maintain, and change motor oil and other fluids and lubricants. Have students prepare specific questions for the mechanics they'll meet.
2. Have students create a checklist of automotive warning signs and their possible solutions. Students can then laminate their checklists and keep them handy in the glove box of their own or their families' cars.

ACTIVITY 5 Keep It Safe!

Designed to reinforce the fifth segment of the DVD, this activity emphasizes the importance of maintaining safety when changing and disposing of a vehicle's motor oil.

Part 1 encapsulates the many steps of an oil change into three basic phases based on safety concerns – Preparing Yourself, Under the Chassis, and Finishing Up. Students review each phase and discuss the reasoning behind each safety precaution.

Part 2 focuses on the safe disposal and recycling of used motor oil, and suggests a starting point for students' research on the environmental risks used oil can present, the uses for recycled oil, and resources for information on the safe disposal of used oil in students' local areas. To drive home the importance of recycling, students use the 3 months/3,000 miles oil change benchmark to calculate how many gallons of used oil they are likely to produce over 10 years, both individually and as a class.

Remind students that it is important to refer to the car owner's manual when choosing the right oil for the vehicle in consultation with the technician performing the oil change, and that it is always okay to request a certain type or brand of premium motor oil (you can even bring your own) when taking the car in for an oil change.

Follow-Up Activities

1. Have student volunteers change a car's oil during a class session. As they move through the process, have other students discuss the importance of each step, especially in terms of safety precautions and procedures.
2. Encourage students to research the dangers of discarding oil in the environment, and challenge them to find out all they can about local, state, and federal oil recycling programs. Have students compile their findings and present reports based on what they've found.

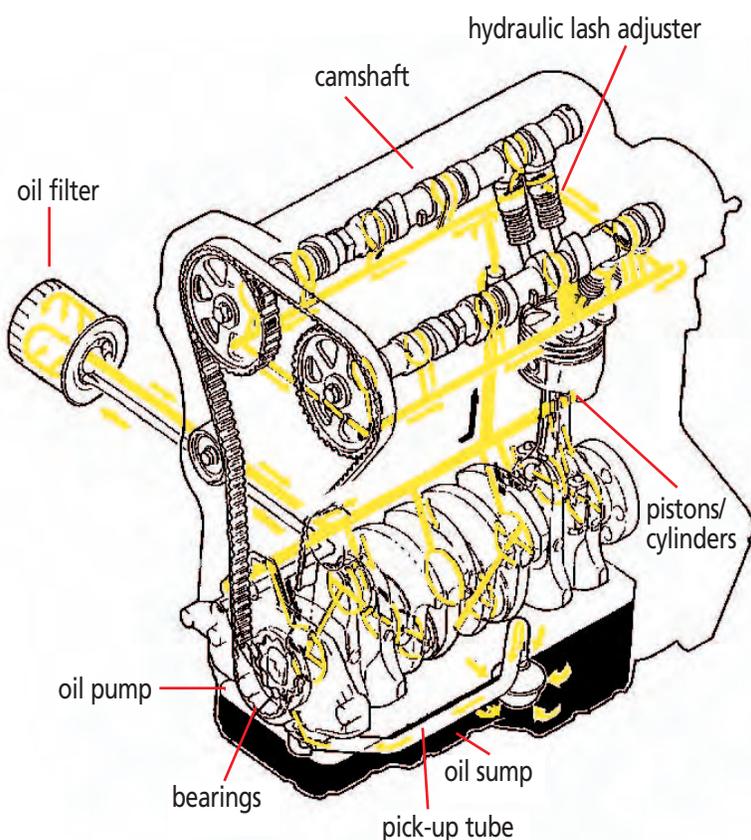
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Know the Flow

Welcome to **Liquid Engineering: The Castrol Guide to Automotive Lubrication**. This short course in automotive know-how can help you better understand your vehicle's need for proper lubrication and regular maintenance.

Part 1

In order to appreciate the importance of vehicle lubrication, you need to understand what motor oil does for an engine – including how and where it does it. So let's start our close-up look at the function of motor oil with this diagram of a typical automobile engine. Based on your knowledge of motor oil and how it works, trace the flow of oil through the engine and its featured parts on the diagram below.



Part 2

Okay...after taking a look at your diagram, take this little quiz to see how well you "know the flow."

- The main functions of motor oil include which of the following?
 - lubricating and cooling engine parts
 - maintaining engine cleanliness and preventing engine wear
 - reducing friction and sludge formation
 - all of the above
- Millions of years ago, the crude oil from which motor oil is made began as
 - minerals from the earth
 - minerals from space
 - prehistoric plants and animals
- In most motor oil products, the proportion of base oils to additives is approximately
 - 85% to 15%
 - 65% to 35%
 - 50% to 50%
- Crude oil consists of a mix of molecules of the following elements
 - nitrogen and oxygen
 - hydrogen and carbon
 - strontium and gold
- Motor oil helps prevent excessive engine wear and extremely high engine temperatures by reducing
 - engine viscosity
 - emissions in the exhaust system
 - friction between moving parts
- The "heart" of an engine's lubrication system is the
 - oil filter
 - oil distribution network
 - oil pump
- Under normal conditions, modern oil filters effectively remove
 - water
 - unburned fuel contaminants
 - abrasives
- By creating a seal between the pistons and cylinders, motor oil plays a key role in generating engine power through
 - combustion
 - compression
 - convection
- Which is not a type of motor oil additive?
 - detergents
 - combustibles
 - dispersants
 - antioxidants
- Dispersants in a motor oil help
 - reduce the air in the oil
 - improve the oil's viscosity
 - reduce the formation of deposits and sludge

Part 3

Motor oil know-how is especially important today, when most vehicles operate under severe driving conditions that can wear down engine performance. Some typical severe driving conditions are listed below. Check off those that apply to you and discuss how they might affect engine performance.

- | | | |
|---|--|---|
| <input type="checkbox"/> Driving in stop-and-go traffic | <input type="checkbox"/> Long idling in traffic and at intersections | <input type="checkbox"/> Short trip driving from place to place |
| <input type="checkbox"/> Towing or hauling heavy loads | <input type="checkbox"/> Driving on dusty roads | <input type="checkbox"/> Driving in extreme temperatures |

Right Choice, Right Time

Motor oils are not created equal. Each one is carefully formulated and classified. Check it out.

Part 1

Let's talk about additives for a minute. A special blend of additives, like those typically found in a premium motor oil like Castrol GTX, helps combat specific threats to motor oil efficiency – and to the life of the engine itself. Check out the drivers profiled below. Each driver's engine can benefit from additives found in motor oil. Match each person's situation to the particular motor oil additive that most directly addresses the problem.

Drivers



1. Jen is an avid skier who spends much of the winter driving in the mountains; her 4x4 has a history of starting hard in cold weather.

2. Tony, who has a half-hour suburban commute to a summer job, drives an older sedan that's nearing the 90,000-mile mark.

3. Steve works part-time after school every weekday, making one delivery after another in a well-worn pick-up truck for an auto parts dealer.

Additives

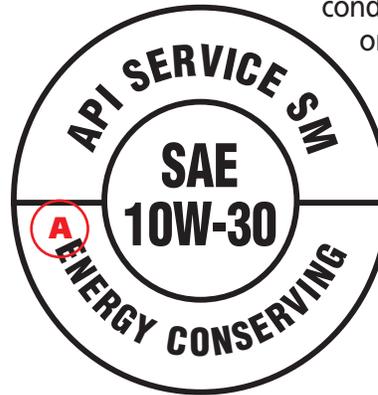
a. Antiwear agents: Help prevent engine wear by forming a film on metal surfaces, helping to prevent metal-to-metal contact and prolong engine life.

b. Dispersants: Help reduce the formation of deposits and sludge in an engine, especially a hard-working one.

c. Viscosity improvers: Protect against viscosity breakdown by improving the change-in-flow properties of the lubricant with changing temperatures.

Part 2

All the information that you need to choose the right motor oil for your vehicle and driving conditions can be found printed on every motor oil container in the API donut. Here's a chance to earn your degree in "donut-ology." Identify the points listed below on this API donut. Label it with the correct letter. The first one is done for you.



- A.** Indicates that the oil will help the vehicle use fuel more efficiently – go farther with same amount of gas.
- B.** Provides information about an oil's viscosity or ability to flow at certain temperatures.
- C.** Indicates the type of engine the oil is made for.
- D.** Indicates that the oil is meant for use in a gasoline engine.
- E.** Defines the motor oil's performance.
- F.** Refers to the thinness of the oil at low temperatures.
- G.** Refers to the thickness of the oil at high temperatures.
- H.** Indicates that the product is a multigrade oil.
- I.** Indicates viscosity classification by the Society of Automotive Engineers.
- J.** Indicates certification by the American Petroleum Institute.

Part 3

To drive home the importance of proper vehicle lubrication and changing your motor oil frequently, Castrol has created a series of "Car Care Minute" videos. Go to www.castrol.com/us and click on "Expert Advice," then scroll down and click on "Car Care Minutes" to view them online. After checking a few of them out, get together in a group and create a presentation in the same style that illustrates the need to change motor oil regularly.

Liquid Engineering

It's pretty clear how important choosing the right motor oil for your vehicle can be, so it just makes sense to want to use the oil that will offer the best protection for your engine. With this in mind, a synthetic motor oil may be the best choice for your car. Let's take a look.

Part 1

Everyone seems to have opinions on the pros and cons of using synthetic motor oils, which are custom-designed from man-made base stocks to outperform conventional oils. Since some of these opinions are based on myths, it can sometimes be difficult to separate fact from fiction.

Take a look at the following situations. Each one involves a driver who is uncertain about switching to a synthetic motor oil because of a myth. Weigh the pros and cons in each case, then role-play the situations in class with other students.

- 1. The owner of an older sports car** wants only the best for his vehicle, and knows that synthetics provide optimum lubrication at extreme temperatures, making for a more efficient engine. But he's also been told that synthetics should only be used in new cars.
- 2. A woman who's just purchased a brand-new SUV** has heard that new vehicles like hers need a break-in period with conventional motor oils before you can use synthetics. She's also heard that using a synthetic could void her new car's warranty.
- 3. A young driver has just bought the used "car of his dreams,"** and is eager to improve its performance, possibly with a synthetic oil that will keep the engine cleaner longer and prevent sludge from sapping its power. But he's concerned that if he switches to a synthetic oil, he can never go back to a conventional product.

Part 2

Castrol's full line of premium motor oils – including conventional and synthetic oils – has been created to suit a wide range of vehicle types and driving demands. After reading the profile of each Castrol motor oil product below, match the product to the driver and vehicle it would best suit.

Castrol GTX: A conventional oil which provides superior protection against sludge build-up* and delivers the highest North American standard of protection against viscosity and thermal breakdown.

Castrol GTX High Mileage: A conventional oil specially formulated for vehicles with over 75,000 miles, designed to provide superior oil burn-off protection...17% better than leading conventional oils** and extend engine life.

Castrol SYNTEC Blend: A blend of conventional and synthetic oil designed to provide superior protection against the wear and tear caused by frequent short-trip driving*.

Castrol SYNTEC: A synthetic motor oil that outperforms leading conventional and synthetic blend oils; in extreme torture tests Castrol SYNTEC 5W-30 maintained maximum horsepower 29% longer than the leading conventional 5W-30.

*Among leading 5W-30 and 10W-30 grades.

** NOACK volatility test among leading 10W-30s.



Drivers	Castrol Product
1. Joe brings his jet skis to Lake Tahoe with his 1996 SUV.	
2. Ben is concerned about getting the most power out of his new sports car.	
3. Christine drives her car back and forth to work every day in the Seattle area.	
4. Jill depends on her van to deliver flowers for a florist in New York City.	

You're the Expert!

By now, you should be well on your way to becoming an expert on automotive lubrication. But did you know that motor oil isn't the only fluid important to vehicle performance?

There are a variety of products critical to keeping your car safe and reliable on the road. Find out more by completing this quiz. Just match each clue to the correct automotive fluid. Write your answers in the spaces provided.

1. Many drivers call this antifreeze.

2. Check this product if your gears slip or grind.

3. This product creates a seal that locks out debris and protects against rust.

4. Turning the corner can be a workout when you run low on this.

5. You tap into this product at every stop sign.

A. Brake fluid: essential for proper function of the brakes. Check your owner's manual for the exact type needed for your vehicle.

B. Power steering fluid: provides a vital link in the steering system. The pump can usually be found behind the fan belt.

C. Automatic transmission fluid (ATF): key to operating an automatic transmission. Check your owner's manual for the recommended type of fluid.

D. Engine coolant: keeps engine from overheating during normal operation and prevents coolant system from freezing up during cold weather. Maintaining the correct mix of water and coolant year-round is vital.

E. Greases: lubricant composed of a fluid lubricant thickened with a material that contributes a degree of plasticity.

All these fluids should be checked whenever you change your oil and replenished or replaced when necessary. For automatic transmission fluid (ATF), the fluid levels and condition will provide valuable clues about the state of your transmission. Odorous or discolored fluids indicate problems and the transmission should be inspected immediately. Transmission fluid has a transparent deep red color. You should replace the fluid if it becomes cloudy, dark, or dirty. You should also change the fluid if it has a burnt odor. Of course, for all of these fluids, you should also "top off" if fluid levels are low and investigate the cause.



Keep it Safe!

When you're changing or disposing of motor oil, safety should always come first. Observing certain precautions throughout this process ensures the safety of your car, yourself, and the environment. So in our final activity, let's "play it safe."

Part 1

Changing oil involves many steps but where safety is concerned the process can be divided into the three basic phases highlighted below. Read the sections and discuss the reasoning behind each safety precaution.

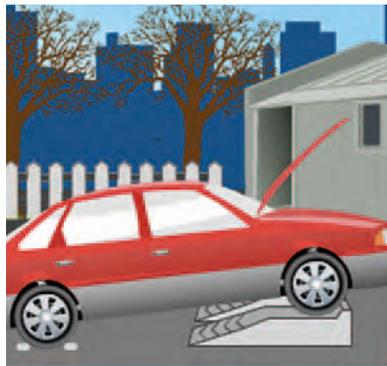
Phase 1: Preparing Yourself

Motor oil may be great for your car, but it is toxic to people. Exposure to used motor oil has been linked to skin cancer and other skin disorders. So, as you prepare to do an oil change, make sure that you gear up with disposable latex gloves, a long-sleeve shirt, and safety glasses.



Phase 2: Under the Chassis

Before changing the oil, make sure your car is steady and secure. Never use a bumper jack to hold your vehicle up – it is simply too unstable. Instead, use portable wheel ramps, which will tilt the car just enough for you to slide underneath.



- Place the wheel ramps on level ground, drive your vehicle up onto them, set your emergency brake, and brace both rear wheels with wooden blocks.
- Put your vehicle in First Gear if you have a manual transmission and in Park if you have an automatic transmission.
- Keep in mind that car parts, like the exhaust manifold, and used oil can be quite hot. Use caution when draining hot oil, which may release rapidly.
- Remember to use a funnel to pour the new oil into the filler hole on top of the engine, because oil spilled onto the exhaust system not only stinks but can potentially be ignited.
- Always be certain to consult your owner's manual for specific safety precautions before climbing under your vehicle.

Phase 3: Finishing Up

After changing the oil, take off and dispose of your dirty latex gloves. Then discard your soiled clothes or wash them separately from other family members' clothes. Make sure to thoroughly wash off any oil that might have gotten on your skin.

Because used oil is highly toxic to the environment, a safe oil change always ends in the proper disposal of used oil. To do so, transfer the used oil to a sealed container and consult your local garage about what to do next. Chances are that a garage in your area will take the oil off your hands and arrange for it to be recycled or safely disposed of. Your state should have an environmental agency that can also tell you where and how to dispose of used oil.



Part 2

Find out all you can about the environmental dangers of used motor oil as well as the benefits of recycling used oil by doing an online search. Go to castrol.com/us or earth911.org to locate a recycling center in your area.

Then try this: Supposing that you change your oil every 3 months or 3,000 miles, as generally recommended. Calculate how many gallons of used oil you are likely to produce over a period of ten years. Then share and discuss your findings with the class.

Extended Activities

1. Invite students to visit the Castrol USA website on the Internet at www.castrol.com/us, where they can find a wealth of information, resources, and expert advice on all aspects of motor oil classification, function, and maintenance.
2. Challenge students to choose another type of automotive lubricant – such as power steering fluid, transmission fluid, etc. – and research its maintenance, function, composition, and importance to the particular system in which it plays a key role.

Are Your Students Outperformers?

The Eric Medlen Outperformers Scholarship Program powered by Castrol SYNTEC rewards aspiring young auto technicians with scholarships to attend an automotive program, technical institute, or other school approved by BP Lubricants USA Inc. Starting on October 1, 2007, Castrol asks would-be auto technicians ages 16-25 to explain, in 500 words or less, why they should win the **2008 Eric Medlen Outperformers Scholarship Program.**

For complete program details and to submit entries, please visit www.syntecoutperformers.com. Entries must be submitted by May 31, 2008.



IT'S MORE THAN JUST OIL.
IT'S LIQUID ENGINEERING.™





LIQUID ENGINEERING: THE CASTROL GUIDE TO AUTOMOTIVE LUBRICATION



IT'S MORE THAN JUST OIL. IT'S LIQUID ENGINEERING.™



www.castrol.com/us

FIND THE RIGHT OIL FOR YOUR VEHICLE...RIGHT HERE

Which Castrol Brand is Right for Your Vehicle?

Castrol GTX

- Unique anti-sludge technology provides superior protection against sludge build-up*
- Exceeds demanding U.S. requirements for viscosity breakdown protection
- Engineered with anti-oxidants, detergents, and dispersants to deliver unsurpassed protection against thermal breakdown
- Exceeds passenger car and gasoline light truck requirements for the protection of gasoline and turbocharged engines where API SM, SL, SJ, or SH is recommended

* Among leading 5W-30s and 10W-30s



CONVENTIONAL

Castrol GTX HIGH MILEAGE

- Helps extend the life of vehicles with over 75,000 miles
- Provides superior protection against oil burn-off...17% better than the leading conventional oils*
- Contains seal conditioners to help reduce oil leakage
- Protects against wear and harmful deposits in higher mileage engines
- Engineered with proprietary additives to minimize compression loss and maximize engine performance

* NOACK volatility test of leading 10W-30s



HIGH MILEAGE

Castrol SYNTEC BLEND

- Specially formulated to provide superior short-trip protection*
- Engineered with Castrol GTX technology and Castrol SYNTEC molecular components
- Offers unsurpassed protection against engine wear caused by frequent short-trip driving*
- Provides high level of fuel economy based on U.S. industry standards **
- Adds greater stability and protection against thermal breakdown compared to conventional oils
- Prevents harmful engine deposits

* In 5W-30 and 10W-30 grades

** 5W-20, 5W-30 and 10W-30 grades



SYNTHETIC BLEND

Castrol SYNTEC

- In extreme torture tests, Castrol SYNTEC 5W-30 maintained maximum horsepower 29% longer than the leading conventional 5W-30*
- Contains powerful additives that help prevent deposit formation
- Neutralizes acids in your engine that can cause rust and corrosion on vital engine parts such as cylinders, bearings, and hydraulic valve lifters
- Meets the world's toughest gasoline engine protection requirements
- Provides stability and endurance under extreme conditions (heat, load, speed)
- Delivers the ultimate performance under high-temperature conditions: unsurpassed protection against volatility burn-off and viscosity increase

* SYNTEC 5W-30; results based on statistically significant values



FULL SYNTHETIC

For more information about the premium products and services that Castrol offers, visit www.castrol.com/us



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Fill It Up

Remember to check the following fluids and/or lubricants on a vehicle whenever you do an oil change, and replenish/fill to proper level when necessary.



Automatic transmission fluid:

Assists lubrication and operation in automatic transmissions. Many car manufacturers recommend changing your automatic transmission fluid every 15,000 to 30,000 miles. Check your owner's manual for recommended change intervals and recommended type of fluid.

Castrol's line of automatic transmission fluids (ATF) is designed to meet a broad range of performance requirements and engineered to maximize the life of your transmission. They include: DEXRON®-VI, Domestic Multi-Vehicle, Import Multi-Vehicle, MERCON® V, ATF+4®, and Type F.



Brake fluid:

Essential for proper function of the brakes (check owner's manual for the exact type needed for your vehicle).

Castrol GT LMA Brake Fluid is recommended for U.S. and foreign vehicles with DOT 3 and DOT 4 requirements, including GM, Ford, and Chrysler, and is ideally suited for Audi, BMW, Jaguar, Mercedes-Benz, Porsche, Saab, Volkswagen, Volvo, Honda, Acura, and many other brake systems.



Gear oils:

Gear oils are designed to withstand the demanding conditions of certain transmissions, transfer cases, and differentials in automobiles, trucks, and other machinery.

Castrol's line of gear oils utilizes premium gear oil technology to deliver excellent anti-wear, anti-scuff, and extreme pressure performance. All Castrol Gear Oils exceed API Service GL-5 to deliver in the most severe extreme pressure situations.



Greases:

A lubricant composed of a fluid lubricant thickened with a material that contributes a degree of plasticity. Greases are typically used in areas where a continuous supply of oil cannot be retained, such as open bearings or chassis components.

Castrol greases are engineered to protect against heat and corrosion. Castrol greases are NLGI #2, lithium complex, or lithium-based for high performance in automotive and light truck applications. For commercial applications, please see the full line of Castrol heavy duty greases.



Power steering fluid:

Provides a vital link in the steering system (the pump can usually be found behind the fan belt).

Castrol GT Power Steering Fluid is recommended for complete fluid replacement and "top-up" in most cars and light trucks. It helps prevent leaks, squeals, rust, and corrosion; protects seals and hoses; and smoothes power steering operation.

If motors are your motivation, you can be an Outperformer.

The Eric Medlen Outperformers Scholarship Program powered by Castrol SYNTEC rewards aspiring young auto technicians with scholarships to attend an automotive program, technical institute, or other school approved by BP Lubricants USA Inc. Starting on October 1, 2007, Castrol asks would-be auto technicians ages 16-25 to explain, in 500 words or less, why they should win the 2008 Eric Medlen Outperformers Scholarship Program. For complete program details and to submit entries, please visit www.syntecoutperformers.com. Entries must be submitted by May 31, 2008.

