Vehicle Painting

Level III

Based on Nov. 2016, Version 2 Occupational standard

Module Title: -Applying Fundamental Solid Colour Matching Technique

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Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- using work instructions, methods and material type
- Reading and interpreting Job specifications
- Observing WHS requirements, and personal protection needs
- selecting and inspecting Materials for quality
- Identifying and checking Hand, power tooling and safety equipment
- Determining Procedures to minimize waste material.
- Identifying Procedures for maximizing energy efficiency.

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- use work instructions, methods and material type
- Read and interpreting Job specifications
- Observe WHS requirements, and personal protection needs
- select and inspecting Materials for quality
- Identify and checking Hand, power tooling and safety equipment
- Determine Procedures to minimize waste material.
- Identify Procedures for maximizing energy efficiency.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

1.2. **Work Instructions**

Work Instructions are documents that clearly and precisely describe the correct way to perform certain tasks that may cause inconvenience or damage if not done in the established manner. That is, describe, dictate or stipulate the steps that must be followed to correctly perform any specific activity or work.

Work instructions are also called work guides, Standard Operating **Procedures**(SOPs) job aids or user manuals, depending on the situation. In any case, the purpose of the work instructions is to clearly explain how a particular work task is performed.

Difference Between Work Instructions and Procedures

Another way of looking at Work Instructions v Procedures is that:

Procedures describe:

- What is the activity is
- Who performs it
- When it is performed

Work instructions describe:

- How the activity is performed.

Purpose of Work Instructions

A work instruction is a tool provided to help someone to do a job correctly. This simple statement implies that the purpose of the work instruction is quality and that the target user is the worker. Unfortunately, in many workplaces, today's work instructions have little connection with this fundamental focus. Factories have encumbered work instructions with content that has been added to satisfy auditors, lawyers, engineers, accountants and yes, even quality managers. We've piled on so much extraneous material that we've lost sight of the intended purpose of work instructions.'

Steps to Writing Work Instructions

1. Follow these steps to write your next set of Work Instructions.
2. Know exactly how to perform the task.
3. Plan how to write steps in the correct order.
4. Write the steps in logical order.

5. Start each instructions with a verb.
6. Write each step as a single action.
7. Include warnings as pre-steps.
8. Review and edit instructions carefully.
9. Write in the positive voice.
10. Avoid opinions, preferences, or choices.

Self-check 1	Written test

Name…… ID……. Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I. Choose the best answer for the following question

1. -------- are documents that clearly and precisely describe the correct way to perform certain tasks that may cause inconvenience or damage if not done in the established manner. (3 pts)

   A. Work Instructions B. Procedures C. Specification D. Methods

2. Work instructions describe:
   A. How the activity is performed
   B. What is the activity is
   C. Who performs it
   D. When it is performed

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Test I

1. ---------- 2. ---------

Information Sheet 2- Using methods and material type

2.1. Work methods

Work methods are the physical actions employed to perform a task. Evaluating and modifying work methods to prevent discomfort and injury is one of several components of an effective ergonomics program. Work methods are also called work practices

The working method will have to be:

- Clearly explained. It will need to be understood by the team working under water, often taking turns, which will have to take individual decisions.
- Rapid to implement. There is a limit to the time that can be spent under water.
- Straightforward to implement. Working under water is hard enough without the addition of further complications.

2.1.1 Spray gun techniques

Spray gun technique and its relationship to atomization of products is often misunderstood by many automotive refinishers. Proper gun technique involves four facets: gun angle, speed, path, and distance. Before handling the gun, it is important to adjust the spray pattern properly.

The proper spray gun pattern is elliptical in shape (8 – 10 inches in Length) with and even amount of material across the entire surface.

- Heavy in the middle could mean too little air flow.
- Divided in the middle could mean too much air flow.

Too much paint at the top or bottom could mean a restriction in the fluid flow, usually at the fluid needle and/or air cap. Clean both and retest.

A crescent shaped pattern could mean a restriction at the fluid needle and/or air cap on one side. Clean and retest. With the air cap turned 90 degrees and a heavy amount of material sprayed, the test pattern should be 8 – 10 inches long, elliptical in shape, and the “runs” a consistent length along the whole pattern.

GUN HANDLING PROBLEMS

The inexperienced painter is prone to several spraying errors including:

Heeling:-This occurs when the painter allows the gun to tilt because the gun is no longer Perpendicular to the surface, the spray produces an uneven layer of paint, excessive over spray, dry spray

Arcing:- This occurs when the gun is not moved parallel with the Surface the result is uneven film build up

Speed of stroke: If the stoke is made too quickly, the paint will not cover the surface evenly. If it is made slowly, sags and runs will develop The proper stroking speed comes with experience

Improper over lap: Improper overlapping results in uneven film thickness, sags and runs

Improper Leverage:- Triggering at the wrong time (on the nearby panel) is another common error.

2.1.2 Spraying techniques

There are several variables contributing to the quality of the spray finish including spraying material viscosity, spray booth temperature, film thickness, and spray practice.

Spraying material viscosity

When preparing material for spraying, thin to the proper viscosity according to the directories on the can, using the thinner or reducer best suited.

Table:- 1 spraying viscosity

Material	Reduction	Viscosity
Acrylic enamel	30 (1/3)%	19 seconds (19")
Acrylic enamel	50%	18 seconds (18")
Acrylic lacquer	150%	15 seconds

Reduction ratio guide

Reduction percentage	Mixing Ratio	Paint material	Solvent materials
25	4:1	4 parts	1 part
33	3:1	3 parts	1 part
50	2:1	2 parts	1 part
75	4:3	4 parts	3 parts
100	1:1	1 parts	1 part

125	4:5	4 parts	4 parts
150	2:3	2 parts	2 parts

Film thickness

The amount of material sprayed on a surface with one stroke of the gun will depend on:

- Width of far, Amount of reduction.
- Distance from gun, Speed of stroke
- Air pressure at the gun

ADJUSTING THE SPRAY (For suction feed spray gun)

A good spray pattern depends on the proper mixture of air and paint droplets much like a fine tuned engine depends on the proper mixture of air and gasoline. There are three basic adjustments, which under normal conditions will give the proper spray pattern, degree of wetness, and air pressure for suction feed guns.

Adjust the air pressure to the specification indicated on the paint can

Set the size of the spray pattern using the fan adjustment or pattern control knob

Set the fluid control knob to regulate the amount of paint according to the selected pattern size: backing the knob out increases the paint flow turning the knob decreases paint flow.

Testing the spray pattern

After setting the air pressure, the fan size, and the fluid flow, test the spray pattern on a piece of masking paper or newspaper.

- Hold the gun 6 to 8 inches away from the paper if spraying lacquer and 8 to 10 inches for enamel. Pull the trigger all the way back and release it immediately. This burst of paint should leave a long, slender pattern on the last paper.
- Turn the pattern control knob in until the spray pattern is 6 to 8 inches high
- For spot repair, the pattern should be about 5 to 6 inches from top to bottom. For paper or overall repair the length of the pattern should be 9 inches from top to bottom.

The Application Stroke

The proper stroke is most important is obtaining a good refinishing job. To obtain a good stroke, proceed as follow:

- Hold the spray gun at the proper distance from the surface
  Short- the high velocity air tends to ripple wet film
  Long- A greater percent of thinner evaporated (dry film result), loss of material
- Hold the gun level and perpendicular to the surface, otherwise uneven paint film will result
- Do not fan the sun and do not use wrist motions if a uniform film is desired. The only time it is permissible to fan the gun is on a small spot spray where the paint film at the edges of the spot should be thinner than the center portion
- move the gun with a steady deliberate pass, about 1 foot per second. Moving the gun too fast will produce a thin film, while moving it too slowly will result in the paint running.
- Release the tiger at the end of each pass

Difficult areas such as corners and edges should be sprayed first

Generally, start at the top un upright surface such as a door panel. The spray gun nozzle should be level with the top of the surface, this means that the upper half of the spray pattern will hit the masking

The second pass is made in the opposite direction with the nozzle level at the lower edge of the previous pass and the other half is sprayed on the unpainted area.

The last pass should be made with the lower half of the spray pattern below the surface being painted

The procedure just followed is called a Single Coat. For a double coat, repeat the single coat procedure immediately. Generally, two or more double coats are required to properly a lacquer top coat.

Allow for flash time (the time required for the solvents to evaporate and the finish to dull slightly.) or several minutes between coats. Two or three single coats are normally required for enamel top coats

when painting a car, spray painting techniques can be the difference in a great looking paint job and one that you might not want other people to see. Whether you will be using a standard auto spray gun or a car airbrush, there are ways that you can help ensure that you do the job right the first time and avoid wasting time and money in doing the job over again. Here are some tips to help you:

Remove or Tape to Avoid Overspray- Until you are experienced in using a paint sprayer and comfortable painting cars, you should attempt to remove parts of the vehicle that need to be painted. This is especially true if you are only painting a bumper, door or a single quarter panel. However, if you're not able to remove the piece, make sure that you tape off the area as to avoid overspray in areas of the vehicle that don't need to be painted. If you need to tape off an area, make sure to use a painter's grade of masking tape that will not damage the finish of the vehicle.

Surface Preparation is Essential- Before you even hook up your spray gun, you should spend a lot of time preparing the surface of the vehicle. When painting a vehicle, sandpaper can often be your best friend. Use low grit sandpaper such as 80 or 300 grit pieces to smooth out the scratches or imperfections in the surface of the vehicle. You should also spend some time practicing good wet sanding methods with 1000 or higher grit papers. The more time you spend preparing the surface of the vehicle, the easier spraying the car will be.

Spray Several Light Coats Rather One Heavy One- Many inexperienced car painters tend to try to paint a vehicle too quickly. Sometimes, you may be tempted to spray a lot of paint onto a car. However, this almost always results in runs or paint build up. Therefore, make sure that you hold your spray nozzle approximately 10 to 12 inches away from the vehicle and spray the vehicle with slow and even strokes. Spray the vehicle from black to left, and not up and down. If you miss an area don't break your rhythm and just wait until you apply the next coat to cover the missed area.

Don't Rush Between Coats- After you've sprayed a coat of paint onto the vehicle, you'll need to give the codes enough time to set properly before applying the next coat. For most types of car paint, you should wait about 15 to 20 minutes between coats. If you are applying a primer, you should wait about 24 hours before applying a base coat or enamel based paint. Also, between primer and paint applications, you should wet sand the vehicle with a 1000 - 1200 grit piece of sandpaper. This will make spraying the vehicle much easier and allow you to use less paint to cover the car.

Correct Mistakes Before Continuing- If you do make a mistake while spraying the vehicle, continue spraying the current coat of paint. However, do not apply another coat of paint until the mistake has been corrected or repaired. Again, use a piece of

sandpaper to lightly sand away paint buildup or runs. Just make sure that you allow the paint to drive before correcting the mistake.

2.1.3 Drying procedures

There are four stages of spray paint drying:

1. Surface dry wherein the solvent of the paint evaporates,
2. Touch dry wherein the paint could stick to your finger or not
3. Hard dry, the point when the paint layer has gotten harder and will not come off,
4. Thorough dry wherein the part of the surface is dry and ready for use.

Drying usually refers to a solvent or thinner evaporating from the paint on a chemical reaction versus the evaporative process of drying. Depending on the type of auto paint used on your car, the paint may either dry, cure or dry then cure. curing is about the paint's binder and how it polymerizes. In other words, curing is dependent Enamel or acrylic enamel paint uses air to cure whereas urethanes and epoxies do not use air to cure. If you are using acrylic enamel paint, there is something you can do to help cure the auto paint.

Step 1

Put the car outside away from falling debris. Also keep the car far away from anything that you don't want to get paint on, such as other cars and buildings.

Step 2

Put on a respirator which can be obtained from the local hardware store. This protects you from harmful fumes emitted from the catalyst or hardener. Also put on protective eye goggles before beginning.

Step 3

Use a catalyst or hardener when applying acrylic four to six weeks to cure, now cures in a matter of days. Mix in the catalyst or hardener into the paint before painting the car. Stir the paint and catalyst or hardener with a paint stirrer until completely mixed.

Step 4

Spray the car with the paint, moving in a back and forth, side to side motion.

Allow the paint job to dry for four to six weeks if not planning to use a catalyst or hardener. Apply polish to the new paint job after it dries, but wait the full four to six weeks to add any wax.

2.1.4 Paint mixing methods

Auto Paint Mixing Safety Working on your car can be messy. It can also be dangerous. Paint, solvents, and other hydrocarbons can irritate the skin. Here's what you'll need to ensure you keep your jeans, shirt, and skin spotless, and your bones intact. Nitrile gloves (to repel chemicals used).

Tips For How to Mix Automotive Paint

Mix a small amount of paint ahead of the full amount. You can then apply this small batch to a test site to ensure your ratios are good and have the effect you wanted, all while not potentially ruining the rest of the paint.

Car manufacturers often have car-coded paints available through dealerships or online.

Procedures for paint mixing

1. Read the instructions on the label thoroughly.
2. Pry the lid of the container and stir the paint thoroughly with a stir stick.
3. To make pouring easier, shape a pouring spout on the container using masking tape.
4. Pour the paint to a graduated measuring container. If using a mark mixing stick, the container does not have to be graduated but must have a flat bottom and straight up and down sides.
5. Add the proper reducing solvent in the proper ratio according to the manufacturer's label.
6. Mix the solvent and paint together by stirring with a stir stick.
7. If the paint requires hardener it must be added as directed on the label while stirring the paint.
8. When all the ingredients stirred together, the viscosity can be check with a viscosity cup. This is done by dipping into the paint, pulling it out over the paint, and timing the amount of time in seconds it takes to empty the cut through the hole in the bottom. Check the manufacturer's viscosity time.
9. I f the viscosity time is slower, reduce paint more. If the viscosity is faster, add more paint to slow it down.
10. The paint is then strained into the spray gun cup using a paint strainer.

11. The spray painting should start above the panel and to the bottom and at a distance of approximately 8” to 10” away from the panel to be painted.

Automotive paint can be broken down into basic categories: acrylic lacquer, acrylic enamel, urethane, and acrylic urethane, etc

Each type requires a slightly different recipe and mixing method, so consult your owner’s manual or your local dealership to determine the right paint for your car and follow the instructions carefully.

Acrylic Lacquer

Acrylic lacquer was an early industry standard that was phased out by the 1980s. In states regulating the use of harmful volatile organic compounds, or VOCs. Acrylic lacquer paints are illegal. Acrylic lacquer paints are easy to use and produce a glossy finish, but are more susceptible to damage from UV rays than a modern urethane-based paint-and-clear coat treatment is. Some classic-car restorers still use acrylic lacquers to maintain a factory-correct look on vintage cars that aren’t used as daily drivers.

Mixing Acrylic Lacquer (Ratio 1:1 Paint/Thinner)

- Inspect the pre-marked mixing container for dust and debris. Wipe it out if necessary.
- Find the 1:1 ratio markers on the container; pour in the paint.
- Using a stirrer, mix the paint to blend the pigments fully.
- Using the 1:1 ratio markers as a guide, pour in the thinner.
- Mix the paint and thinner together for several minutes, making sure the consistency is uniform.
- You did it!

Acrylic Enamel

Acrylic enamel creates a hard exterior shell-like acrylic lacquer, but lasts longer and provides better UV protection.

Acrylic enamels are separated into two categories: single-stage, which dries to a glossy finish, and two-stage, which includes a base layer of pigmented paint and a separate clear coat. The clear coat adds a glossy finish and extra protection.

Mixing Acrylic Enamel One Stage (Ratio 8:1:1 Paint/Thinner/Hardener)

- Inspect the pre-marked mixing container for any dust and debris. Wipe it out if necessary.
- Read the paint's instructions on when to add each ingredient as some require the hardener to be added at a specific time.
- After you find the 8:1:1 ratio markers, pour in the paint.
- Using a stirrer, mix the paint to blend the pigments fully..
- Using the 8:1:1 ratio markers, pour in the thinner.
- Mix the paint and thinner together.
- At the indicated time, add the hardener, filling the container to the right 8:1:1 level.
- Stir the mixture together.
- You're ready!

Mixing Acrylic Enamel Two-Stage (Base Coat Ratio 1:1 Paint/Thinner, Clear Coat Ratio 4:1 Paint/Hardener)

Base Coat

- Inspect the pre-marked mixing container for any dust and debris. Wipe it out if necessary.
- After you find the 1:1 ratio markers, pour in the paint.
- Using a stirrer, mix the paint to blend the pigments fully.
- Using the 1:1 ratio markers, pour in the thinner.
- Mix the paint and thinner together.
- Done!

Clear Coat

- In a second pre-marked container, inspect for any dust and debris. Wipe it out if necessary.
- After you find the 4:1 ratio markers, pour in the clear coat.
- Stir the clear coat to make sure consistency is correct.
- Using the 4:1 ratio markers, add the hardener at the indicated time.
- You're done!

Urethane

Urethane paint is extremely resistant to rock chips and fading, and looks fantastic when applied correctly, but those properties come at a cost, which is generally higher than other automotive paints.

Urethane is also tricky to mix and apply, as ambient temperatures will determine which type of urethane activator is needed (fast, medium, or slow). Other factors that affect urethane application are humidity, airflow, and total wanted paint thickness, which may require you to use paint thinner, and isn't usually recommended for weekend warriors.

Mixing Urethane Multi-Stage (Base Coat Ratio 4:1 Paint/Activator, Clear Coat Ratio 4:1 Paint/Hardener)

Base Coat

- Inspect the pre-marked mixing container for any dust and debris. Wipe it out if necessary.
- Find the 4:1 ratio marker and pour in the paint.
- Using a stirrer, mix the paint to blend the pigments fully.
- Using the 4:1 ratio marker, pour in the correct activator (fast: below 70 degrees, medium: 70 to 80 degrees, and slow: above 80 degrees).
- Stir the paint and activator to combine.
- Repeat the process, allowing for drying times, if further base coats are required.
- All done!

Clear Coat

- In a second pre-marked container, inspect for any dust and debris. Wipe it out if necessary.
- After you find the 4:1 ratio markers, pour in the clear coat.
- Stir the clear coat to make sure consistency is correct.
- Using the 4:1 ratio markers, add the hardener at the indicated time.
- You're done!

Acrylic Urethane

Acrylic Urethane is now the industry standard as it provides long-lasting UV protection, excellent resistance to chips and dings, and is cheaper.

But like Urethane, ambient temperatures will affect what types of urethane activator is used (fast, medium, or slow), and humidity, airflow, and total wanted paint thickness can require additional steps and considerations. This isn't recommended for weekend warriors.

Mixing Acrylic Urethane (Base Coat Ratio 4:1 Paint/Activator, Clear Coat Ratio 4:1 Paint/Hardener)

Base Coat

- Inspect the pre-marked mixing container for any dust and debris. Wipe it out if necessary.
- Find the 4:1 ratio marker and pour in the paint.
- Using a stirrer, mix the paint to blend the pigments fully.
- Using the 4:1 ratio marker, pour in the correct activator (fast: below 70 degrees, medium: 80 to 70 degrees, and slow: above 80 degrees).
- Stir the paint and activator to combine.
- Repeat the process if further base coats are required, allowing for drying times.
- All done!

Clear Coat

- In a second pre-marked container, inspect for any dust and debris. Wipe it out if necessary.
- After you find the 4:1 ratio markers, pour in the clear coat.
- Stir the clear coat to make sure consistency is correct.
- Using the 4:1 ratio markers, add the hardener at the indicated time.
- You made it, congrats!

2.1.5 Paint straining methods

Paint strainers are disposable painting products designed with a fine mesh material. The purpose of a paint strainer is to remove all impurities (clumps, dirt, dust, dried flakes, etc.) from the paint, prior to a paint job.

Types of strainers

From small, funnel-shaped fine mesh strainers to larger 5-gallon bag strainers- there is a wide range of options and sizes for any paint job type. The most popular options include:

Bag Strainers: Bag paint strainers are great for all types of paints, stains, varnish, and liquids. These strainers remove dried flakes, lumps, filaments and other dust particles. Bag strainers are ideal for 1, 2 or 5 gallons of paint and are designed with double stitched edges for durability. Available in plain top and elastic top options (Elastic top strainers provide a snug fit on the paint bucket rim, and stay in place.)

Cone Strainers: The tried and true, traditional cone strainer is great for removing impurities in latex paint and oil-based paints. Unlike the bag strainer, cone strainers also known as paper paint strainers, are not designed to fit around the edge of a paint bucket. We recommend using a cone strainer holder to filter paint above a paint bucket. Available in multiple mesh counts (the higher the mesh count, the fewer impurities can filter through)

Pump Strainers: Pump strainers are used to filter unwanted, superfine particles, specifically in spray equipment to prevent clogging. These strainers typically include an opening for a spray pickup tube. Decrease your prep time, and strain as you spray!

How to use a strainer

Although all strainers are designed to do the same thing, their processes may differ based on the type of strainer you use.

Bag strainers are great for larger amounts of paint. To use, simply

- place the bag strainer in the bucket and fold the top edge over the budget rim.
- carefully pour the paint into the bag.
- Avoid straining too much at once, as it may take time to separate the paint and impurities.
- using a strainer holder above the bucket.
- Carefully pour the paint into the paper paint strainer.
- Position the strainer on the bucket rim, and thread the spray hose through the provided opening.!

2.1.6 Paint thinning methods

Paint is divided into two categories: oil-based (or alkyds) or water-based paints. Oil-based paints should be thinned or cleaned up only with petroleum or mineral-based products. In contrast, latex paint is water-based and should be cleaned up and thinned only with water.

How to Thin Automotive Paints

1. Prepare paint for thinning. Set aside the appropriate amount of paint you will need for your project. ...
2. Fill a spray bottle with paint thinner or lacquer. These items are sold at any hardware supply store. ...
3. Combine the thinner into the automotive paint. ...
4. Mix the thinner and the paint.

Thinning automotive paint is necessary before using a spray gun to apply the paint. The paint needs to pass easily through the gun's nozzle to achieve an even color across your auto's surface. If the paint is too thick, you won't have an even flow out of the airbrush gun and the gun will continually get clogged. Thin your automotive paint to a more appropriate consistency before you attempt to airbrush for an easier application.

Step 1

Prepare paint for thinning. Set aside the appropriate amount of paint you will need for your project. It is best to set aside all of the paint you will need in the project all at once. This will ensure all of the paint is thinned evenly and in the same fashion. Place the paint in a clean plastic container.

Step 2

Fill a spray bottle with paint thinner or lacquer. These items are sold at any hardware supply store. You will need to choose the appropriate thinner or lacquer to mix with the type of auto paint you will be using. The contents of your paint will define what type of thinner you will use. Follow the guidelines on the back of each thinner container to choose one that works with the contents of your paint brand. Applying the thinner using a spray bottle will make for easier handling; it will decrease the chances of adding too much thinner and ruining your paint.

Step 3

Combine the thinner into the automotive paint. There is no exact measurement of thinner that should be used. It varies widely within brands and even colors. It is best to follow the manufacturer's outline for an approximate calculation. For the best results, spray a few squirts of thinner into the paint at a time while stirring with a mixing stick. This will allow you to monitor the paint's consistency as you go, rather than initially guessing the amount you will need.

Mix the thinner and the paint. Once you have reached a point of appropriate consistency, mix the combination well. To test the consistency, pick up the container of paint and gently tilt the container side to side. Before adding thinner, the paint would have a slow reflex, lagging slightly in drifting off the sides of the container after you tilt the container. Once you have reached the right consistency, the paint will drift at about the same speed that you are tilting the container. Keep in mind you do not want your paint to be too thin, which will show up as the movement of paint in the container being quicker than your tilting motion.

2.1.7 Colour test card preparation

The automotive repair industry relies heavily upon the use of test cards. Before the first coat of a new colour is sprayed on a new car, paint companies have prepared and evaluated test cards to ensure that the new formula will perform properly. The words “test cards” should remind us that we need to do an evaluation before moving on to the real task at hand.

Aftermarket retouch products are expected to perform as well as the original heat-cured coatings. During the past few years, paint suppliers have seen a move to raise the bar with regard to exposure durability and chemical resistance. This all started a few years ago when acid rain damage became an issue and was followed by the need for retouch products to have consistently better performance than previous products.

At the retouch level, increased product performance and/or durability can, in most cases, mean total reformulation of the product or revision of the existing formula. In the reformulation process, paint manufacturers may be forced to use another special additive or develop a new or revised resin base in order to gain the best possible product performance. Air-dried products are rigorously tested for humidity and chip resistance, salt spray, chemical resistance, long-term durability and colour retention in

some of the harshest environments possible. All paint companies are required to subject their test panels to a barrage of quality requirements. Those results are then scrutinized by many sets of eyes before the paint system receives final approval.

Test cards are needed when you've identified a problem colour or when experience tells you matching could be a problem. Test cards are a routine part of any collision repair process. Developing test cards is not rocket science, and the following steps can be easily accomplished with the car in the prep stages, thus freeing up precious booth time.

Procedure for colour test card preparation

Step 1:

Spray the test card with a base-coat and a clear coat and compare it against the original paint work. Test spraying the test card with your base-coat colour is important, it helps you determine if the colour is going to match before spraying it onto the vehicle. It also gives you practice for learning the spray pattern of your paint spray can, so you'll get a better finish without runs or drips.

Step 2:

Due to a vehicle's age, and how it has been looked after; garaged, etc. getting an exact match isn't always possible, which is why you aim for a "close" match.

Step 3:

Make sure you write the necessary details on the back of your spray test cards such as vehicle make and model, for future reference. Be sure to save your spray test cards to create your own personal colour reference library. They will help you in the future save time and money and avoid any unnecessary waste of paint.

Self-check 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I. Choose the best answer for the following question

3. Which of the following is types of paint strainers? (4pts)

   A. Pump B. Bag C. Cone D. All

4. Which of the following includes under stages of spray paint drying? (4 pts)

   A. Surface dry wherein the solvent of the paint evaporates,

   B. Touch dry wherein the paint could stick to your finger or not

   C. Thorough dry wherein the part of the surface is dry and ready for use.

   D. All

Note: Satisfactory rating ≥ 4 points Unsatisfactory ≤ 4 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Test I

1. ---------- 2. ---------

Information Sheet 3- Reading and interpreting Job specifications

3.1 Job Specification

A job specification defines the knowledge, skills and abilities that are required to perform a job in an organization. Job specification covers aspects like education, work-experience, managerial experience etc which can help accomplish the goals related to the job. Job specification helps in the recruitment & selection process, evaluating the performance of employees and in their appraisal & promotion. job specification and job description help in giving a overview of the job in terms of its title, position, roles, responsibilities, education, experience, workplace etc.

Importance of Job Specification

The importance and purpose of job specification is a thoroughly understand the specific details of a job. Jobs can be of different types and can require a different skill sets to get the maximum output from a particular.

- Gives important details related to the job like education & skills, prior work experience, managerial experience, personality traits etc which would help an employee accomplish the objectives of a job.
- For a recruiter, job specification lays down the guidelines basis of which the company can recruit and select the best possible candidate who would be best suited for the job. Apart from actually finding the right candidate or employee,
- Used for screening of resumes & shortlist only those candidates who are the closest fit to the job.
- Gives specific details about a job and what kind of skill sets are required to complete the job.

Components of Job Specification

There are many parameters which are considered while giving the job specification for a certain profile.

1. **Educational Qualification:** This parameter gives an insight on how qualified a certain individual is. It covers their basic school education, graduation, masters degree, other certifications etc

2. **Experience:** Job specification clearly highlights the experience required in a particular domain for completing a specific job. It includes work experience which can be from a specific industry, position, duration or in a particular domain. Managerial experience in handling and managing a team can also be a job specification criteria required for a particular position
3. **Skills & Knowledge:** This is an important parameter in job specification especially with knowledge and skill based profiles. The higher the position in a company, the more niche the skills become and more is the knowledge required to perform the job. Skills like leadership, communication management, time, team etc are mentioned.
4. **Personality traits and characteristics:** The way in which a person behaves in a particular situation, handles complex problems, generic behavior etc are all covered in the characteristics of a job description. It also covers the emotional intelligence of a person i.e how strong or weak a person is emotionally

Job Specification Example

Here is a sample job specification, which is prepared for a marketing manager in a telecom company.

Table 1 Job specification

Education	Must be an engineer and MBA in marketing for a reputed MBA institute
Work experience	Must have prior work experience in marketing & sales (preferably telecom or FMCG)
Skills & Knowledge	Must be a good communicator and must be able to lead a team. Prior experience in handling ATL-BTL activities and managing promotional events. Must be able to handle social media like Facebook, Twitter and help build online brand Experience in managing PR and media Strong analytical skills and problem solving skills Must understand business, come up with innovative products and launch them
Personality Traits &	1. Must be presentable and a good orator 2. Should be calm in complex situations and show leadership skills in

Characteristics	managing multiple teams 3. Should be emotionally strong and should give timely deliverables

The above table is a sample of job specification. More specific details can also be put to give a better understanding about the job.

Advantages of Job Specification

There are several benefits of having a comprehensive job specification. Some advantages are listed below:

- Job specification highlights all the specific details required to perform the job at its best
- It gives the HR managers a threshold and a framework on the basis on which they can identify the best prospects
- Helps in screening of resumes and saves time when there are multiple applications by choosing those who are closest to the job specification
- HR managers can used job specification as a benchmark to evaluate employees and give them required trainings
- It also helps companies during performance appraisal and promotions

Disadvantages of Job Specification

As we know, job specification arises from the job description; it also has some related problems. Let us have a look at those limitations:

- Change in technology impacts the requirement of the company, i.e. changing of skills, qualification, experience, knowledge needed to execute the roles and responsibilities properly.
- A job specification is a lengthy process and requires complete knowledge of the job position.

Steps

Write up a rough outline. It can be helpful to create a rough outline of your job description before setting down to write the final versions. ...

1. Decide on the job title. ...
2. Include the details of the job. ...
3. Create a summary of the job. ...

4. Include the duties and responsibilities of the job. ...
5. Add job factors to the description

Table 2. Difference and Comparison of job specification and job description

BASIS	JOB DESCRIPTION	JOB SPECIFICATION
Meaning	Job description is the written document in which all the information regarding a particular job including role, responsibilities and duties is summarized in a systematic manner.	Job specification is the set of specific qualities, knowledge and experience, a person must possess to perform a particular job.
Origin	Originates from Job Analysis	Based on Job Description
Elements	Consist of job title, job location, role, responsibilities, duties, salary, incentives and allowances	Involves personal attributes, skills, knowledge, educational qualification and experience
Objective	Describes the job profile	Specifies the eligibility criteria
What is it?	What the company is offering to the candidate.	What the company is demanding from the candidate.
Application by Human Resource Manager	Used to give the sufficient and relevant information of the job	Used to match the right attributes with the job so described

Self-check 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. --------- is the knowledge, skills and abilities that are required to perform a job in an organization (4)

   A. Job specification B. Job procedure C. Job order D. Job profile

2. List four components of job specification (4 pts)

Note: Satisfactory rating - 4 points Unsatisfactory - below 4 points

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1.

2.

Information Sheet 4- Observing OHS requirements and personal protection needs

3.1. OHS requirements

Occupational health and safety, is a multidisciplinary practice dealing with all aspects of health and safety in the workplace, with a strong focus on preventing workplace hazards.

OHS requirements through safe work practices at any on or off-site automotive workplace. It requires the performance of work in a safe manner through awareness of risks and work requirements, and the planning and performance of safe work practices with concern for personal safety and the safety of others.

core elements of successful safety programs

1. Safety culture.
2. Employee training and empowerment.
3. Hazard identification and control systems.
4. Focus on compliance.
5. Continuous improvement.
6. Leadership and organizational buy-in.
7. The safety manager role.

A health and safety program is a definite plan of action designed to prevent accidents and occupational diseases. Some form of a program is required under occupational health and safety legislation. A health and safety program must include the elements required by the health and safety legislation as a minimum.

Because organizations differ, a program developed for one organization cannot necessarily be expected to meet the needs of another. This document summarizes the general elements of a health and safety program. This approach should help smaller organizations to develop programs to deal with their specific needs.

3.2. Personal protection needs

There are times when it will be necessary to use personal protective equipment (PPE) to protect workers from being affected by certain hazards.

Personal protective equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Personal protective

equipment may include items such as gloves, boots, sleeves, aprons, safety glasses and shoes, earplugs or muffs, respirators (masks), or coveralls, vests and full body suits. All personal protective equipment should be safely designed and constructed, and should be maintained in a clean and reliable fashion. It should fit comfortably, encouraging worker use. If the personal protective equipment does not fit properly, it can make the difference between being safely covered or dangerously exposed. Employers are also required to train each worker required to use personal protective equipment to know:

- When it is necessary
- What kind is necessary
- How to properly put it on, adjust, wear and take it off
- Proper care, maintenance, useful
- The limitation of the equipment
- life, and disposal of the equipment

PPE should only be used:

- When no other control method is possible;
- While other controls are being installed or implemented;
- For emergencies and during maintenance activities;
- For situations where other control methods don't provide enough protection.
- PPE should not be used:
- just for the sake of it;
- throughout an entire workplace/department unless it has been identified as genuinely necessary.

How to select PPE

Once the need for PPE has been established, the next task is to select the proper type. Use the following guidelines to help ensure the best PPE is selected.

- Match the PPE to the hazard. There are no shortcuts to PPE selection. Conduct a complete hazard assessment and choose the right PPE to match the hazards.
- Get expert advice and shop around. Discuss your needs with an occupational health and safety specialist and trained sales representatives.
- Involve the workers who need to use the PPE in evaluations. Various models should be trialed by workers at the workplace so they have the opportunity to evaluate them.

- Consider the physical comfort of PPE (ergonomics). If a PPE device is unnecessarily heavy or poorly fitted it is unlikely that it will be worn. Use every opportunity to provide flexibility in the choice of PPE as long as it meets required legislation and standards.
- Evaluate cost considerations. The cost of PPE is often a concern and disposable options are not always cheaper in the long term.

There are also standards for firefighting protective clothing, respiratory protective equipment (masks), occupational protective gloves and more.

Auto plant workers are exposed to a variety of harsh environments that require all-overprotective gear. Employers should provide the following PPE apparel: aprons, coveralls, coats, pants, hats, hoods, sleeves, gloves, and totally encapsulating chemical protective suits.

The Requirement for PPE

- To ensure the greatest possible protection for employees in the workplace, the cooperative efforts of both employers and employees will help in establishing and maintaining a safe and healthful work environment. In general, employers are responsible for:
- Performing a “hazard assessment” of the workplace to identify and control physical and health hazards.
- Identifying and providing appropriate PPE for employees.
- Training employees in the use and care of the PPE.
- Maintaining PPE, including replacing worn or damaged PPE.
- Periodically reviewing, updating and evaluating the effectiveness of the PPE program.

In general, employees should:

- Properly wear PPE,
- Attend training sessions on PPE,
- Care for, clean and maintain PPE, and
- Inform a supervisor of the need to repair or replace PPE.

Self-Check – 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the best answer for the following question

1. The following are core elements of successful safety programs except (2 pts)
   A. Hazard identification and control systems C. Safety culture
   B. Employee training and empowerment D. None
2. Employers are also required to train each worker required to use personal protective equipment to know: (2 pts)
   A. When it is necessary C. What kind is necessary
   B. The limitations of the equipment D. All
3. Employees should: (2 pts)
   A. Properly wear PPE,
   B. Attend training sessions on PPE,
   C. Care for, clean and maintain PPE
   D. All

Note: Satisfactory rating ≥ 3 points Unsatisfactory < 3 points

You can ask you teacher for the copy of the correct answers.

Score = _____
Rating: _____

Answer sheet

Test I

1. ---------- 2. ---------- 3. ----------

Information Sheet 5- selecting and inspecting Materials

4.1. Material selection

Material selection is the act of choosing the material best suited to achieve the requirements of a given application. Many different factors go into determining the selection requirements, such as mechanical properties, chemical properties, physical properties, electrical properties and cost. These must be weighed during the material selection process.

1. Materials Selection Process
2. Identify product design requirements
3. Identify product element design requirements
4. Identify potential materials
5. Evaluate materials
6. Determine whether any of the materials meet the selection criteria
7. Select materials

Paint is a chemical product composed of many raw materials. The properties of the paint are determined by the binder while the pigment prevents rust and gives the paint its color.

Material inspection is an important tool to achieve quality concept. It is necessary to assure confidence to manufacturer and aims satisfaction to customer. material inspection is an indispensable tool of modern manufacturing process. It helps to control quality, reduces manufacturing costs, eliminate scrap losses and assignable causes of defective work.

Purpose of Inspection

- To distinguish good lots from bad lots.
- To distinguish good pieces from bad pieces.
- To determine if the process is changing.
- To determine if the process is approaching the specification limits.
- To rate quality of product.
- To rate accuracy of inspectors.

- To measure the precision of the measuring instrument.
- To secure products-design information.
- To measure process capability.

Our raw material inspections are a vital step in that process, helping to ensure that your supplier is meeting your specifications and giving you insight into the nature of your raw materials':

- Identity
- Safety
- Suitability for your product

A vast range of industries use raw materials testing at the start of the production process. These include, but are not limited to, consumer goods and retail, health and wellbeing, food and agriculture, and automotive businesses.

A raw material inspection is to select materials or item for an manufacturing or processing at factory at first stage. Inspection and tests on all aspects of materials as physical, chemical, AIM's inspector determine or verify materials the requirements of a specification, regulation, or contract are met.

The main objective of inspection is to meet customer requirements, wants, and needs. The objective is to prevent defective product flowing down the successive operations and prevent loss to the company. Many characteristics cannot be inspected at the final stage of production. during painting the technician use different materials. some of these are

4.1.1 **Acrylic lacquers**

Acrylic Lacquer is a premium Automotive formulation designed to give a lustrous durable finish. Our formula dries quickly, has superior adhesion to metal, and dries to a high gloss sheen. Once dry, it can be machine or hand buffed for an even glossier appearance.

1. Premium Automotive Formulation
2. Any-angle spray technology
3. Comfort-tip spray nozzle
4. Excellent adhesion
5. Indoor/Outdoor durability

Now, we get into the rarer types of paint. Acrylic lacquers have been discontinued by many manufacturers, simply because they are now considered outdated.

Acrylic lacquers are used on classic or antique cars, because these vehicles aren't used as daily drivers. This is the same reason you find acrylic lacquers on showroom vehicles. This is a paint that undisputedly provides the most glaring shine on a vehicle. But, this sunglass-inspiring shine comes at a price: it doesn't provide nearly as much protection as a clear coat finish would and so should only be used on limited use cars. If you used this as a daily driver, you'd end up paying dearly trying to keep the finish showroom-shiny. More often than not, these lacquers are mixed with a thinner to make them easier to spray because, on its own, lacquer is typically a thick, glue-like substance.

4.1.2 **Air dry synthetic enamels**

Synthetic Enamel paint is a type of oil based paint with superior adhesion qualities. It is available in two types of finishes - glossy and matt and can stick to all primers. It can withstand frequent cleaning without losing its shinning. The paint is fairly durable and stain resistant.

AIR DRY ENAMEL is a high quality synthetic enamel that is suitable for re-spray of automobile and touch up of original paint work. AIR DRY ENAMEL dries and cures naturally when exposed air. This paint is ideal for painting new or maintenance purpose in various industries such as in automotive, general metal and furniture. With its exciting colour option and superb gloss retention, AIR DRY ENAMEL comes in 490-series and 450-series, which the 450-series has became a favorite choice in the market in recent years due to economical advantage and its good quality.

Features:

- High quality synthetic enamel
- Exciting colours to choose
- Superb gloss retention
- Wide range of usage

4.1.3 **Two-pack urethane acrylic enamels**

Two-pack Acrylic Polyurethane Enamel is an acrylic polyurethane enamel which provides a durable high gloss exterior and interior coating for chemical and saline coastal environments. It has excellent colour and gloss retention properties. When fully cured, it forms an extremely tough and abrasion resistant finish.

Acrylic Polyurethane Enamel (2 Pack) is an acrylic polyurethane enamel which provides a durable high gloss exterior and interior coating for chemical and saline coastal environments. It has excellent colour and gloss retention properties. When fully cured, it forms an extremely tough and abrasion resistant finish. A non-pigmented version is available. Acrylic urethane enamel is a high performance, two pack acrylic urethane coating. It has superior resistance to UV degradation when compared to most imported similar products. Although it can be low baked, its extremely fast curing properties allow it to air dry satisfactorily at normal ambient temperatures. In addition, its unique formulation and solvent balance allows it to be used with conventional one pack primers and putties. It can also be supplied direct to clean baked enamel and two pack enamel surfaces. Maximum adhesion to these surfaces is achieved after a light sand.

4.1.4 **Metallic two-pack enamels**

Two-Pack Epoxy Topcoat Enamel – Designed to be used in conjunction with Regal epoxy primers for application to most metal substrates. Thisepoxy metal painthas excellent durability and impact resistance. This coating offers protection from solvents, acids, alkalis and salts.

- Coverage: 5-10 m² per litre
- Touch Drying Time: 12 hrs
- Recoat: 24 hrs
- Hard Drying Time:48 hrs
- Full Cure: 7 days

Figure 1. two pack epoxy metal enamel

4.1.5 **Clear acrylic lacquers**

Clear Acrylic Lacquer is a universal lacquer achieve a smooth, glossy shine. The fast drying formula is easy to use so that you can transform you car's exterior at home, creating a durable finish with shine that will last.

Here you'll find a few application pointers on how to make your clear coat look great.

- Assess the basecoat. ...
- Practice makes perfect. ...
- Plan for 2-3 coats. ...
- Measure your distance. ...
- Avoid moisture! ...
- Avoid spraying on a hot day. ...
- Use a spray can Trigg

4.1.6 **Metallic acrylic lacquers**

Metallic-metal effect aerosol acrylic lacquer creating shining metallic effect. A fast drying, high quality, with excellent hiding properties. ... It can be used on many surfaces such as metal, wood, stone, sliklas, ceramics, paper, cardboard, hard plastic.

4.1.7 **Pearl finishes**

A pearl finish is a medium gloss that maintains high durability. Both beautiful and easy to clean, a pearl finish lends dimension to trim while being optimal for walls in high-traffic areas.

General Finishes Pearl effects are water based decorative, acrylic pearlescent colors used to create specialty finishes. They may be applied over General Finishes milk paints, stains and water based topcoats to create a translucent metallic Pearl effect. Pearl effects are thick enough to cover a surface but may also be brushed on lightly to create a dusting effect. Experimentation is the key to using this versatile product. This product will give you a metallic copper-color. This is an opaque paint, meaning it has solid coverage...not transparent. It is more of a red copper.

Typically, aluminum specs are what give metallic paint its glittery shimmer, making the color appear more vibrant. Pearl paint uses mica to give the cara subtle array of colors. These tiny, man-made ceramic crystals reflect and refract light, which varies what colors you see when you look at the paint.

Pearl paint has tiny flecks of iridescent mica added to a clear coating that acts a binder for the pearl. When applied over white or in between a base coat and a top coat (or sometimes mixed with a top coat) it can give a beautiful glimmer to your paint that can change by the angle of the sun or how you view the car.

What is Pearl Paint?

Pearl Paint jobs are extremely subtle and look best out in full sunlight. A lot of modern cars use a pearl coat on normal colors like white to give a little pop when the vehicle is out in the sun. Much like a candy paint job pearl paint is a mid coat that is applied over a base color (usually white). Pearl paint has tiny flecks of iridescent mica added to a clear coating that acts a binder for the pearl. When applied over white or in between a base coat and a top coat (or sometimes mixed with a top coat) it can give a beautiful glimmer to your paint that can change by the angle of the sun or how you view the car. Pearl paint is a little easier to apply than a candy but shares some of the difficulties when spraying as you want to make sure it is applied evenly to avoid blotchiness in the final finish.

4.1.8 **Water-based finishes**

When you open a can of water-based finish and one of oil-based finish, you don't need long to spot (or smell) the difference. Water-based finishes have a milky look while oil-based finishes are much darker. Both finishes give the floor a nice sheen, but water-based finishes have a clear, natural look. Oil-based finishes give the wood an amber

tint. If you want to keep the natural colors of your hardwood, a water-based coating does just that. Certain woods look better with an amber color, but that doesn't mean you have to opt for an oil-based finish. There are water-based sealers made with color enhancers to give your floor an amber glow similar to that of an oil-based finish.

4.1.9 **Paint thinners**

A paint thinner is a solvent used to thin oil-based paints or clean up after their use. Commercially, solvents labeled "Paint Thinner" are usually mineral spirits having a flash point at about 40°C (104°F), the same as some popular brands of charcoal starter

Common solvents historically used as paint thinners include:[citation needed]

- Mineral spirits(US) /White spirit(UK)
- Acetone
- Turpentine
- Naphtha
- Toluene
- Methyl ethyl ketone(MEK)
- Di-methyl form amide(DMF)
- 2-Butoxyethanol, or any of the other glycol ethers

Less common solvents used as paint thinner include:-

- Ethyl benzene
- Xylene
- n-Butyl acetate
- Butanol

4.1.10 **Paint reducers**

paint reducers are used for urethane-based paints. For example, if the paint is an enamel-based product, do not use a thinner, but rather a reducer. A urethane reducer allows you to adjust the consistency of the paint to make it easy to spray on the car surface. The reducer then evaporates, allowing the paint to set and harden.

Reducers in automotive paints are solvents used to thin paint. These additives make the paint flow better so the result is even, professional coats.

4.1.11 **Hardener**

Hardener, (Or activator as it is known in the business) dries the paint by chemically cross-linking the paint into the hardener, making a urethane mix that is much more impervious to chemical attack. Paint will never cure fully if it is not activated.

When adding paint hardener to a can of partially used latex paint, first cover your work surface with newspaper so you don't make a mess. Paint hardener usually comes in packets that can be used to harden up to 1 gallon of latex paint. Pour a packet of paint hardener into the can and stir it with a wooden paint stick. Paint hardener is activated by water, so add 1 cup of water to the mixture and stir. Leave the can of paint alone for about 30 minutes. Although it will have a consistency like oatmeal, it will not spill out of the can and is safe to dispose of.

The primary ingredient in paint hardener is sodium polyacrylate, which is a crystallized salt product. The salt crystals absorb moisture very quickly and turn the paint into a solid, rubbery substance. The solid cannot "re-wet," so the paint will not return to its liquid form even if it comes into contact with liquid at the landfill. Sodium polyacrylate needs water to produce this chemical reaction, so paint hardener cannot be used with oil-based paints. Oil-based paints must be taken to a hazardous waste disposal or recycling center.

Safety Precautions

Paint hardener may cause slight to moderate eye irritation if particles come in contact with your eyes. The dust from the main ingredient, sodium polyacrylate, may also cause lung inflammation if inhaled. Most people will not be affected by the dust, but people with asthma or other respiratory conditions may want to take precautions by wearing a dust mask while pouring the paint hardener into paint cans. Those with sensitive eyes may want to wear protective eyewear while working with paint hardener. Make sure that your bare skin is safe and does not come in prolonged contact with the paint hardener, since it can cause irritation and redness.

Paint Hardener is an environmentally-friendly paint management solution that turns liquid paint solid for curbside disposal. It quickly hardens latex and acrylic paints and stains so you can dispose of the solidified paint safely. You save time and effort than painting out or drying up and there is less mess too. No need to use newspaper, kitty litter, or sand.

4.1.12 **Cleaning materials.**

Here are 12 of the best cleaning products for your car, according to both experts and product reviewers. These products will make your car shine from top to bottom, inside and out.

Every editorial product is independently selected, though we may be compensated or receive an affiliate commission if you buy something through our links.

Best Car Shampoo and Conditioner

Meguiare's Gold Class Car Wash does the trick, The Car Coach Lauren Fix says, and a gallon of the concentrate should last a year. A capful in a bucket of water will clean the car from roof to wheels.

Figure 2. car shampoo and conditioner

Do you run your car through a commercial car wash? **If you do, here's what it's doing to your car's finish.**

Best Car Glass Cleaner

3M Glass Cleaner is a foaming spray that cleans off dirt, bugs and tree sap, says Greg Kopf, automotive expert for car supply websiteCARiD.com. This cleaner won't leave streaks, and it's also safe to use on vinyl and plastic inside your car. Here's a clever streak-free glass hack.

Figure 3. 3M Glass cleaner

Best Car-Drying Towels

Half the battle when washing your car can be drying it fast enough to avoid water spots. With a name like The Absorber, this towel should do the trick. It's chamois, which

absorbs water faster than a terry cloth or microfiber towel. It has more than 2,000 five-star reviews on Amazon!

Figure 4. car drying towels/absorber

Best Trim Cleaner

Armor All Trim and Plastic Restorer fights wear and tear onexterior plastic, which is prone to sun fading and wax stains, Kopf says. Armor All is easy to use, too. Apply, let the cleaner sit, then wipe it off.

Figure 5. Trim and Plastic Restorer

Another All-Around Great Car Cleaner

Turtle Wax also makes a car wash product that Fix likes. Mix one ounce with one gallon of water to wash away dirt and make your car shine. Reviewers praise this product for the mirror-like finish, with one saying their black car looked like patent leather.

Figure 6. Turtle Wax

Best Car Interior Cleaner

With more than 3,000 five-star reviews on Amazon, Car Guys Super Cleaner works onall interior surfaces—plastic, rubber, vinyl, leather and fabric. Reviewers love its stain-busting power that restores interiors to their original color and leaves a matte finish.

Figure 7. Car Guys Super Cleaner

Best Tire Cleaner

Armor All Wheel and Tire Cleaner gets Lowe's vote for wheels and tires. The foaming spray dissolves brake dust as well as dirt and makes tires glossy black. Just be sure to protect yourself from brake dust and wear rubber gloves while cleaning. Check out these tips for making your tires last longer.

Figure 8. Wheel and Tire Cleaner

Best Leather Cleaner

Lexol Leather Conditioner"is the best, period,"The Car CoachFix says. "It's made of natural products and truly does the job. It absorbs well and doesn't leave a film behind." The two-step cleaner and conditioner combo is also used to clean saddles!

Figure 9. Lexol Leather Conditioner

Best Car Cleaning Set

Lowe is a fan of the Trinova car wash kit for pro results at home. It includes shampoo, wax and tire shine spray; a trim restorer for rubber and plastic around the doors, windows and front grill; and an interior cleaner that's good for your dashboard and seats. It also comes with a quick detailer for taking care of dust and dirt in between washings.

Figure 10. Trinova car wash kit

Best Auto Carpet Protector

Fix likes Scotchgard protecting carpets and fabric. Car carpet has different materials underneath than the carpet in your house, which is why she says to avoid home carpet cleaners. And, she adds, don't skip vacuuming the carpet.

Figure 11. Scotchgard protector carpet

Best Car-Cleaning Splurge

Steam cleaners use distilled water instead of soap or chemicals. Lowe likes the Auto Right Steam Machine for its heat control, portability and varied brushes. It comes with 11 attachments in all!

This steam cleaner heats up to 290° to kill bacteria and promises to run for 45 minutes at a time, per battery charge. It's a splurge ($72), but you can also use it in your home to remove wallpaper and clean tile grout.

Figure 12. steam cleaner

Self-Check – 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the best answer for the following question

1. Purpose of Inspection (2 pts)
   A. To distinguish good lots from bad lots
   B. To rate quality of product.
   C. To rate accuracy of inspectors
   D. All
2. ----- is a premium Automotive formulation designed to give a lustrous durable finish. (2 pts)
   A. Acrylic Lacquer C. Clear acrylic lacquers
   B. Metallic two-pack enamels D. All
3. --------- are used for urethane-based paints (2 pts)
   A. Paint thinner
   B. Hardener,
   C. Paint reducers
   D. Cleaning materials.

Note: Satisfactory rating ≥ 3 points Unsatisfactory < 3 points

You can ask you teacher for the copy of the correct answers.

Score = _____
Rating: _____

Answer sheet

Test I

1. ---------- 2. ---------- 3. ----------

5.1. Hand & Power Tools

Hand and power tools are a common part of our everyday lives and are present in nearly every industry. These tools help us to easily perform tasks that otherwise would be difficult or impossible. However, these simple tools can be hazardous and have the potential for causing severe injuries when used or maintained improperly. Special attention toward hand and power tool safety is necessary in order to reduce or eliminate these hazards.

Figure 13 hand and power tools

Hand tools

Hand tools are tools that are powered manually. Hand tools include anything from axes to wrenches. The greatest hazards posed by hand tools result from misuse and improper maintenance.

Some examples include the following:

- If a chisel is used as a screwdriver, the tip of the chisel may break and fly off, hitting the user or other employees.
- If a wooden handle on a tool, such as a hammer or an axe, is loose, splintered, or cracked, the head of the tool may fly off and strike the user or other employees.
- If the jaws of a wrench are sprung, the wrench might slip.
- If impact tools such as chisels, wedges, or drift pins have mushroomed heads, the heads might shatter on impact, sending sharp fragments flying toward the user or other employees.

When using hand tools

- All hand tools, whether furnished by the department or employee owned, must be maintained in safe condition.
- Hand tools must be inspected before each use. Unsafe hand tools must not be used on any campus worksite.
- Hand tools must be used for the designed purpose.
- Impact tools must be free of mushroomed heads.
- Wooden handles must be free of cracks or splinters and be tight to the tool.
- Wrenches must not be used when jaws are sprung to the point that slippage occurs.
- Electric power operated tools must be double-insulated or properly grounded.
- Appropriate personal protective equipment, such as safety glasses with side shields, face shields, leather work gloves, or leather work boots must be worn when using hand tools.

Power tools

A power tool is a tool that is actuated by an additional power source and mechanism other than the solely manual labor used with hand tools. The most common types of power tools use electric motors. Internal combustion engines and compressed air are also commonly used. Other power sources include steam engines, direct burning of fuels and propellants, such as in powder-actuated tools, or even natural power sources such as wind or moving water. Tools directly driven by animal power are not generally considered power tools.

Power tools are used in automotive industry, cleaning, and around the house for purposes of driving (fasteners),drilling, cutting, shaping, sanding, grinding, routing, polishing, painting, heating and more.

Power tools are classified as either stationary or portable, where portable means hand-held. Portable power tools have obvious advantages in mobility. Stationary power tools, however, often have advantages in speed and precision. A typical table saw, for instance, not only cuts faster than a regular hand saw, but the cuts are smoother, straighter, and more square than what is normally achievable with a hand-held power saw. Some stationary power tools can produce objects that cannot be made in any other way. Lathes, for example, produce truly round objects.

Stationary power tools for metal working are usually called machine tools. The term machine tool is not usually applied to stationary power tools for woodworking, although such usage is occasionally heard, and in some cases, such as drill presses and bench grinders, exactly the same tool is used for both woodworking and metalworking.

The following safety rules are common to all power tools.

- Do not operate power tools or equipment unless you have been authorized to do so.
- Inspect tools daily to ensure that they are in proper working order. Do not use damaged or defective tools.
- Use tools for their intended purpose and in the manner intended.
- All power tools and electrical devices must be properly grounded.
- Keep guards and protective devices in place at all times. Never use equipment or tools from which guards have been removed.
- Do not use electric power tools and equipment when standing in water.
- Only qualified persons are to repair electric tools or equipment.

To prevent hazards associated with the use of power tools, workers should observe the following general precautions:

- Never carry a tool by the cord or hose.
- Never yank the cord or the hose to disconnect it from the receptacle.
- Keep cords and hoses away from heat, oil, and sharp edges.

- Disconnect tools when not using them, before servicing and cleaning them, and when changing accessories such as blades, bits, and cutters.
- Keep all people not involved with the work at a safe distance from the work area.
- Secure work with clamps or a vise, freeing both hands to operate the tool.
- Avoid accidental starting. Do not hold fingers on the switch button while carrying a plugged-in tool.
- Maintain tools with care; keep them sharp and clean for best performance.
- Follow instructions in the user's manual for lubricating and changing accessories.
- Be sure to keep good footing and maintain good balance when operating power tools.
- Wear proper apparel for the task. Loose clothing, ties, or jewelry can become caught in moving parts.
- Remove all damaged portable electric tools from use and tag them: "Do Not Use."

Hand tools and power tools present a host of potential hazards such as flying objects, electrical shock, falling objects, punctures and lacerations. Here are 10 quick and easy tips for safely working with hand and power tools.

1. **INSPECT YOUR TOOLS**. Never issue or use a damaged or defective hand or power tool. Always make sure they are in good working order before and after each use.
2. **PICK THE RIGHT TOOL**. Make sure you are using the correct tool for the task at hand. This also means using the right sized bits, blades and accessories on your power tools.
3. **WEAR YOUR PP**E. Issue personal protective equipment to your employees and make sure they wear them properly. This comprises of items like safety goggles, hard hats, etc.
4. **DON'T ALTER YOUR TOOLS**. Never remove guards or disable safety devices on power tools. Don't paint or cover up your tools as this could prevent you from noticing chips or cracks.
5. **HANDLE WITH CARE**. Tools are not toys. Never throw or toss a tool in the direction of or directly to a coworker. Never use electrical cords to lower or lift a tool to get it to a workspace.

6. **KEEP YOUR DISTANCE**. When working with hand and power tools be sure you have enough room to safely operate without coming into contact with other objects or coworkers.
7. **PICK UP AFTER YOURSELF**. Don't leave idle hand tools lying around the job site. They can lead to tripping or be accidentally knocking on someone's head.
8. **UNPLUG AND DISCONNECT**. Don't leave electric power tools plugged in when not in use, when making adjustments such as replacing blades and bits, or loading fasteners.
9. **KEEP YOUR WORKSPACE CLEAN**.A cluttered floor can lead to accidental trips or falls which can be extremely dangerous when working with hand and power tools.
10. **GET TRAINED UP**. Make sure you and your employees are thoroughly trained on the proper use of hand and power tools required for the task at hand..

Self-Check – 6	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the best answer for the following question

1. ---------- is a tool that is actuated by an additional power source. (2 pts)

   A. power tool B. Hand tools C. First aid D. None

2. Which of the following is types of hand tools (2 pts)

   A. Wrenches B. Grinder C. Drill machine D. air compressor

3. which safety rules used to prevent hazards associated with the use of power tools (2 pts)

   A. carry a tool by the cord or hose.
   B. Keep cords and hoses near to heat, oil, and sharp edges.
   C. Keep all people not involved with the work at a safe distance from the work area.
   D. yank the cord or the hose to disconnect it from the receptacle

Note: Satisfactory rating - 6 points Unsatisfactory - below 6 points

You can ask you teacher for the copy of the correct answers.

Score = _____
Rating: _____

Answer sheet

Test I

1. ---------- 2. ---------- 3. ----------

Information Sheet 7- Determining Procedures to minimize waste material

6.1 Waste management and disposal

Waste management is the collection, transport, processing or disposal, managing, monitoring and regulation of waste materials. The term usually relates to materials produced by human activity, and the process is generally undertaken to reduce their effect on health, the environment or aesthetics. Waste management is a distinct practice from resource recovery which focuses on delaying the rate of consumption of natural resources. The management of wastes treats all materials as a single class, whether solid, liquid, gaseous or radioactive substances, and tried to reduce the harmful environmental impacts of each through different methods. Waste types may include

solid (non-hazardous) e.g. construction and demolition

liquid (non-hazardous) e.g. chemical and aqueous

hazardous - regulated, prescribed, quarantined, medical and clinical

Recoverable resources e.g. recyclable and green waste.

7.2. Waste management techniques

It was away of eliminating or utilizing waste in to use able form through the following techniques.

7.2.1. Waste reduction or prevention

Waste reduction or prevention is the preferred approach to waste management because waste that never gets created doesn't have waste management costs. An example of waste reduction is reducing unnecessary packaging from manufactured products and produce. If this excess packaging could be avoided, no one would have to be concerned with the cost and effort of collecting the excess packaging, separating it for recycling, breaking it down, transporting it to manufacturers, and then integrating the recycled materials back into the manufacturing process. Waste reduction also helps conserve resources for future generations and contributes to a cleaner environment

7.2.2. Waste reuse

Reuse refers to checking, cleaning or repairing recovery operations, by which products or components of products that would have become waste are prepared so that they can be re-used without any other pre-processing. Preparing for re-use therefore implies

changes in practices; both in terms of consumer purchasing habits and in terms of the manufacturing process. Waste can be used as source of fertilizer or alternative energy sources (biogas or fuel wood).The consistency of manure is usually classified as solid, semisolid, slurry or liquid, depending on its fluidity. Animal manure most be handled properly so that odours, dust, flies, rodents, and other nuisances are controlled. The system of waste handling must not allow the waste to be dumped in to streams, rivers, lakes, or reservoirs.

7.2.3. Waste audit

Waste audit is referred to as an examination of the amount and type of waste a particular organization receives. There are many types of waste that will be researched during the Waste Audit project such as paper, municipal waste, commercial, industrial, construction, and demolition. Determining the amount and type of waste received by an area will become very useful to any production for future decision making. Knowing what the site is receiving will help us take a stand and work in areas we feel are weak in our Sub regions..

7.2.4. Waste minimization

Waste minimization is the application of a systematic approach to reducing waste at source. The basic concept is one of preventing the waste generation rather than having to install end-of-pipe treatment systems to solve the problem. Waste minimization is an activity that relates to all inputs and outputs from an industry, business, site or process. Any raw material input to a process that does not become part of the product, is termed waste. This can be in the form of emissions to air, land and water and rejects. Waste is not simply material excess to requirements, but represents a loss in profits and can reflect as much as between 1% and 4% of a company's turnover. Waste minimization is achieved through the implementation of a number of steps. The first steps include obtaining commitment to the program from senior management, appointing a project champion to manage the program and selecting a project team to assist in data collection. All processes within the factory are then investigated and data collected on all inputs and outputs in terms of quantity and Value.

Wastes in Automotive Repair Shops

Automobile repair shops produce many types of waste some hazardous, some not necessarily hazardous but still potentially damaging to the environment if not handled properly, and all requiring proper treatment and/or disposal at significant cost to the business. A list of the types of waste that the shop owner or manager must contend with would include:

- Solvents (paints and paint thinners)
- Antifreeze
- Scrap metal
- Batteries and other auto parts
- Oils and oil filters
- Fuels of various types
- Acids and alkalis (contaminated rags and towels)

Whatever the nature and characteristics of the waste may be, it all has one thing in common: All waste represents loss of resources and loss of money.

The most effective way to minimize these losses associated with waste is to avoid producing the waste in the first place. This is the concept behind DNREC's Pollution Prevention Program, which has produced this Fact Sheet to assist you and others in the automobile repair business to reduce your losses while at the same time helping to improve the environment.

Businesses throughout the country have implemented waste reduction programs and found that there are many benefits to be gained from such an approach to the management of resources. Reducing the amount of waste your business generates can help you:

- Reduce operating costs
- Reduce waste disposal costs
- Reduce long-term liability
- Help sustain environmental quality
- Improve workplace safety and health
- Project a positive public image

Establishing Good Housekeeping Practices

Improving a business's housekeeping practices is often the easiest and least expensive way to reduce waste. Good housekeeping includes good inventory control and efficient operating procedures. Here are some housekeeping tips:

- Keep storage and work areas clean and well organized, and keep all containers properly labeled.
- Inspect materials upon delivery, and immediately return unacceptable materials to the supplier.
- Keep accurate records of material usage so that you can measure reductions in use. Mark the purchase date on each container and adopt a "first in, first out" policy so that older materials are used up before new ones are opened; assign someone to distribute and keep track of the materials.
- Locate and repair all leaks to prevent loss of raw materials. Practice preventive maintenance to avoid future losses.
- Keep all containers covered to prevent evaporation and spillage.
- Keep waste streams separate to increase their potential for reuse, recycling, or treatment. Don't allow nonhazardous materials to become contaminated with hazardous materials, as this will result in all of the waste needing to be treated as hazardous waste.
- Install flow meters, flow control devices, and shut-off nozzles to cut down on water usage.

Self-Check -7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List at least Five types of waste that the shop owner or manager must contend with would include? (5paint**)**?

2. List at least two housekeeping tips? 5 point

Note: Satisfactory rating ≥ 3 points Unsatisfactory < 3 points
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Short Answer Questions

1.

2.

.

Information Sheet 8- Identifying Procedures for maximizing energy efficiency

8.1. Energy efficiency

Wondering where or how to get started in making your workplace more energy efficient and sustainable**?** Here are a few simple ways you can save energy in the workplace and bring positive changes to your working environment.

The efficiency is the energy output, divided by the energy input, and expressed as a percentage. A perfect process would have an efficiency of 100%. W_{out} = the work or energy produced by a process. Units are Joules (J).

Energy conversion efficiency (η) is the ratio between the useful output of an energy conversion machine and the input, in energy terms. The input, as well as the useful output may be chemical, electric power, mechanical work, light (radiation), or heat.

To make your manufacturing facility more energy efficient and less expensive to run, here are ways to reduce industrial energy costs on your production floor.

- Develop an Energy Management Team. ...
- Conduct an Energy Audit. ...
- Strategically Schedule Machinery Use. ...
- Schedule Shut-Downs and Start-Ups. ...
- Optimize Air Compressors.
- Ways to conserve energy
- Adjust your day-to-day behaviors. ...
- Replace your light bulbs. ...
- Use smart power strips. ...
- Install a programmable or smart thermostat. ...
- Purchase energy efficient appliances. ...
- Reduce your water heating expenses. ...
- Install energy efficient windows. ...
- Upgrade your HVAC system

1.8.1 **Operational risk assessment and treatments**

Risk assessment is a process to evaluate what chemicals or processes in the concern would cause harm at work in terms of its likelihood and severity, and to adopt suitable control measures to reduce the risks.

The Guidance Notes Chemical Safety in the Workplace: Guidance Notes on Risk Assessment and Fundamentals of Establishing Safety Measures issued by the Labour Department sets out some principles and systematic approaches for conducting risk assessment pertaining to chemical hazards.

Risk assessment should be performed by competent persons with suitable experience and training in the work activities of paint spraying. The persons should have adequate understanding of the chemicals and processes of paint spraying being assessed as well as a good knowledge of the required safe practices. They may also consult specialists for expert advice if needed.

Employers should ensure that a risk assessment is conducted on all paint spraying works pertinent to potential exposure to the hazardous substances and processes.

When considering the potential health effects, exposure to airborne hazardous substances should be kept below the relevant Occupational Exposure Limits (OELs) stipulated in the Code of Practice on Control of Air Impurities (Chemical Substances) in the Workplace issued by the Labour Department. The values of the OELs refer to the airborne concentrations of individual chemicals below which no adverse health effects would impose on nearly all workers upon exposures by the route of inhalation. Air monitoring may be needed for this purpose.

As OELs do not represent 'no effect' levels at which every employee can be guaranteed protection, employers should also consider how to:

- Ensure exposure standards are not exceeded under any circumstances;
- Keep the level of exposure as low as reasonably practicable; and
- Eliminate or further reduce exposure in the future whenever reasonably practicable.

A practical way to conduct risk assessment on paint spraying processes includes the following steps.

Step 1:- The first step is to list all the substances used or produced in the paint spraying process, for example, paints, solvents, resins, powders and the surface preparation substances, such as adhesives, paint removers, rust converters, rust removers and dusts produced in grinding.

Step 2:- The second step is to obtain and examine the information about their hazards from the label on the container and the material safety data sheet (MSDS).

The hazardous substances can be classified into the following three hazard categories, namely high, medium and low, as follows:

- High hazard: includes substances that contain or are:
- cancer-causing chemicals, for example, coal tar;
- Skin or respiratory sensitizers, for example, isocyanides in polyurethane paints;
- Mutagens or reproductive hazards, for example, ethoxy ethyl acetate;
- Substances which cause severe effects after repeated or prolonged exposure, for example, styrene;
- Metallic hazardous substances, for example, cadmium;
- Substances which cause acute lethal or non-lethal irreversible effects after a single exposure;
- Substances which cause acute irritant effects;
- Classified as toxic substances;
- Classified as corrosive substances;
- Classified as strong supporters of combustion; or
- Two (or more) pack paints, for example, a polyurethane paint and its hardener.
- Medium hazard: includes any substance that contains organic solvents or is a flammable liquid not listed in high hazard category.
- Low hazard: includes any other substances not listed above.

Step 3:- The third step is to inspect the workplace and procedures to find out who are being exposed to the hazards. This involves:

- discussion with employees about their work practices, procedures and environment;
- determining whether any hazardous substances are being released into the work area, with particular attention to

- Evidence of contamination; and
- Employee's experience or symptoms of exposure;
- consideration of other potentially exposed persons including passers-by, cleaners and maintenance workers;
- consideration of the effects of any unusual or special circumstances;
- consideration of the combined effects of two or more hazardous substances;
- estimation of the extent of the exposure, such as the level, frequency, duration of the exposure and the different routes of entry; and
- consideration of the existing control measures to find out whether:
- Suitable controls are already in place and effectively maintained; and
- Employees have been trained in the adoption of such controls.

Step 4:- The fourth step is to rate the risks associated with hazardous substances and processes of paint spraying, i.e., how great the risks are. The ratings of risks depend on the estimated likelihood and the potential severity of the hazards. On the other hand, the severity of a hazard, or its harm, depends on various factors such as its hazard category (high, medium or low) and the quantity of the chemical to be used.

1.8.2 **Toxic substances**

Toxic Substances- These are substances liable either to cause death or serious injury or to harm human health if swallowed or inhaled or by skin contact. Some toxic substances can be found in everyday products like household cleaning chemicals, prescription drugs, alcohol, pesticides and cosmetics.

Here are some examples of natural toxic chemicals:

- Mercury.
- Snake venom.
- Caffeinein coffee, tea, kola and cocoa.
- Arsenic.
- Ricinfrom castor beans.
- Petroleum.
- Hydrogen sulfide.
- Chlorine gas.

Other substances hazardous to health in motor vehicle repair include:

- Fuels, brake fluids and lubricants, including waste oil;
- Fumes and gases from welding and cutting;
- Dusts from abrasive wheels, etc

- Degreasing fluids, cleaning products, including strong hand cleaners;
- Adhesives and fillers;
- Battery acid.

Solvents in car paints are a recognized source of occupational toxicity. In particular, they can cause DNA damage and occupational rhino bronchitis. These results may indicate that toxic solvents in car paints act in synergism with moderate noise exposure, damaging the cochlear hair cells.

5 most hazardous chemicals that are commonly found in an automotive workplace and the risks they pose to workers' health after long periods of exposure:

Asbestos

Auto mechanics can be exposed to asbestos while they work on the brake drum of cars, as some brake.

The asbestos dust is easily inhaled unknowingly by the workers. The asbestos dust has been known to be the major, a severe form of cancer.

The following car parts are known to contain asbestos.

- Hood liners
- Brakes
- Clutches
- Gasket material, heat seals, valve rings and packing

How Do the Mechanics Become Exposed to Asbestos?

Exposure to harmful asbestos happens when the car parts containing this harmful substance undergo wear and tear. The asbestos is released when a mechanic removes the faulty parts to make a replacement.

The mechanics' families and friends are also not exempt from this danger because asbestos can linger on their clothes until they get back home. Therefore, all automotive parts must be thoroughly.

The common symptoms of asbestos overexposure to look out for are:

Irregular breathing– any mechanic experiencing irregular breathing should seek immediate medical attention because this might be a result of an asbestos deposit on the lungs which can develop into mesothelioma.

Swollen face and arms– This is usually an indication that the cancer is spreading to other parts of the body and should never be overlooked. Urgent medical attention should be sought immediately.

Chest and back pains– Many people overlook this symptom because it is regarded as a normal occurrence in active men who carry out physical work in their jobs. The chest pain is commonly a result of a buildup of fluids on the right side of the lungs. The buildup creates pressure which results in the pain that is felt.

The most effective way to stay protected from asbestos dust is to use protective suits and respirators while working in an environment where exposure to asbestos is possible.

After work, the protective suit should be properly cleaned and carefully stored away and the workplace cleanup should be done in a way thatavoids the dust spreading

Antiknock Agents

Antiknock agents are commonly used by mechanics to improve the fuel efficiency of an engine and the general capacity, as well.

The main constituent of the antiknock agent is methyl cyclopentadienyl manganese tri-carbonyl(MMT). Beside it, ketone solvents, like methyl isobutyl ketone, have also been identified as the constituents.

These are harmful compounds that can cause health issues ranging from eye irritations, shortness of breath, headaches, dizziness, and nausea. MMT has been reported to be a common cause of liver and kidney malfunctions.

MMT can poison a person if it is

- Swallowed
- Inhaled
- Absorbed by skin

Also, in some cases MMT can get into a person’s eyes. As a prevention, all workers must wear protective equipment when handling MMT. If exposure still occurs, the best course of action depends on how the person was exposed to it:

- If it has been swallowed, seek medical attention immediately
- If it is in a person’s eyes, irrigate them immediately using eye
- If it is inhaled, use respirator support

- If it came into contact with skin, wash it with soap immediately

All these measures require you to have a well stocked and ready First or even an entire station. Additionally, it is important to have at least one person who is trained in First Aid.

Figure 14. first aid kit and eye wash station

Manganese

Manganese is another potentially dangerous compound. Auto mechanics and welders are at risk of suffering from central nervous system health issues when manganese finds its way into their bloodstream through their lungs when inhaled.

Manganism is the clinical term given to the neurological syndrome caused by a prolonged unprotected exposure to manganese.

A person affected by Manganism will experience the following symptoms:

- Impaired motor skills and coordination
- Easily irritable and very uncomfortable
- Constantly feeling nervous
- Psychiatric challenges (hallucinations)

The symptoms of Manganism are similar to those of Parkinson's disease. The long term effects cause impaired neurological functions. The symptoms begin to manifest after about 5 to 20 years of unprotected exposure to manganese.

Lead Dust and Fumes

Lead dust and fumes are harmful elements that have severe health consequences. Auto mechanics are exposed to these poisons when:

- working on radiators
- welding

- mishandling batteries
- painting car parts
- using lubricants.

There is no known cure that is reported to be effective in reversing the effects of lead poisoning. Its symptoms include causing damage to the neurological system.

Lead poisoning should be avoided because a large portion of the poison inhaled remains in the lungs. Lead causes: muscle pains, diarrhea, abdominal discomfort, depression, constipation etc.

These are common symptoms of other illnesses and this is a reason why the detection of lead poisoning is very hard and in many cases people affected get misdiagnosed.

Workers in auto-mechanic workshops are in danger of suffering from neuromuscular, gastrointestinal, and neurological health issues.

The most common symptoms of lead poisoning include:

- Short-term memory loss and inability to concentrate
- Depression and impaired coordination
- Numbness and general body discomfort.
- Unprotected exposure for long periods causes a visible blue line to appear on the gums and a bluish, black edge to the teeth.
- Solvents & Diesel Exhaust Fumes
- Harmful solvents like benzene, toluene and xylene can cause hematological distortions in the human system.
- Almost all and this poses a great health risk to workers in the automotive industry who use these solvents daily.

Figure 15. diesel fumes

Diesel fumes can also cause severe to mechanics; they can suffer from breathing problems like asthma, allergic reactions, and compromised immune systems.

Brain damage has also been identified as one of the potential effects of these poisons.

When mechanics experience any form of irregularities in their breathing, they should seek immediate for a proper evaluation.

The effects of breathing in diesel fumes include:

- Vomiting
- Feeling lightheaded
- Headache
- Irritation of the eyes, nose and throat
- Numbness
- Discomforting feeling in the chest
- Noisy breath.

1.8.3 **Electrical safety**

Electric shock or electrocution can be associated with electrostatic spray painting. Spray painting in general can involve electrical equipment which, if not properly earthed or not regularly maintained, can result in electric shock.

Static electricity charges can be generated in any spray painting process where two differently charged materials come into contact or are brushed together. A static electrical charge can be enough to ignite flammable materials.

Electrical installations and the use of electrical equipment are a hazard in spray painting areas, paint mixing and storage areas. Where such installations or equipment are necessary, special equipment and wiring precautions should be used to prevent a potential fire or explosion. An immediate hazard is created where electrical equipment that is damaged or equipment designed for “domestic use” is operated in these areas. Electrical installations must comply with AS 3000 (known as the SAA Wiring Rules) which outlines the standards for wiring. Installations should be designed to be intrinsically safe for use in explosive atmospheres.

Airless paint spraying using high fluid pressures can produce static electricity that may cause a spark. Therefore, the airless spray gun and any conductive article that is being

sprayed, including containers into which the flow from the gun is directed, should be electrically earthed.

1.8.4 **Extinguishing fires**

One of the major safety concerns associated with spray application is the combustible and flammable vapours, mists, and residues that may be created.

It is important to ensure that all potential sources of ignition have been removed prior to spraying flammable and combustible products. Potential sources of ignition include:

- Open flames (work space heating units)
- Cutting and welding torches
- Gas fired heaters
- Electrical outlets and lighting
- Non-explosion proof equipment such as radios, lamps, heaters and motors
- Static electricity
- Smoking

The correct type of fire extinguishers must be readily available at the work site.

Gasoline is used so much in the shop that people forget it is very dangerous if not handled properly. A spark or lighted match in a closed place filled with gasoline vapor can cause an explosion. Even the spark from a light switch can set off an explosion. So you must always be careful with gasoline. Here are some tips.

- There will be gasoline vapors around, if gasoline is spilled or a fuel line is leaking.
- You should keep the shop doors open or keep the ventilating system going.
- Wipe up the spilled gasoline eat once, and put the rags outside to dry.
- Never smoke or light a cigarette around gasoline.
- When you work on a leaky fuel line, carburetor, or fuel pump, catch the leaking gasoline in a container or with rags.
- Put the soaked rags outside to dry.
- Fix the leak as quickly as possible. And don't make sparks around the car, for example, by connecting a trouble light to the battery.
- Gasoline should be stored in an approved safety container.
- Never store gasoline in a glass container. They could break and could cause an explosion and fire. Oily rags can also be a source of fire. They can catch fire

without a spark or flame. Oily rags and waste should be put into a special safety container where they can do no harm

Figure 16.
Gasoline and all flammable liquids should always store in an approved safety containers.

Figure 17 Recommended container for Gasoline or flammable liquids

Fire Extinguishers

Note the location of the fire extinguishers in the shop. Make sure you know how to use them. The quicker you begin to fight a fire, the easier it is to control. But you have to use the right kind of fire extinguisher, and use it correctly. The chart explains this. Talk over any questions with your instructor

Fire protection

Every auto body and paint shop requires fire extinguishers. Since fires are classified as classes there are different types of extinguishers specially designed for a particular class of fire.

Classes of fires _ Fires are classified according to the type of fuel energising the fire. knowledge of the classes of fires is important since the type of fuel involved will determine the method of extinguishing the fire. Each class of fire requires a specialized action.

Class-A Fires

These fires result from the combustions of carbonaceous materials such as wood textiles and papers for class A Fires extinguishers containing water, which will cool and

quench the burning material, are suitable. Dry chemical Extinguishers may also be used since they provide a fire vet ardent blanket to prevent reflashes.

Class-B Fires

These fires result from materials that become gaseous when heated such as oil, grease and paints. For class B fires, carbon dioxide extinguishers are Excellent. Dry chemical Extinguishers are also useful in these fires.

Class-C Fires

Live electrical equipment is the cause of class C fires for class C fires use Ethics a carbon dioxide extinguisher (carbon dioxide is non conductive) or a dry chemical extinguisher. Dry chemical extinguisher. Dry chemical extinguishers are called tri-class extinguishers since they can be used on class A, B and C fires.

Class-D fires

The specialized classification includes fires from comestible metals, such as magnesium, titanium, Zirconium and potassium. It should be noted that the same fire might involve more than one class as soon as the fire spreads to other materials. Also once electricity is disconnected, a class C fire becomes another class of fire.

For class D fire special extinguishing powders may be applied by a scoop or shovel.

Table 3. class of fires

FIRES	EXTINGUISHERS TYPE	USE	OPERATION
A CLASS *A* FIRES ORDINARY COMBUSTIBLE MATERIALS SUCH AS WOOD, PAPER, TEXTILES AND SO FORTH. REQUIRES. . .COOLING-QUENCHING	 **FOAM** SOLUTION OF ALUMINUM SULPHATE AND BICARBONATE OF SODA	OK FOR **A B** NOT FOR **C**	*FOAM*: DON'T PLAY STREAM INTO THE BURNING LIQUID. ALLOW FOAM TO FALL LIGHTLY ON FIRE 
B CLASS *B* FIRES FLAMMABLE LIQUIDS, GREASES, GASOLINE, OILS, PAINTS AND SO FORTH. REQUIRES. . .BLANKETING OR SMOTHERING	 **CARBON DIOXIDE** CARBON DIOXIDE GAS UNDER PRESSURE	NOT FOR **A** OK FOR **B C**	*CARBON DIOXIDE*: DIRECT DISCHARGE AS CLOSE TO FIRE AS POSSIBLE. FIRST AT EDGE OF FLAMES AND GRADUALLY FORWARD AND UPWARD 
C CLASS *C* FIRES ELECTRICAL EQUIPMENT, MOTORS, SWITCHES AND SO FORTH. REQUIRES. . .A NONCONDUCTING AGENT	 **DRY CHEMICAL**	MULTI-PURPOSE TYPE: OK FOR **A B C** ORDINARY BC TYPE: NOT FOR **A**; OK FOR **B C**	*DRY CHEMICAL*: DIRECT STREAM AT BASE OF FLAMES. USE RAPID LEFT-TO-RIGHT MOTION TOWARD FLAMES 
	 **SODA-ACID** BICARBONATE OF SODA SOLUTION AND SULPHURIC ACID	OK FOR **A** NOT FOR **B C**	*SODA-ACID*: DIRECT STREAM AT BASE OF FLAME 

Self-Check – 8	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the best answer for the following question

1. fires result from materials that become gaseous when heated such as oil, grease and paints called ---------- (2 pts)

   A. Class-B Fires B. Class-C Fires C. Class-A Fires D. Class-D fires

2. which car parts contain asbestos. (2 pts)

   A. Brakes B. Clutches C. Hood liners D. All

3. examples of natural toxic chemicals (2 pts)

   A. Chlorine gas B. Petroleum. C. Mercury D. All

.

Note: Satisfactory rating ≥ 3 points Unsatisfactory < 3 points

You can ask you teacher for the copy of the correct answers.

Score = _____
Rating: _____

Answer sheet

Test I

1. ---------- 2. ---------- 3. ----------

Operation Sheet 1– paint mixing methods

Procedures to ensure the job gets done safely and without delay

step 1. Read the instructions on the label thoroughly.

step 2. Pry the lid of the container and stir the paint thoroughly with a stir stick.

step 3. shape a pouring spout on the container using masking tape.

step 4. Pour the paint to a graduated measuring container

step 5. Add the proper reducing solvent in the proper ratio

step 6. Mix the solvent and paint together by stirring with a stir stick.

step 7. Add hardener if required.

step 8. check viscosity.

step 9. If the viscosity time is slower, reduce paint more. If the viscosity is faster, add more paint to slow it down.

step 10. Strain the paint using a paint strainer.

LAP TEST	Performance Test

Name…… ID……Date……

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **3** hour. The project is expected from each student to do it.

Task 1: Perform paint mixing.

LG #31	LO #2- Mix solid paint colours

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Introducing Paint mixing techniques
- Performing Mixing paint by using the appropriate method

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Introducing Paint mixing techniques
- Performing Mixing paint by using the appropriate method

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Information Sheet 1- Introducing paint mixing techniques

1.1. paint mixing techniques

The paint industry is one kind of process that depends on the automatic control techniques. The paint composition is the most important issue in paint industry. Therefore, many techniques have been developed to overcome this problem. In the past, paint composition has been done manually where sometimes does not meet the required color. For this reason, the automatic paint preparation techniques take place to solve the manual paint composition. an automatic color machine depends on the Lab VIEW techniques as a control algorithm is designed and fabricated. The proposed control technique is one kind of graphical control techniques that uses a block diagram and icons as a control algorithm. The Lab VIEW program is divided in two parts. The first is the front panel (user interface) and the second is Block diagram (algorithm code). The Lab VIEW provided the user with user interface panel which will help the user to feed the quantity of the desired new color. The precision of the output color was acceptable compared to the original color. The outcome of the project will help researchers and those interested in the area of paint industry to explore the features of Lab VIEW and its usage.

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: give short answer

1. Define paint mixing techniques . (6)

Note: Satisfactory rating ≥ 3 points Unsatisfactory < 3 points

You can ask you teacher for the copy of the correct answers.

Answer sheet

Test I

Score = _____
Rating: _____

Information Sheet 2- Performing Mixing paint by using the appropriate method

2.1. paint mixing

Paint mixing is a process of adding two or more paints together to get original paints/same paints to the original during repairing that the customer needs. which activity performs in a correct procedures.

Procedures for paint mixing

1. Read the instructions on the label thoroughly.
2. Pry the lid of the container and stir the paint thoroughly with a stir stick.
3. To make pouring easier, shape a pouring spout on the container using masking tape.
4. Pour the paint to a graduated measuring container. If using a mark mixing stick, the container does not have to be graduated but must have a flat bottom and straight up and down sides.
5. Add the proper reducing solvent in the proper ratio according to the manufacturer's label.
6. Mix the solvent and paint together by stirring with a stir stick.
7. If the paint requires hardener it must be added as directed on the label while stirring the paint.
8. When all the ingredients stirred together, the viscosity can be check with a viscosity cup. This is done by dipping into the paint, pulling it out over the paint, and timing the amount of time in seconds it takes to empty the cut through the hole in the bottom. Check the manufacturer's viscosity time.
9. I f the viscosity time is slower, reduce paint more. If the viscosity is faster, add more paint to slow it down.
10. The paint is then strained into the spray gun cup using a paint strainer.
11. The spray painting should start above the panel and to the bottom and at a distance of approximately 8" to 10" away from the panel to be painted.

Self-Check – 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: give short answer

1. what is paint mixing . (6)

Note: Satisfactory rating ≥ 3 points Unsatisfactory < 3 points

You can ask you teacher for the copy of the correct answers.

Answer sheet

Test I

Score = _____
Rating: _____

Operation Sheet 1– Performing Mixing paint by using the appropriate method

Procedures to ensure the job gets done safely and without delay

step 1. Wear appropriate PPE

step 2. Prepare tools and equipments used for the operation

step 3. Read the instructions on the label thoroughly.

step 4. Pry the lid of the container and stir the paint thoroughly with a stir stick.

step 5. shape a pouring spout on the container using masking tape.

step 6. Pour the paint to a graduated measuring container

step 7. Add the proper reducing solvent in the proper ratio

step 8. Mix the solvent and paint together by stirring with a stir stick.

step 9. Add hardener if required.

step 10. check viscosity.

step 11. If the viscosity time is slower, reduce paint more. If the viscosity is faster, add more paint to slow it down.

step 12. Strain the paint using a paint strainer.

LAP TEST	Performance Test

Name…… ID……Date……

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **3** hour. The project is expected from each student to do it.

Task 1: Performing Mixing paint by using the appropriate method

LG #32	LO #3- Prepare test card and perform visual matching test

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Preparing Test card to enable a visual comparison between matched and original paints.
- Performing Visual matching tests and noting findings.
- Making Matched and original paint comparisons activities

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Prepare Test card to enable a visual comparison between matched and original paints.
- Perform Visual matching tests and noting findings.
- Make Matched and original paint comparisons activities

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Information Sheet 1- Preparing Test card to enable a visual comparison between matched and original paints.

1.1. color test card

The automotive repair industry relies heavily upon the use of test cards. Before the first coat of a new colour is sprayed on a new car, paint companies have prepared and evaluated test cards to ensure that the new formula will perform properly. The words “test cards” should remind us that we need to do an evaluation before moving on to the real task at hand.

Test cards are needed when you’ve identified a problem colour or when experience tells you matching could be a problem. Test cards are a routine part of any collision repair process. Developing test cards is not rocket science, and the following steps can be easily accomplished with the car in the prep stages, thus freeing up precious booth time

Test card preparation procedures

Step 1:

Spray the test card with a base-coat and a clear coat and compare it against the original paint work. Test spraying the test card with your base-coat colour is important, it helps you determine if the colour is going to match before spraying it onto the vehicle. It also gives you practice for learning the spray pattern of your paint spray can, so you’ll get a better finish without runs or drips.

Step 2:

Due to a vehicle’s age, and how it has been looked after; garaged, etc. getting an exact match isn’t always possible, which is why you aim for a “close” match.

Step 3:

Make sure you write the necessary details on the back of your spray test cards such as vehicle make and model, for future reference. Be sure to save your spray test cards to create your own personal colour reference library. They will help you in the future save time and money and avoid any unnecessary waste of paint.

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: give short answer

1. what is color test card? (6)

Note: Satisfactory rating ≥ 3 points Unsatisfactory < 3 points

You can ask you teacher for the copy of the correct answers.

Answer sheet

Test I

Score = _____
Rating: _____

Information Sheet 2- Performing Visual matching tests and noting findings

2.1. Visual matching test .

Color is a human perception based on a number of factors, and it is one of the most important visual cues we have for inspecting objects. For example, to make sure a consumer product elicits the desired color perception from the purchaser or user, manufacturers must test it under standardized conditions with a system that mimics human vision.

The goal of a visual color-matching system should not be confused with other color-measurement systems such as a common ‘color’ system for color sorting. Producing crayons, for example, may use visual color matching or color sorting at different times. The crayon manufacturer may want to guarantee that the red crayon in each color-assorted box will look identical in every box. This application needs a visual color-matching system to predict whether two red crayons will look the same to a customer. The manufacturer may also want to make sure that there is only one red crayon in each box. This can be done with a simple color-sorting system.

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: give short answer

1. what is Visual color matching tests ? (6)

Note: Satisfactory rating ≥ 3 points Unsatisfactory < 3 points

You can ask you teacher for the copy of the correct answers.

Answer sheet

Test I

Score = _____
Rating: _____

Information Sheet 3- Making Matched and original paint comparisons

3.1. Matched and original paint comparisons

Body paint matching is an art, and only an experienced auto body shop can accurately match new paint to an original finish. All automotive paints have codes specific to the color, but there are thousands of variations and shades. This number is used to correctly match the paint should a repair ever be necessary.

When your car is involved in an accident, the objective is to have it repaired to an as-good-as-new condition. One of the most challenging stages of auto body and collision work is final finishing and paint matching.

A good repair not only makes you feel better about your car but also has financial implications if you decide to sell or trade. Leased vehicles have the same issue at turn in time, because excessive damage may be charged back to you if the dealer has to correct mistakes made by the body shop.

We have all seen bodywork that is not up to par, and it often looks worse than the original accident when not done properly. If the entire panels have been replaced, there is often a noticeable difference between the new panel and the rest of the car because of mismatched paint. It is the job of the repair shop to make sure your car looks as good as new, and this is a challenge as paint matching is one of the most difficult skills to master.

When your car was painted at the factory, the entire body is painted at the same time from the same batch of paint. This ensures that all the parts of the car are the same color and shade of paint. Body paint matching is an art, and only an experienced auto body shop can accurately match new paint to an original finish. All automotive paints have codes specific to the color, but there are thousands of variations and shades.

Additionally, color variations from original are inevitable because of normal aging. When a car has been on the road for a few years, there is a normal fading of the color. Even if

a new batch of paint is mixed to factory specifications, there may still be a noticeable difference, and this is where the skill of the body shop comes in.

There are many techniques used by auto body specialists to match colors starting with the body color code from the manufacturer. There is a tag, usually inside the door jamb, with code numbers and one of these codes is the paint color for your car. This number is used to correctly match the paint should a repair ever be necessary. The number of colors available is staggering, Even basic colors such as black and red have dozens, if not hundreds of different shades.

The older the car, the more difficult it may be to match the paint. At this point insurance coverage has some influence on the repair work. If a door panel on an older car needs to be repaired a good body shop should be able to match the paint to your satisfaction. There are blending techniques that allow new paint to lightly overspray old paint to achieve a transition that is not noticeable. In some cases, it may not be possible to match the paint due to weathering and fading, and it may be necessary to paint the entire side of the car. Some insurance companies may refuse to pay for this additional work, and you may have to make your case with the adjuster or ask the repair shop to include this extra step in the interest of doing a quality repair.

Another factor to consider is that if you have an older car that was not in a pristine condition, to begin with, you cannot expect a body shop to restore it to " like new" condition. Ask if the older sections of the car can be buffed to brighten them up. This may be an extra cost option to consider if it brings that new car feeling back again.

Any accident is an unpleasant experience that you want to put behind you. One important step is having your car repaired properly, and the best way to do that is to use an experienced body and collision repair shop that warranties their work, will repair the hidden damage that may not be apparent for a month after the accident and stands by their work.

Let's say you get a little scratch or a ding on your car. You'd like to match the exact color to have it repaired and looking good. If your car is older, the colors might not be easy to find. So how do you match auto paint? First, you need to know a few things about automotive paint:

- Automotive paint is made of resin, pigment and solvent.

- Resin determines the durability of your paint and the quality of the application [source: autobodysupply].
- Solvent provides the right amount of viscosity, so the paint can be applied [source: auto body supply].
- Pigment comes in powder form and includes colors or toners that are mixed together to give the finish.

When choosing a color to match your car:

1. Find the color code for the original paint on your car. You'll need the manufacturer's name, the car's model number and the year the car was manufactured. With this information, you may be able to find your car's color code on the manufacturer's Web sites, but it depends on the age of your car. You can also find your car's color code on the car's identification plate (sometimes called the Service Parts Identification) [source: roberts paint care].
2. Take the color code to an auto body supply shop or repair shop and order the paint. Keep in mind that some cars may have two tones and need two or more paint colors [source: autobodysupply].
3. Mix the paint until you get the exact color you need: start with the variations in lightness and darkness and adjust the hue until it matches. Always blend the color to achieve a color match. Even if the color looks close enough, blend it! Remember, you don't want the color of the spot you're repairing to be too light or too dark, and you have a lot of variables to deal with [source: autobodysupply]. Matching the exact color is especially important when spot repairing.

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: choose the best answer

1. ------- is an art, and only an experienced auto body shop can accurately match new paint to an original finish. (2)

   A. paint matching B. paint identification C. paint mixing D. paint replacing

2. When your car was painted at the factory (2)

   A. the entire body is painted at the same time from the same batch of paint

   B . the entire body is painted at the different time from the same batch of paint

   C. the entire body is painted at the different time from the different batch of paint

   D. the entire body is painted at the same and different time from the different batch of paint

3. which of the following is true? (2)

   A. Automotive paint is made of resin, pigment and solvent.

   B. Solvent provides the right amount of viscosity

   C. Pigment comes in powder form and includes colors or toners that are mixed together to give the finish

   D. All

Note: Satisfactory rating ≥ 3 points Unsatisfactory < 3 points

You can ask you teacher for the copy of the correct answers.

Score = _____
Rating: _____

Answer sheet

Test I

1.---------- 2. ---------- 3. ----------

Operation Sheet 1– Preparing Test card to enable a visual comparison between matched and original paints

Procedures to ensure the job gets done safely and without delay

step 1. Wear appropriate PPE

step 2. Prepare tools and equipments used for the operation

step 3. Spray the test card with a base-coat and a clear coat and compare it against the original paint work

step 4. Test spraying the test card with your base-coat colour

step 5. Getting an exact match

step 6. Write the necessary details on the back of your spray test cards

step 7. Save your spray test cards to create your own personal colour reference library.

Operation Sheet 2– Making Matched and original paint comparisons

Procedures to ensure the job gets done safely and without delay

1. Find the color code for the original paint on your car.
2. find your car's color code on the car's identification plate
3. Take the color code to an auto body supply shop or repair shop and order the paint.
4. Mix the paint until you get the exact color you need:
5. start with the variations in lightness and darkness
6. adjust the hue until it matches.
7. Always blend the color to achieve a color match.
8. Matching the exact color is especially important when spot repairing.

LAP TEST	Performance Test

Name…… ID……Date……

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **3** hour. The project is expected from each student to do it.

Task 1: perform Test card preparation to enable a visual comparison between matched and original paints

Task 2. perform Matched and original paint comparisons

LG #33	LO #4- Cleanup work area and maintain equipment

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Collecting and storing reused material.
- Removing waste and scrap
- Cleaning and making ready tools and equipment and work area
- Tagging unserviceable equipment and identifying faults
- Completing operator maintenance in accordance to worksite procedure
- Maintaining tooling in accordance with workplace procedures

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Collect and store reused material.
- Remove waste and scrap
- Clean and make ready tools and equipment and work area
- Tag unserviceable equipment and identifying faults
- Complete operator maintenance in accordance to worksite procedure
- Maintain tooling in accordance with workplace procedures

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Information Sheet 1- Collecting and storing reused material

1.1. Housekeeping Signs

The workplace or office is a place where productivity is expected and having a pleasant work area certainly adds to a positive environment. Employees can do their part in addition to regular cleaning staff housekeeping and caretaker maintenance to keep it clean, safe, and healthy for all.

Collecting and storing material that can be reused

The proper care and storage of materials, tools and equipments are not only the concern of the management but of the workers who use the equipment.

A major responsibility of the technician is to ensure that materials, tools and equipment are maintained in a good condition and are readily available when required for the various work activities. Faulty tools and equipments are a common reason for delays on technical activities.

Good organization of stored materials is essential for overcoming material storage problems whether on a temporary or permanent basis. There will also be fewer strain injuries if the amount of handling is reduced, especially if less manual materials handling is required. The location of the stockpiles should not interfere with work but they should still be readily available when required. Stored materials should allow at least one meter (or about three feet) of clear space under sprinkler heads.

Figure 18 properly stored tools

Importance of proper storage of tools and equipments

- It is important factor for safety and health as well as good business.
- Improves appearance of general-shop and construction areas.
- Reduce overall tool cost through maintenance.
- This also ensures that tools are in good repair at hand.
- Teaches workers principles of tool accountability.

Pointers to follow in storing tools and equipments

- Have a designated place for each kind of tools.
- Label the storage cabinet or place correctly.
- Store them near the point of use.
- Wash and dry properly before storing.
- store sharp edge materials properly when not in use with sharp edge down.
- Put frequently used items in conveniently accessible conditions.
- Gather and secure electrical chord to prevent entanglement or snagging.
- Cutting boards should be stored vertically to avoid moisture collection
- Metal equipments can be stacked on one another after drying.
- Make sure the areas where you are storing the equipment are clean, dry and not overcrowded.

Self-Check – 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: choose the best answer

1. Importance of proper storage of tools and equipments
   A. Teaches workers principles of tool accountability
   B. Improves appearance of general-shop and construction areas
   C. Reduce overall tool cost through maintenance
   D. All
2. Pointers to follow in storing tools and equipments
   A. Label the storage cabinet or place correctly
   B. Wash and dry properly before storing
   C. Store them near the point of use.
   D. All

Note: Satisfactory rating ≥ 3 points Unsatisfactory < 3 points

You can ask you teacher for the copy of the correct answers.

Score = _____
Rating: _____

Answer sheet

Test I

1.---------- 2. ----------

.

Information Sheet 2 - Removing waste and scrap

2.1. Waste Disposal Practices

There are eight major groups of waste management methods, each of them divided into numerous categories. Those groups include source reduction and reuse, animal feeding, recycling, composting, fermentation, landfills, incineration and land application. You can start using many techniques right at home, like reduction and reuse, which works to reduce the amount of disposable material used.

Methods of Waste Disposal

Landfill:- which is the most popularly used method of waste disposal used today. This process of waste disposal focuses attention on burying the waste in the land

Incineration/Combustion:- which is a type disposal method in which municipal solid wastes are burned at high temperatures so as to convert theminto residue and gaseous products..

Recovery and Recycling:- It is the process of taking useful discarded items for a specific next use. These discarded items are then processed to extract or recover materials and resources or convert them to energy in the form of useable heat, electricity or fuel.

Recycling is the process of converting waste products into new products to prevent energy usage and consumption of fresh raw materials. Recycling is the third component of Reduce, Reuse and Recycle waste hierarchy. The idea behind recycling is to reduce energy usage, reduce volume of landfills, reduce air and water pollution, reduce greenhouse gas emissions and preserve natural resources for future use.

Plasma gasification:- It is another form of waste management. Plasma is a primarily an electrically charged or a highly ionized gas. Lighting is one type of plasma which produces temperatures that exceed 12,600 °F .With this method of waste disposal, a vessel uses characteristic plasma torches operating at +10,000 °F which is creating a gasification zone till 3,000 °F for the conversion of solid or liquid wastes into a gas.

Self-Check – 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Write short and precise answer

1. List methods of Waste Disposal

Note: Satisfactory rating ≥ 3 points Unsatisfactory < 3 points

You can ask you teacher for the copy of the correct answers.

Score = _____
Rating: _____

Answer sheet

Test I

1.---------- 2. ----------

.

Information Sheet 3- Cleaning and making ready tools and equipment and work area

3.1. Cleaning

Cleaning up is not just a measure of respect for the workspace, it also removes hazards. Plan to easily and regularly remove trash and debris. Enforce a strict cleanup policy throughout the workspace. Keep work areas tidy as well by minimizing the number of wires running around. Extension cords quickly become tripping hazards, and power strips also cause trouble on the ground or as they tumble erratically on a desktop. We suggest you provide access to grounded outlets all along the perimeter of the room and/or dropped from the ceiling for each workbench.

Kinds of Cleaning Solvents

Solutions are homogeneous mixture of two or more components. They can be gaseous, liquid or solid. When we speak of a solution, we usually think of a solid dissolved in water. While water is the most common solvent, other liquids are frequently employed as solvents for certain substances for example wax maybe dissolved in gasoline. The dissolved material in a solution is termed as solute (e.g. wax) while the dissolving medium is called solvent (e.g. gasoline). However, the term can be interchanged depending on which substance is of greater amount.

Solvent is a component of a solution that dissolves solute and is usually present in large proportion or amount. It can be classified as polar or non polar. Polar solvents are solvents which dissolve/are soluble in water; while non polar solvents are solvents which do not dissolve/are insoluble in water.

Solvents usually used for cleaning in automotive shops are: water, gasoline, kerosene, thinner and detergent soap.

Table 4. kinds of cleaning solvents based on their solubility in water.

Cleaning Solvents	Solubility in Water	Polar	Non polar
a. water	soluble	x	
b. gasoline	insoluble		x
c. kerosene	insoluble		x
d. thinner	insoluble		
e. detergent soap	soluble	x	x

Properties of Cleaning Solvents

A useful generalization much quoted is that “Like dissolves like”. More specifically, high solubility occurs when the molecules of the solute are similar in structure and electrical properties to the molecules of the solvent.

When there is a similarity of electrical properties; e.g. high dipole element between solute and solvent, the solute-solvent attractions are particularly strong. When there is dissimilarity, solute-solvent attractions are weak. For this reason, a polar substance such as H2O usually is a good solvent for a polar substance such as detergent soap but a poor solvent for a non polar substance such as gasoline.

Table 5. Uses of Cleaning Solvents

Cleaning Solvents	Uses
1. Gasoline	-It is used to wash oil/greasy tools/equipment.
2. Diesoline	-It is used to wash oil engine, transmission and other parts of the vehicle.
3. Kerosene	-It is used to remove dust, grease oil, paint, etc.
4. Thinner	-It is used to remove spilled paint on the floor, walls and tools.
5. Soap and water	-It is used to wash/clean upholstered furniture such as seats, tables, cabinets, etc.

Occupational Health and Safety Practices in Handling Cleaning Solvents

A great percentage of eye injury and cuts results from a disregard for the simplest of rules in handling cleaning solvents. You should never use compressed air to clean your clothes, hands or body. The pressure could cause the cleaning solvents and dirt particles to penetrate your skin, resulting in infection and /or blood poisoning. Do not use compressed air to clean an object immediately after it has been removed from a hot cleaning tank. First, rinse the cleaning solvents away with water. Do not use carbon tetrachloride as a cleaning solution. The fumes, when inhaled can cause serious internal injury and possibly result in death. When steam-cleaning, place the object to be cleaned on a pallet and wear a face shield and rubber gloves for protection against loose debris. If a job or cleaning task requires the use of gloves, use the appropriate gloves. Do not for instance use welding gloves when removing an object from a hot tank, or rubber gloves when welding. If you have cut, nicked, or burned yourself, or something has got into your eyes, report immediately to the first-aid person. Keep all inflammable cleaning solvents in closed tin containers and whenever possible, store them in a separate area.

Self-Check – 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Instruction I : match column "A" with "B" (2points each)

"A"	"B"
-----1. kerosene	A. used to wash oil/greasy tools/equipments
-----2. Gasoline	B. used to wash oil engine, transmission and other parts of the vehicle
-----3. Diesoline	C. used to remove dust, grease oil, paint, etc
-----4. Thinner	D. used to wash/clean upholstered furniture such as seats, tables, cabinets, etc
-----5. Soap and water	E. used to remove spilled paint on the floor, walls and tools.

5 and above correct answered points passed mark.

Information Sheet 4- Tagging unserviceable equipment and identifying faults

4.1. TAGS

The use of tags is considered an administrative control and as such only provides limited protection to people and plant; therefore in all cases a physical isolation must be used in conjunction with a tag to prevent the accidental activation of an isolation point.

Attaching the Tag

The person attaching the tag must completely fill the tag with the following information:

- Name & company of person placing tag
- The classification/department the person works for
- The date that the tag was placed
- The equipment / plant the tag was placed on
- Contact number
- Work order / job number if applicable
- Signature

It is important to clearly identify the exact piece of equipment that the tag and lock was placed on to allow identification of those personnel working on the plant.

Depends on what you need it for. You can include a stub to give to your customers, or feature numbering so you can easily track each defective part. Choose materials with a bit more durability if you'll be working outside, replace old tags, or fasten your tags to something new.

- We specialize in Repair Tags and we stock several different options for whatever suits your space. Check out our repair tag material guide to compare.
- All tags feature smudge-proof surface. Write your information with a pen, pencil, or marker.
- Bright colored repair and inspection tags with bold, legible prints display and highlight vital information.
- Order tags with our handy Tag-in-a-Box for convenient storage and dispensing of tags. Just pull and tear!
- Looking for the right fit? Get a custom design. Our customer service staff is happy to help you find what you need.

Self-Check – 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. Mention six information must completely fill the tag during a person attaching the tag (6 pts)

Note: Satisfactory rating ≥ 3 points Unsatisfactory < 3 points
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet 5- Completing operating maintenance in accordance to worksite procedure

5.1. Tools and Equipment Maintenance

All tools, equipment and vehicles must be properly maintained so that workers are not endangered. Construction regulations require inspections of vehicles, tools, machines and equipment before use.

components of maintenance program

A maintenance strategy includes procedures as well as corrective and preventive maintenance..

1. Corrective maintenance (cm) restores the function of a failed device and allows it to be put back in to service.
2. Preventive maintenance (pm) aims to extend the life of the tools/equipment and reduce failure rates. Preventive maintenance is the systematic care and protection of tools, equipment, machines and vehicles in order to keep them in a safe, usable condition, limit downtime and extend productivity. We must always be aware that maintenance tasks themselves are potentially hazardous and can result in injury.

Inspections ensure that tools and equipments are operating correctly. Safety inspections ensure the tools/equipments are safe for both patients and operators

The successful maintenance program is:

- Well organized and scheduled,
- Controls hazards,
- Defines operational procedures, and
- Trains key personnel.

Self-Check – 5	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. ---------- restores the function of a failed device and allows it to be put back in to service. (3pts)

A. Preventive maintenance C. Corrective maintenance

B. Inspections D. None

2. The successful maintenance program is (3 pts)

A. Well organized and scheduled

B. Controls hazards

C. Defines operational procedures

Note: Satisfactory rating ≥ 3 points Unsatisfactory < 3 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet 6- Maintaining tooling in accordance with workplace procedures.

6.1. Maintaining tooling

Tools need to have enough space to be operated safely and not endanger the operator or other people in the space. People need to concentrate when trying new tools, especially ones that can injure. Make sure there is enough real estate to use a tool safely. Work areas need to be well lit and clean. Ventilation and/or air filtering is required for many tools.

The equipment itself needs to be as safe as possible. Tools should be well maintained and not have safety features removed or defeated. This is especially important when using second-hand tools that might not have a perfectly safe heritage. When acquiring new tools consider spending the extra money on models with advanced safety features, such as a Saw Stop table saw.

Make well-stocked first-aid kits visible and easily accessible throughout your space. Post clear and visible warning signs on all equipment and where necessary.

Provide personal safety equipment such as goggles, earplugs, gloves, etc. to those who don't have their own.

Accidents may happen. They probably will, and let's hope they are all minor. Nonetheless, do make sure that there is a legal entity that owns the space so that the effects of a serious injury don't extend the horror with legal ramifications

Self-Check – 6	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. Which of the following are false during maintaining tooling
   A. tools not endanger the operator or other people in the space.
   B. The tools itself not needs to be as safe as possible
   C. Tools should be well maintained and not have safety features removed or defeated
   D. Tools need to have enough space to be operated safely

Note: Satisfactory rating - 1 points Unsatisfactory - below 1 points
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Short Answer Questions

Operation Sheet 1– Cleanup work area and maintain equipment

Procedures to ensure the job gets done safely and without delay

step 1. Clean up every time whenever you leave an area, including sweeping the floor.
step 2. Clean and return all tools to where you got them.
step 3. Use compressed air sparingly; never aim it at another person or use it to clean hair or clothes.
step 4. Shut off and unplug machines when cleaning, repairing, or oiling. (Never use a rag near moving machinery.)
step 5. Use a brush, hook, or a special tool to remove chips, shavings, etc. from the work area. Never use the hands.
step 6. Keep fingers clear of the point of operation of machines by using special tools or devices, such as, push sticks, hooks, pliers, etc.
step 7. Keep the floor around machines clean, dry, and free from trip hazards.
step 8. clean up and dry spills immediately and put a chair or cone over them if they are wet enough to cause someone to slip.

LAP TEST	Performance Test

Name…… ID……Date……

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **2** hour. The project is expected from each student to do it.

Task 1: Perform Cleanup work area and maintain equipment

Reference Materials

Book:

WEB ADDRESSES

https://www.depaulachevrolet.com/different-types-of-car-paint-what-you-need-to-know/
https://www.rustoleum.com/product-catalog/consumer-brands/auto/general-purpose-paints/acrylic-lacquer
https://www.inspection-for-industry.com/paint-inspection-services.html

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The trainers who developed this learning guide

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