Natural Laws Affecting Vehicle Control

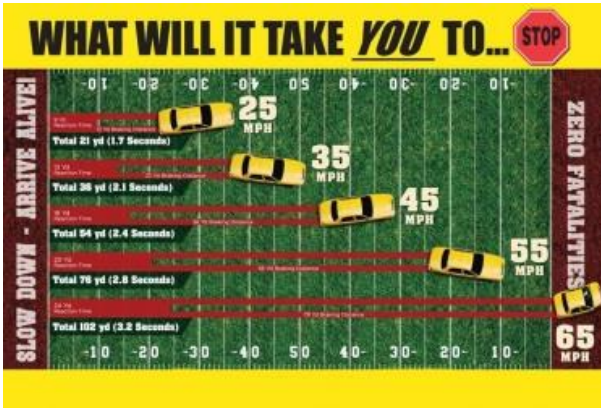
Gravity and Energy of Motion

Gravity and energy of motion affect the way a vehicle performs. A 3,000 lbs. vehicle can really get away from you if you do not understand and control these natural forces. Especially in conditions that are less than ideal.

Gravity is the force that pulls all things downward. You can feel this pull when you drive up or down a hill. When traveling up a hill you'll have to apply more gas to continue at the same speed. When traveling down a hill you'll have to apply the brake to prevent going too fast. It will also take longer to stop if traveling downhill.

The point at which the weight of an object is even all around it is called its center of gravity. A vehicle handles better with a low center of gravity, which is why sports cars and race cars are as low to the ground as possible. A 4x4 loaded with camping gear on the roof rack has a high center of gravity, and therefore a better chance to roll over in a corner at high speeds.

A moving object has **energy of motion**, or "kinetic" energy. The more a vehicle weighs the more energy of motion it has and the longer it will take to stop the vehicle. If vehicle A weighs twice as much as vehicle B, vehicle A will take twice as long to stop as vehicle A. However, a vehicle's energy of motion will change in proportion to the *square* of its change in speed. This means if you double your speed it will take four times the distance to stop! If you triple your speed – nine times the distance to stop.



Friction and Traction

Probably the most important pieces of equipment on your car are the four tires that hold it to the road. The force that is in play here is called **friction** – and the friction created by a tire on the road is called **traction**. Rub your hands together briskly and you'll feel the heat and resistance this is created by friction.

And while each tire on a vehicle seems large enough to do the job, only a small "footprint" of each tire is actually in contact with the road. That's not too bad if the tire tread is new, the tire is properly inflated, and the roadway surface is clean and dry, but if not, the footprints are much smaller and/or irregular. Imagine a 3,000 lb. vehicle being held onto the road by four tire "footprints" about the size of a paper plate and you see how important good tires and proper speed really are if you would prefer to stay on the road.

Tire Inflation

Each tire is designed to operate best at a certain level of air pressure inside that tire. Check your owner's manual or the side of each tire to find that number. It will be listed as *psi*, or pounds of air per square inch. Many tires will have a number like "35 psi" on them and it is best to keep the air pressure as close to that number as possible.

Overinflated tires have too much pressure in them and only the center of the tire will grip the road properly and it will wear out more quickly in the center of the tire and will not last as long.

Underinflated tires only provide traction on the outside edges of the tire, usually where there isn't any tread. The outside edges of an underinflated tire will wear out first and they will not last as long.

A **properly inflated** tire grips evenly across the surface of the tire, whisking away any water on the road and providing maximum traction.

Outside air pressure can change the pressure in your tires without you knowing it. In the winter, when the air is colder, tire pressure drops and you will likely need to add air to your tires. In the summer, when the air is warmer, tire pressure will likely increase and you may need to let out a little air. Use an inexpensive tire pressure gauge to ensure you are keeping your tires at the recommended level. Properly inflated tires help a vehicle handle better and get better gas mileage!

A simple tool to check your tire for proper tread is a penny. Place the penny with the top of Lincoln's head into the tread of your tire. "If you can see Lincoln's head, you need more tread." Try it!

Curves

The physics involved in driving come into play even more when you enter a curve. Energy of motion (momentum) will try to keep your vehicle going in a straight line and your speed will try to make your tires lose traction. Control your speed and you will safely and smoothly enter and exit a corner. You will discover, after taking this course, that the solution to many of our problems on the road is speeding. Slow down and most problems go away.

Force of Impact

Collisions usually happen "in the blink of an eye" and they can be violent and deadly. You can protect yourself and reduce the force of an impact by doing several simple things.

First, slow down. Speed is the most important factor in determining how hard two objects will collide. Always try to reduce speed in an emergency.

Second, a heavier vehicle will cause more damage than a lighter one. Watch out for the larger vehicles on the road.

Third, the distance a vehicle travels after it hits another object affects the force of impact. If you hit the brakes and then a trash can you will continue to move forward for quite some time before stopping. The impact will not be much. However, if you hit your brakes and then a tree, the tree won't give much and the distance your vehicle will travel after impact will be short. Sadly, your internal organs, including your brain, continue to travel at the speed you were driving before hitting the tree and the brain slams into the inside of your skull (and your other organs slam into the inside of your body) at the speed your car was traveling, resulting in serious injury or death.

Wearing your seat belts is the number one thing you can do to prevent injury and death in a collision. Seat belts will almost always keep your body in the vehicle where you are safer.

Air bags are a balloon-type of device that automatically inflates during a collision to slow your body down and reduce the force of impact. Air bags are designed to be used with seat belts and work best when the driver is at least 10 inches from the steering wheel – where the driver side front air bag is housed. Also, keep your hands at 9 and 3 on the wheel to prevent hand, wrist, and arm injuries during an air bag deployment. Air bags deploy at around 200 mph! Because of this, children under the age of 13 should never be placed in a front seat with an air bag. Their little bodies cannot withstand that much force. Some newer vehicles have switches that give owners the ability to turn front air bags off in cases where children must sit up front.

REVIEW QUESTIONS
HOMEWORK PACKET 4

NAME: _____ DATE: _____

DIRECTIONS: Answer the following questions based on what you learned from the homework packet.

1. How does gravity affect driving?

2. If one car is traveling 35 mph and will take 100 feet to stop and another similar car is traveling 65 mph, what is the distance the car traveling 65 mph will need to stop?

3. What is the relationship between friction and traction?

4. On an underinflated tire, what part of the tire wears out first?

5. Name two advantages to keeping your tires properly inflated.

6. Name the force that wants to keep your vehicle going straight when driving into a curve.

7. What is the number one thing you can do to prevent injury and death in a vehicle?

8. How does an air bag prevent injuries and death?

9. Children under the age of ___ should never sit in a front seat with an air bag.

10. How much does a basic set up new tires cost? (If you have Internet access, look it up! If you don't, call a local tire seller)