Safety Considerations

Description
This Activity Plan is designed as one among many through which students will rotate in small groups. Safety is extremely important and it is suggested that this be the first Activity Plan covered. Each automotive mechanic's work environment is unique and comes with its own inherent safety risks.

Lesson Outcomes
The student will be able to:

• Safely use tools that are required to perform the associated automotive Activity Plans
• Distinguish between safety-related terms and requirements
• Know when different types of safety equipment are required for various automotive procedures

Assumptions
The students will have received:

• A basic understanding of general or generic technology education shop safety
• Some shop safety theory from the teacher prior to practically working in an automotive shop atmosphere

Terminology
Earmuffs: a type of hearing protection that is placed over the head and around the ears to dampen loud noises.

Face shield: a type of facial helmet that protects an operator's full facial area.

Earplugs: a set of plugs, one of which is pushed into each ear to dampen loud noises.

Rubber gloves: a type of hand protection that is worn to protect the hands from harmful chemicals.

Particle mask: a mask that is worn around the mouth and nose area to protect the lungs.

PSI: an abbreviation for pounds per square inch.

Safety glasses: a special type of glasses worn to protect the eyes.

Estimated Time
60 minutes
\textbf{Recommended Number of Students}

20, based on the \textit{BC Technology Educators’ Best Practice Guide}

\textbf{Facilities}

Automotive shop or a technology education shop that will accommodate a vehicle

\textbf{Tools}

Pen or pencil

\textbf{Materials}

- Students will need a vehicle in order to do this safety Activity Plan. The following Activity Plan is a type of lab that the students will do to strengthen their familiarity with the various specific hazards that the automotive mechanic can and will encounter. In addition students should have access to a computer where they can research the answers to the safety lab.

- Shop Safety (Handout)

- Safety Considerations in the Automotive Shop (Quiz)

- Safety Test
Activity

Have students complete the worksheet that follows the images on the next three pages. Encourage students to wander around the shop to help find their answers. The images supplied in this Activity Plan are designed to accompany discussion about the worksheet once it has been completed.

Figure 1—Wearing eye protection for a brake job

Figure 2—Protective face shield

Figure 3—Hearing protection
Safety Considerations

Figure 4—An automotive protective rubber glove

Figure 5—Putting on a dust mask

Figure 6—Open-toed shoes are unsafe!

Figure 7—Vehicle exhaust

Figure 8—Radiator fans pose a serious hazard

Figure 9—Thermal analysis of exhaust system and manifold. Hot exhaust can seriously burn you.
Figure 10—Never blow compressed air at someone else!

Figure 11—Car engulfed in flames

Evaluation Guidelines

- The students can attain at least 90% on this lab.
- The students can attain at least 90% on the additional attached safety quiz.
Shop Safety

Note
In order to be allowed in the shop area you must pass the safety test at a 90% competency rate (three incorrect answers or 27/30). Any failures must be rewritten outside of class time.

Contact Lenses
Be aware of other students even if you do not wear contacts.

1. If dirt or acid gets in the eye, the contact must come out to clean the eye. Ask the student if they are wearing contacts or tell the student if you are wearing them.
2. When arc welding, the flash or spark is bright enough to fuse or weld the contact to the eyeball. Always wear the proper dark eye protection when arc welding and warn other people around you that you are welding. (It is a natural instinct to turn toward a bright light and someone who wears contacts might do it unknowingly.)

Batteries

1. Car batteries contain sulphuric acid and are therefore highly corrosive and explosive. The acid will eat through car paint, clothes and skin. Wash with water immediately. When carrying batteries, use the proper battery carrying strap to protect your clothing.
2. No smoking, open flame or sparks should be around batteries.
3. When working on batteries use the special lead pliers to eliminate the chance of spark (lead does not conduct electricity).
4. A bad battery can give off a distinctive rotten egg smell. Never attempt to jump start a battery in this condition. It is likely to explode.

Compressed (Shop) Air
Absolutely no horseplay with compressed air. It is extremely dangerous. Pressure is between 140–160 psi.

• There is enough pressure to force air through the skin and into the bloodstream, and as doctors and intravenous drug users know, air in the bloodstream can cause death.
• The shop air can also create a siphoning effect where if you are pointing the air nozzle at someone it can pick up dirt off the floor and shoot it at them.
• Never spin bearings on your fingers with compressed air. They can seize up and then twist your fingers off.
• The pressure is strong enough to do internal body damage when placed up rectal, nasal or ear passages.

Creepers
Do not leave creepers lying down on the floor. Someone could slip on them. Lean them up against the car or hang them back on the wall.
Floor Area

Keep the area clean and tidy. Pick up any loose nuts or bolts and wipe up any spills. These can cause tripping and slipping, especially when carrying heavy engine parts.

Greasy and Oily Rags

Put any paper towels or rags that are saturated with gas, oil or grease into the special red container. If they are thrown into the regular garbage, spontaneous combustion may occur.

Gasoline and Fuel Tanks

Gas can combust or ignite at 40° Celsius (a very low temperature). Therefore:

1. All gas tank work must be done outside (WCB regulations).
2. NO open or exposed trouble lights can be used when working on gas tanks or around gas. (Gas is very cold and will burst the light bulb, creating a fire hazard.) Special enclosed safety lights are okay.
3. Absolutely no flames, sparks or smoking around gasoline.

Driving Instructions

Only one person should give directions to a student driving in or out of the shop. Never stand directly in front of or behind the car while you are giving directions. There are many recorded accidents in which people mixed up the clutch and gas and brake pedals or their feet slipped.

Brake Dust

Asbestos/cancer concern. Older cars’ brakes were made with asbestos, which is a cancer-causing agent. Try not to breathe any. NEVER blow brake dust with the compressed air. It sends all the dust throughout the entire shop, and then we breathe in the fine particles. Instead, clean a brake part by washing it down with water.

Electricity

Common sense says that electricity and water do not mix. Be especially aware of this on days when it rains or snows, as puddles form when water drips off the car.

• If any cords are damaged or need repair, tell the teacher so they can be fixed.

Lighters

Plastic butane lighters (BIC style) have been known to explode when a welding spark hits them. If you smoke, DO NOT bring lighters into the shop.

Fires and Extinguishers

The fire triangle is made up of heat, fuel, and oxygen. If one of these are eliminated, then the fire goes out. All extinguishers work on this principle. There are three basic types of fires:

1. Class A fire: burnable solids like paper, cardboard and wood. The silver water extinguisher works great for this type of fire (by cooling).
2. **Class B fire**: flammable liquids like gas, oil, grease and paint. Oil/gas and water do not mix, so using a Class A extinguisher would spread the fire and make it bigger! The Class B type extinguisher uses chemical foam to smother the fire (removes the oxygen).

3. **Class C fire**: electrical equipment fires. Try to turn off the source of electricity (red safety button in the shop). Water and other liquid extinguishers are a definite No! This type of fire requires carbon dioxide or carbon tetrachloride extinguishers.

Some extinguishers are combined: A, B and C, or B and C. To use an extinguisher, apply the PASS method:

- Pull
- Aim
- Squeeze
- Sweep

Always turn in a used or partly used extinguisher.

**Note**: You have prior permission to use a extinguisher if you feel the need arises. BUT YOU MUST TELL THE TEACHER so that the extinguisher can be recharged. This is in all cases, even if you did not emptied the extinguisher or the gauge still reads OK. There is a slow leakage of pressure once the seal has been broken, making it useless after a few weeks.

**Antifreeze**

This is an environmental and safety concern. Use the following procedures with antifreeze:

- Place used antifreeze in special containers. Do not pour it down the drain or onto the grass.

- Do not leave antifreeze lying around in open containers. It is poisonous to cats and dogs (they like the sweet taste of it).

**Radiators**

Do not open radiator caps when hot. It is quite easy to get third degree burns from them. You should be able to keep your hand comfortably on the radiator for 10 seconds for it to be considered not hot. This is because a radiator works on the principle of pressurization for its cooling abilities. When liquid is under pressure, it increases the liquid’s boiling point. So if the radiator contains water, which normally boils at 100° Celsius, under pressure it will stay a liquid even up to temperatures of 130–140° without boiling. But once you release the pressure by turning the radiator cap, the liquid water turns instantly to a superheated steam. The pressure also increases because it has turned into a gas (gases like to take up more space or volume than a liquid). So instead of a normal radiator system having about 15 psi pressure, it could go as high as 100 psi. It becomes virtually impossible to close the radiator cap once it has been opened.
Wheel Lug Nuts

Make sure that the tapered side of the nut points in toward the car (goes toward the wheel).

All lug nuts must be checked by the teacher after the tire is replaced.

Exhaust Fumes

Look out for yourself and other people. There are over 100 different chemicals that come out of the tailpipe. In Canada, four come under federally regulated law:

- Pb or lead: Lead has been linked to many health hazards, but this threat has been totally eliminated by the advance of unleaded gasoline. However, leaded gas is still available in the USA.

- HC or hydrocarbons: This is raw, unburned gas that goes from the gas tank, through the engine and out the tailpipe without being burned. This often causes stinging and irritation to the eyes.

- CO or carbon monoxide: Probably the most deadly of all the gases. When it enters our bodies, it tries to rob oxygen out of our bloodstream to make carbon dioxide (the natural stuff we exhale). Thus, if exposed long enough, we become dizzy, unconscious and die.

- NOx or nitric oxide: A natural by-product of burning fuel that has been linked to general health hazards.

There are two other fumes that are cause for concern and will most likely be federally regulated in the upcoming years:

- SOx or sulphur oxide: Thought to be the cause of turning evergreen trees brown. As well, sulphur poses some general health hazards for humans.

- Mg or magnesium: This substitute for lead in unleaded gasoline is thought to be connected with several health risks, but little research into its effects has been done.

With the exception of HC, most of these gases are silent killers. You cannot:

- Taste them
- Feel them
- Smell them
- See them
- Hear them

Also, some of these exhaust fumes are heavier than air, so watch out if you are under another car in the next bay. Either have the bay doors open or hook up the exhaust hose and fan system.
Safety Considerations in the Automotive Shop

1. List five items in the shop that could potentially pose a risk to your eyes.

__________________________________________
__________________________________________
__________________________________________
__________________________________________
__________________________________________

2. When would you need to wear a face shield—and not just safety glasses—in an automotive shop?

__________________________________________
__________________________________________
__________________________________________
__________________________________________
__________________________________________

3. List three places in the automotive shop where hearing protection would be required.

__________________________________________
__________________________________________
__________________________________________
__________________________________________
__________________________________________

4. What is one example of when you should wear protective rubber gloves in the automotive shop?

__________________________________________
__________________________________________
__________________________________________
__________________________________________
__________________________________________

5. What is one example of when lung or breathing protection should be worn?

__________________________________________
__________________________________________
__________________________________________
__________________________________________
__________________________________________
6. Why are open-toed shoes not allowed in the automotive shop?

7. Give one example where long hair could pose a hazard in the automotive shop.

8. Why is it a safety hazard to run a vehicle in an automotive shop?

9. Describe one major safety hazard that can be found under the hood of a vehicle.

10. List two separate areas in a vehicle where you could get burned.
Safety Test

Name ___________________________  Date ___________________________

1. List two hazards connected with contact lenses.
   a. ___________________________________________
   b. ___________________________________________

2. List one hazard with batteries.
   _____________________________________________

3. Shop privileges will be suspended if you are caught horseplaying with the compressed air.
   a. True
   b. False

4. Which choice best describes a Class A fire?
   a. Burnable solids like paper and wood
   b. Electrical devices like electric motors
   c. Burnable metals like magnesium and potassium
   d. Burnable liquids like gasoline and oil

5. Which choice best describes a Class B fire?
   a. Burnable solids like paper and wood
   b. Electrical devices like electric motors
   c. Burnable metals like magnesium and potassium
   d. Burnable liquids like gasoline and oil

6. Which choice best describes a Class C fire?
   a. Burnable solids like paper and wood
   b. Electrical devices like electric motors
   c. Burnable metals like magnesium and potassium
   d. Burnable liquids like gasoline and oil

7. What should you never do with brake dust?
   _____________________________________________

8. What are the two dangerous gases that are emitted from the exhaust pipe? (Abbreviations are accepted.)
   a. ___________________________________________
   b. ___________________________________________
9. When, where, why and how are exhaust gases dangerous?
   a. ____________________________________________
   b. ____________________________________________
   c. ____________________________________________
   d. ____________________________________________

10. What should you do after you use a fire extinguisher?
    ____________________________________________

11. It is OK to throw antifreeze down the sewer drain.
    a. True
    b. False

12. What two things make a hot radiator dangerous?
    ____________________________________________
    ____________________________________________
    ____________________________________________
    ____________________________________________

13. When discussing the use of fire extinguishers, what does the acronym PASS stand for?
    P _________________
    A _________________
    S _________________
    S _________________

14. When giving driving instructions, where should you stand?
    a. In front of the car
    b. At the back of the car
    c. In the passenger seat
    d. To the side of the car

15. List two safety rules when working with fuel tanks.
    a. ____________________________________________
    b. ____________________________________________
16. On wheel lug nuts, which way does the taper side of the nut go toward?

17. Butane lighters and welding do not mix.
   a. True
   b. False

18. On wheel lug nuts, what must be done after you have tightened them?

19. Where should greasy and oily rags go?

20. Why should the floor be kept clean and spill-free?