GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

REMOTE LEARNING ACTIVITY BOOK (RELAB)
SUBJECT: AUTOMOTIVE
GRADE: 11

TEACHER GUIDE
(Expected answers)

GGT2030
GROWING GAUTENG TOGETHER

INTRODUCTION AND PURPOSE OF THE RELAB

The Covid 19 pandemic has caused serious impact to schooling resulting in major learning loss and instructional time. This scenario has resulted in school implementing rotational timetables-where learners attend school on alternate days or weeks. The Remote Learning Activity Book was conceptualized to engage learners in constructive learning on days they are at home. Hence the RELAB was developed as a strategy to enhance remote learning.

The RELAB is underpinned by the following Legislative demands:

a) Responding to GDE Strategic goal 2 promoting quality education across all classrooms and schools
b) **DBE Circular S13 of 2020** the requires the GDE to support the implementation of the Recovery Annual Teaching Plan (RATP)
c) **GDE Circular 11 of 2020** requiring districts to issue Learning Activity Packs to support schools for lockdown learning. Understanding learning constraints at home as majority of learners do not have access to devices or data to use for online learning. Many households are depending on schools to provide them with learning resources packs

RELAB is designed as workbook with activities based on the Revised Annual Teaching Plan. The exercises are pitched at a standard to expose learners at Grade 10 & 11 to content at different cognitive levels. The NSC diagnostic reports in different subjects have revealed that learners fail to analyse questions and as a result fail to respond accordingly.

The RELAB is intended to ensure that learners work on exercises that consolidate and reinforce topics taught while at school. These exercises are be completed at home and would receive feedback as groups or individually when at school. It is therefore of paramount importance that teachers assess the work with learners in class, as a way of providing constructive feedback. Teacher are also required to diagnose learner responses, remediate where necessary and plan further intervention.

Educators are encouraged to create whatsapp groups to remind learners on what is expected of them in a particular week/ day(s). Effective utiisation of the RELAB activity book would further ensure that all topics in the RATP are covered simultaneously. Feedback from learners at home will confirm usage of the RELAB material and assist to prepare learners for formal assessments.

Topics- Grade 11 Automotive

1. **Safety – Generic**
2. **Tools – Generic**
3. **Engines- Generic**
4. **Engines- Specific**
5. **Systems and Control – Specific (Mechanical)**
   - **Drive Systems**
   - **Brake systems**
   - **Axles& Steering systems**
   - **Suspension layouts**
6. **Systems and Control – Specific (Electricity)**
7. **Maintenance - Generic**
8. **Forces- Generic**
9. **Terminology- workshop layout**

Expected Answers

Question 1 and 2 Safety

Below is a rubric to assess the essay question on HIV and Aids.

Level of Achievement	General Approach	Comprehension
Exemplary (10 pts)	•Addresses the question. •States a relevant, justifiable answer. •Presents arguments in a logical order. •Uses acceptable style and grammar (no errors).	•Demonstrates an accurate and complete understanding of the question. •Backs conclusions with data and warrants. •Uses 2 or more ideas, examples and/or arguments that support the answer.
Adequate (6 pts)	•Does not address the question explicitly, although does so tangentially. •States a relevant and justifiable answer. •Presents arguments in a logical order. •Uses acceptable style and grammar (one error).	•Demonstrates accurate but only adequate understanding of question because does not back conclusions with warrants and data. •Uses only one idea to support the answer. •Less thorough than above.
Needs Improvement (3 pts)	•Does not address the question. •States no relevant answers. •Indicates misconceptions. •Is not clearly or logically organized. •Fails to use acceptable style and grammar (two or more errors).	•Does not demonstrate accurate understanding of the question. •Does not provide evidence to support their answer to the question.
Not Answered well. Poor attempt (1 pts)		

Question 3

Should there be an emergency, that mean somebody got hurt or seriously hurt, that immediate attention can be given to the wound before professional help can be obtained.

Question 4

- Adhesive Plaster Strips
- Bandage
- Cotton Wool
- CPR Resuscitation Barrier Device
- First Aid Dressing
- Gauze Swabs
- Gloves
- Gloves
- Scissors (General)
- Splints
- Tweezers (Metal)
- Wound Cleaner
- Any other that may not appear in this memorandum

Worksheet lesson 2

First aid multiple choice answers

1. A
2. A
3. C
4. D
5. A
6. C
7. C
8. A
9. A
10. C
11. B
12. A
13. D
14. C
15. A

Topic-Grinders

- **Any six of the following:**

  - The safety guard must be in place before you can start the grinding process.
  - Protective shields must be placed around the grinding object to protect people passing by.
  - Use the right blade for the grinding job.
  - Do not force the grinding stone on the object.
  - Make certain that there are no cracks in the stone before you start the job.
  - Protective clothes and eye protection are essential when working with an angle grinder.
  - Wear ear plugs or muffs.
  - Wear safety boots with steel toe caps.
  - Wear overalls or other close-fitting clothing.
  - Wear gloves.

2. **Any five of the following:**

- Use a machine only once the guards have been correctly fitted.
- Wake sure that there is no oil or grease on the floor around the machine which could cause you to slip.
- Check that the tool rest is not more than 3 mm from the surface of the grinding, wheel. Gaps exceeding 3 mm increase the risk of material being drawn in between the tool rest and grinding wheel.
- When starting the machine, don't stand in front of the wheel. Before you start grinding, let the machine idle for a few seconds. The risk of the grinding wheel rupturing is higher at start-up than when it is running at its operating speed.
- If the wheel is running unevenly, dress it with an emery-wheel dresser.
- Grind only on the face of a straight grinding wheel and never on the side of the wheel.
- Use wheels only for their intended purpose. Certain types of grinding wheels should only be used for their corresponding materials. Most grinding wheels are only suitable for grinding ferrous metals. The appropriate degree of coarseness should also be selected for the finish required in the material.
- Approach the wheel carefully and gradually, and don't 'jab' materials onto it. Jabbing puts uneven pressure on the wheel surface causing uneven wear or structural damage to the wheel.
- Never 'force grind' so that you cause the motor to slow or stop.
- Adjust the tool rest only when the wheel is stationary.
- Clamp work pieces and holding devices safely and firmly.
- Never allow the wheel to stand in cutting fluid as this may cause the wheel to run 'off balance' when you switch the machine on again

3. **Any five of the following:**

The following steps are advised:

- Select the correct type of wheel for the job.
- Inspect the wheel for cracks and tap it to apply the 'ringing test'. Never use a grinding wheel which is damaged or not properly dressed.
- Make sure that the wheel's speed does not exceed the manufacturer’s recommendation.
- Never force the wheel onto the spindle.
- Use only one smooth paper spacer on each side of the wheel.
- Use true and correctly recessed flanges of the same size and at least one-third the diameter of the wheel.
- Using a spanner, gently tighten the grinding wheel so that it is held firmly.
- Replace the guards correctly.
- Stand aside and set the machine in motion. Let the machine idle before you dress the wheel, using an emery-wheel dresser.
- Finally, stop the machine and reset the tool rest to within 2 mm of the wheel surface.
- Ensure that the tool rest is parallel to the wheel surface.

4. Any five of the following:

Remember the following safety precautions when using surface grinders:

- The safety precautions applicable to other types of grinders are applicable when using a surface grinder.
- Protective clothes and eye protection are essential when working with a surface grinder.
- Before operating the surface grinder, be sure you have been taught how to control it and are aware of the potential dangers associated with it.
- Do not operate the surface grinder unless all guards and safety devices are in place and working correctly.
- Make sure that you understand the operating instructions applicable to your machine.
- Never clean or adjust the machine while it is in motion.
- Report any dangerous aspect of the machine immediately and stop using it until it has been repaired by a qualified person.
- You may have to stop your machine in an emergency. Learn how to do this quickly and automatically.

Worksheet lesson 5

1. Any six of the following:

   Observe the following safety precautions when using a portable drilling machine:

   - Wear safety goggles.
   - Choose the correct size and type of drill bit. A metal bit is used to drill into iron and a masonry bit to drill into a brick wall.
   - The bit must be placed into the chuck of the drill and tightened into place by using the chuck key Make sure that the bit is centred.
   - Place the key in the key holder provided at the bottom of the drill's handle.
   - If you are drilling into metal, mark the position with a centre punch.
   - Stand firmly with your legs slightly apart and one leg more forward than the other.
   - Hold the drill firmly and squeeze the trigger.
   - If you are drilling through a metal plate, you must decrease your pushing pressure when you come close to drilling through the last piece of the metal plate

2. Observe the following safety precautions when using a drill press:
   - Choose a correctly sharpened drill bit for the type of work you need to do and the material of the workpiece.
   - Do not leave the key in the chuck when you are not at the machine.
   - Never leave the machine running if it is unattended.
   - Clamp the workpiece securely to the table and do not hold it by hand.
   - Never try to stop the workpiece by hand if it slips from the clamp.
   - A drill should run at the correct speed for the job.
   - Don't force a drill bit into the workpiece - this may cause broken or splintered drill bits and possible injuries.
   - Use a brush or wooden rod to remove chips from the drill. Do not use your fingers, waste or rags.
   - When reaching around a revolving drill, be careful that your clothes do not get caught in the drill or drill chuck.
   - Do not use a drilling machine with a faulty switch.
   - Do not wear loose clothing or jewellery when drilling.

1. Any five of the following:

Observe the following precautions when using a power saw:

- See that all guards are in place.
- Make sure that no oil, grease or obstacles are around the machine.
- Select the right blade for the material to be cut.
- When changing blades, ensure that the machine is switched off at the main switch.
- Remove or replace the blade gently Quick movements, such as pulling off the blade, may result in a badly cut hand.
- Do not adjust guides while the machine is running.
- All material must be clamped properly before cutting is started.
- Long pieces of material must be supported at the end.
- Always stop the machine when you leave it unattended.

Worksheet lesson 6

1.

Shears, guillotines, presses.

(1) Where the opening at the point of operation of shears, a guillotine or a press is greater than 10 mm, the user shall cause such machine to be provided with ─

(a) a fixed guard which prevents hands or fingers reaching through, over, under or around the guard into the point of operation; or

(b) a self-adjusting guard which automatically adjusts itself to the thickness of the material being worked and which prevents hands or fingers reaching through, over, under or around the guard into the point of operation; or

(c) a manually or automatically operated moving guard which completely encloses the point of operation of such machine and which is so arranged that the working stroke cannot be commenced unless the guard is closed and which cannot be opened unless the ram or blade is stationary; or

(d) an automatic sweep-away or push-away which pushes any part of the operator's body out of the danger zone when the working stroke commences; or

(e) an electronic presence-sensing device which prevents or arrests a working stroke if it senses that any part of a person's body or any other foreign object is in the danger zone:

Provided that the guarding provided in terms of this subregulation shall not in itself create any threat to the safety of persons.

(2) The user may use or permit the use of shears, a guillotine or a press without the guarding contemplated in subregulation (1) if the operating controls to set it in motion require the simultaneous engagement of both hands of all the operators involved in the operation of the machine, and such operating controls ─

(a) are situated at such distance from the point of operation that none of the operators has enough time to reach the danger zone with any part of his body before the working stroke is completed; or

(b) are so designed that the working stroke will be arrested if any one of the operators removes one of his hands from the controls:

Provided that the operating controls shall be so arranged that they cannot be bypassed.

(3) The user shall cause any full-revolution clutch shear, guillotine or press which is fed by hand to be provided with an anti-repeat device.

2. Any of the following:

Safe distance safeguarding,
Safe holding safeguarding,
Safe work procedures,
Work-holding equipment (such as back gauges),
Properly designed and protected foot pedals, and
Hand-feeding tools.

Worksheet – Lesson 7

1. Safety rules to observe when working with an arc welding machine

- Make sure the area around which one is going to work is clear of obstruction.
- Use as small a rod as possible when tackling the job. This will give a much better and neater weld on completion of the job.
- Only weld in well-ventilated areas.
- Seek medical attention if one is burnt in any way.
- Do not weld near flammable materials or liquids.
- Do not weld on petrol tanks or any container that has any flammable liquids or gas in it.
- Radiation from the arc is dangerous to the eyes.
- Avoid striking an arc when other people are nearby.
- Take precautions to avoid electric shock.

1.

The following are some safety precautions that should be followed whenusing oxy-acetylene apparatus:

Welding or flame-cutting operations may not be undertaken, unless:

- An operator has been instructed on how to use the oxy-acetylene welding plant safely.
- The workplace is effectively partitioned off.
- An operator uses protective equipment.
- Effective ventilation is provided and maintained.
- Masks or hoods maintaining a supply of safe air for breathing are provided and used by the people performing such operations.
- Additionally, any vessel that contains a substance which, when heated, may ignite or explode (or react to form dangerous or poisonous substances) must not be welded or heated until it has been properly cleaned.
- Where hot work involving welding, cutting, brazing or soldering operations is carried out at places other than workplaces, steps must be taken to ensure proper and adequate fire precautions. When in doubt, the manufacturer’s instructions are always the final authority on safety precautions and procedures. African Oxygen (Afrox) freely supplies safety booklets from their outlets and depots on all aspects of welding safety.

- Never use damaged equipment.
- Never use oil or grease on or around oxygen equipment.
- Never use oxygen or fuel gas to blow dirt or dust off clothing or equipment.
- Never light a torch with matches or a lighter.
- Always use a striker.
- Always crack cylinders before assembling the regulators to remove any dust. Always make sure regulators have their adjusting screws released by turning them anticlockwise until free before opening cylinder valves.
- Stand to the side of a regulator and not in front of it when opening cylinder valves.
- Always wear proper welding goggles, gloves and clothing when operating oxy-acetylene equipment.
- Always have a fire extinguisher handy when operating oxy-acetylene equipment.
- Always use the proper regulator for the gas in the cylinder.
- Always use cylinders in the upright position only.
- Always keep the valve wrench on the acetylene cylinder valve when in use. Open the cylinder valve a maximum half of a turns.
- Do not carry lighters, matches or other flammable objects in your pockets when welding or cutting.

2.

Every gas cylinder should have a plate attached with the following particulars:

- name of the manufacturer
- country of origin
- year of manufacture
- manufacturers serial number
- name, number and date of the standard of design
- design gauge pressure in pascals
- maximum permissible operating pressure in pascals
- operating temperature

3.

The following safety precautions must be observed when handling gas cylinders:

- Store full cylinders separately from empty ones.
- Keep cylinders in a cool place and protect them from sunlight and other sources of heat.
- Always store and use acetylene cylinders in an upright position.
- Store oxygen cylinders apart from acetylene cylinders.
- Never stack cylinders on top of one another.
- Do not bang or work on cylinders.
- Never allow cylinders to fall.
- Do not allow oil or grease to come into contact with oxygen fittings as they form an inflammable mixture.
- Keep the caps on the cylinders for protection.
- The thread on an oxygen cylinder is a right-hand thread.

Worksheet lesson 8

1.

- The predetermined pressure must never be exceeded. This operating pressure is always less than the maximum safe pressure and is shown by a pressure gauge on the apparatus.
- Pressure gauges must be tested regularly and adjusted or replaced if any malfunction occurs.
- The platform on which the workpiece rests must be rigid and square with the cylinder of the press.
- The platform must rest on the supports provided and should not be supported by the cable by which it is raised or lowered.
- Objects to be pressed must be placed in suitable jigs. Ensure that the direction of pressure is always at 90° to the platform.
- To prevent damage to soft material, the prescribed equipment must be applied.
- The level of the hydraulic fluid in the reservoir should be checked regularly. If fluid has to be added frequently, it is an indication that there may be an internal leak.
- Regularly inspect the apparatus for rigidity and tighten all nuts and bolts.
- Pins and/or other equipment that keep the platform at a desired height on the frame must be inspected regularly for damage.
- When the apparatus is equipped with cables to alter the working height of the platform, the cable and pulleys must be inspected for damage and lubricated with grease.

Tools – Specific

Worksheet Lesson 5

1. Dial indicators are used as precision-measuring tools in the setting up of work on machinery such as centre lathes or milling machines.
2. A dial indicator is used to determine:
    - the 'runout' of a flywheel
    - if a crankshaft is bent
    - if a work piece in a lathe is running true
    - if two pieces of equipment are the same size
    - the bearing nip on a bearing shell used on a crankshaft
3. Never drop or throw your dial indicators or dial bore gauges onto the bench
   Return your dial indicators and dial bore gauges to their cases when you are finished with them
   Do not lay your dial indicators or dial bore gauges on the bench where they can get damaged
   Always use your dial indicators and dial bore gauges at room temperature to avoid distortion from heat or cold
   Check the accuracy of your dial indicators and dial bore gauges periodically and recalibrate as needed
   Never use your dial bore gauge on moving parts
4.
    A. Lock screw
    B. Short hand
    C. Scale mark plate
    D. Outer frame with limiter
    E. Stem
    F. Spindle / plunger
    G. Long hand

Worksheet Lesson 6

1. A telescopic gauge provides a quick and accurate means of checking inside measurements. Small gauges have two plungers which are internally spring- loaded. A telescopic gauge is inserted into the item to be measured, locked and then removed to check the size, using an outside micrometer.
2. Care:
   - Do not over-tighten the locking screw.
   - Do not force the telescopic plungers into the bore.
   - Take care when removing the telescopic gauge after measurement was taken.
   - Store gauges safely away after use.

Worksheet Lesson 7

Proper Torque Wrench Use and Maintenance

A torque wrench is a precision instrument designed to apply a specific amount of force to a fastener. Whether tightening head bolts on an automobile engine, lugs for tire and rim installation or inspecting fastener tolerances on high-performance equipment, it is extremely important that proper care is used.

Guidelines are typically provided noting acceptable torque ranges, the order in which specific fasteners are tightened and the number of times a fastener must be tightened and loosened to ensure uniform torque application. Failure to properly torque fasteners can lead to equipment damage, personal injury or worse.

It is important to follow acceptable maintenance and use practices, such as:

1. Safety glasses or goggles should be worn at all times when using any hand tool.
2. Always follow the manufacturer's directions regarding torque direction, proper force, torque pattern/sequence, use or non-use of lubrication on fasteners and torque "tighten/release" cycles.
3. Do not exceed the recommended working range of the torque wrench. Reliable measurements are based on a percentage of the working range. In general, most mechanical wrenches have a useable range from 20% to 100% of full scale. Most electronic wrenches have a useable range from 10% to 100% of full scale.
4. Do not use accessories or handle extensions unless specifically allowed by the torque wrench manufacturer.
5. Take time to inspect the tool and check for worn or cracked sockets. Properly lubricate and replace worn parts.
6. Avoid dropping or sliding a torque wrench. Dropping a torque wrench on a hard surface can cause the instrument to lose reliable calibration. If you suspect that a wrench has been dropped, have the tool inspected by the manufacturer or reputable calibration service.
7. Always store a torque wrench in a protective case and/or location when not in use.
8. Avoid exposure to temperature extremes, high humidity, fluid immersion and corrosive environments.
9. If using a click-type torque wrench, always store it at the lowest level on the scale.
10. Avoid marking, etching or placing labels on torque wrenches.

11. Use a torque wrench to apply a specific torque value during the final assembly process. Do not use a torque wrench as the primary means of tightening or loosening fasteners.
12. As most torque wrenches are length specific, always grasp the torque wrench in the centre of the handle. If two hands need to be used, place one hand on top of the other.
13. Apply torque in a slow, methodical manner and avoid sudden, “jerking” movements.
14. When the wrench signals (by clicking, beeping or lights) that a specific torque has been reached, stop pulling immediately.
15. After 5000 cycles or up to one year of use, whichever comes first, have your torque wrench inspected and recalibrated by the manufacturer or reputable calibration service.
With proper care, a high-quality torque wrench should provide accurate measurements for many years.

Worksheet Lesson 8

(1). 8,11mm

(2). 11,25mm

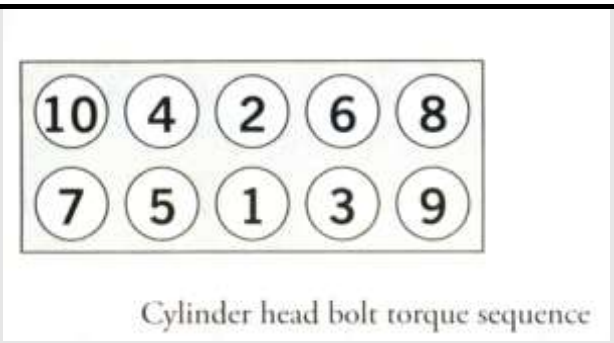
(3). 14,19

(4). 8,91mm

WEEK 4

Activity 5

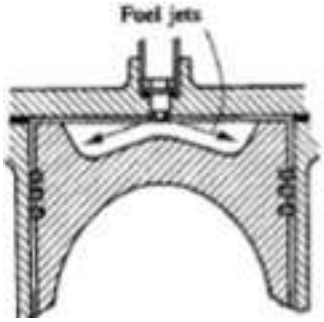
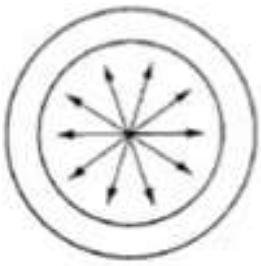
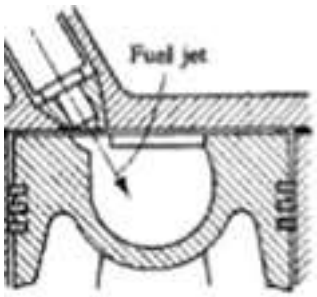
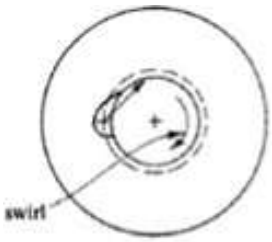
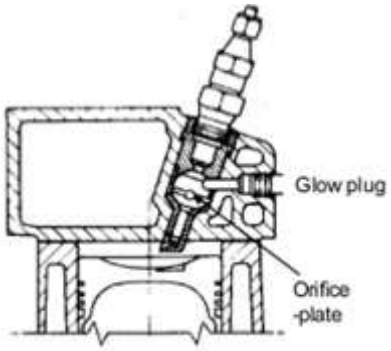
Instructions	Record of work completed.
The Teacher will complete this Memo based on the measurements of the engine in the workshop.	
1. Use a dial indicator and do various measurements. Record these measurements in opposite column	1. Run-out on a shaft/disc: Reading: _____
2. Use telescopic gauges and a outside micrometre to measure the bore of and engine. Measure top just below ring groove. Measure bottom and compare two readings	2. Bore measurement: Top_____ Bottom_____ Difference if any_____
3. Torque a cylinder head in the correct sequence.	3. Specifications of engine head to be torqued: Engine used: _____ (Example: Ford 1600) Nm _____

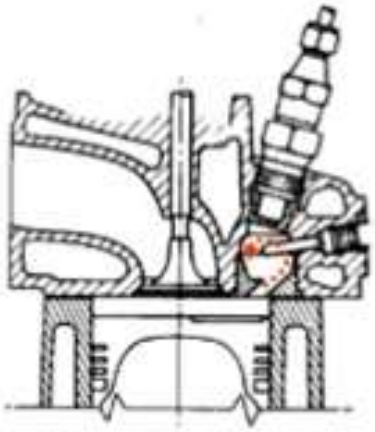
Draw the sequence you would use in opposite column. **4.** Do various measurements with a vernier calliper.	 Cylinder head bolt torque sequence 4. Readings: Name each item that was measured (Example Big end journal) Name: _____ Measurement: _____ Name: _____ Measurement: _____ Name: _____ Measurement: _____

WEEK 5

ACTIVITY 6

Grade 11	Term: 1	Week No:	5	Class	
Topic: Tools	**Combustion chamber designs**				

Instructions	**Record of work completed**
Draw a sketch of the following types of combustion chambers: 1. Combustion chamber in piston. 2. Pre combustion chamber	**1.** Direct combustion chambers   Top View (Quiescent Chamber)   Top View (Swirl in chamber) **2.** Indirect combustion chambers with pre-combustion chambers: 

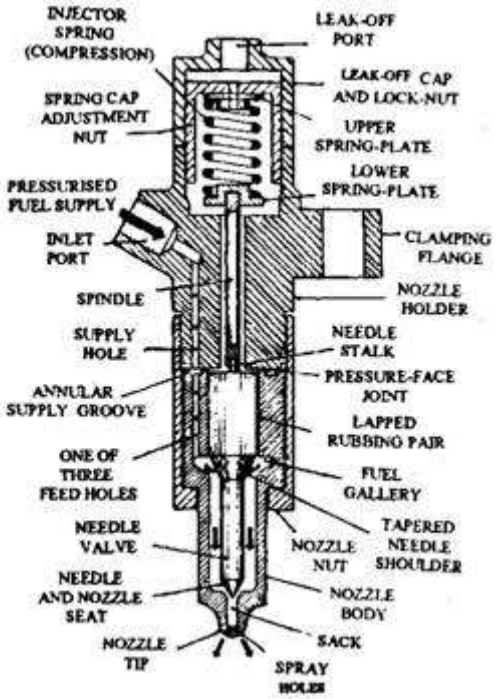
3. Explain the difference between direct and indirect injection	 **Indirect injection**: turbulent and swirl pre-chamber **3.** • With **direct injection** the fuel is directly injected into the combustion chamber that is situated in the piston crown. Fuel not heated by a glow plug. Cylinder head is flat. • With **indirect injection** fuel is injected into a pre-combustion chamber that is situated in the cylinder head. Combustion chamber connected by passage to cylinder. Fuel can be pre heated by a glow plug.

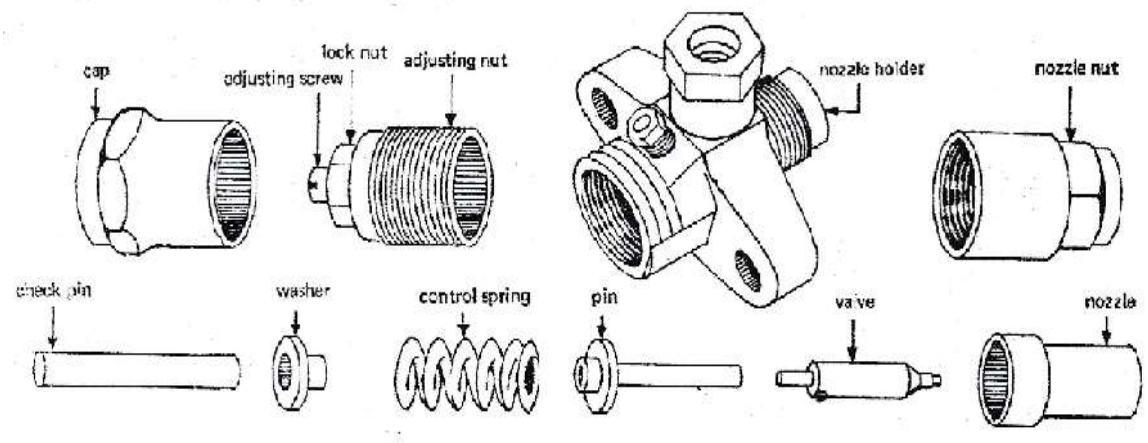
ACTIVITY 7

Grade 11	Term: 1	Week No:	7	Class	
Topic: Engines	**Injectors**				

Instructions	**Answers/Record of work completed**
1. Define the function of an injector.	**1.** • Change the diesel fuel from a liquid to a fine atomised spray. • Spray fuel into correct spray pattern. • Start and end of injection instantaneously without leaking.

2. Dismantle a mechanical injector.
   Investigate and inspect all the components to have a thorough understanding of its operation. Draw an explode view of injector components.



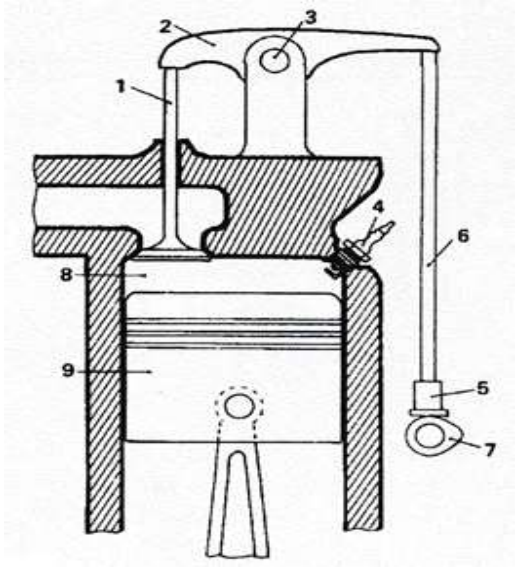


3. Which factors in an engine design will determine the type of injector nozzle to be used? 4. Why are glow plugs sometimes used with diesel engines? 5. Explain how a Piezo injector is activated to inject fuel.	**3.** • Combustion chamber design • Piston design • Compression ratio used **4.** Mostly used with indirect injection because the engine does not use such a high compression ratio. It can battle to start when air is very cold. **5.** • Piezo injectors use piezoelectric technology to open • and close fuel injectors at extremely high speeds and precision to inject fuel into an internal combustion engine. These injectors are used in both petrol and diesel engines to improve their performance and efficiency. • Piezo electricity results from squeezing or applying pressure from certain crystal-like materials or certain ceramics. If this process is reversed and electricity is applied to these same materials, they will expand and return to their original size as soon as the electricity is cut off. The expansion of one crystal is too small to see with the naked eye.

	• How Piezo electricity make Piezo injectors work is by using the expansion of the crystals to open the injector. The expansion of one crystal is much too small to open the injector so there are several hundred little Piezo crystals placed one above the other covering a length of more than half the injector. • When electricity passes through these hundreds of crystals their combined expansion is enough to open the injector and as stated before they return to their original size as the electric charge stops. The crystals expand downwards, and an upward movement is required to open the injector; so two very small levers are used to reverse the process and open the injector and a spring closes it as the crystals retract. • Higher precision switching on and off.

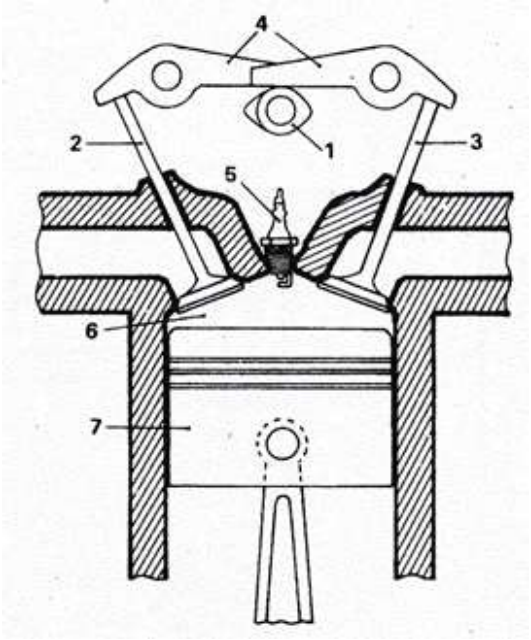
ACTIVITY 8

Grade 11	Term: 1	Week No:	8	Class	
Topic: Engines	**Valve assemblies**				

Instructions	**Answers/Record of work completed**
1. Draw labelled sketches of the following valve arrangements: a. I head with camshaft in the engine block. b. W head with overhead cam assembly.	**a.**  1. Valave 2. Rocker 3. Rocker shaft 4. Spark plug 5. Valve lifter/cam follower 6. Pushrod 7. Camshaft 8. Combustion chamber 9. Piston **b**.

2. Why is an I-head valve assembly less efficient than a W-head arrangement?

3. Why is the combustion chamber design theoretically ideal on the W-head valve arrangement?



1. Camshaft
2. Inlet valve
3. Exhaust valve
4. Rockers
5. Spark plug
6. Combustion chamber
7. Piston

2.

- Long pushrods and mechanisms to open valves, difficult to maintain accurate valve clearances. This affects volumetric and thermal efficiency negatively.
- High compression ratios is not always possible.

3.

- Less corners and cavities in combustion chamber makes it easier for gasses to flow in and out which leads to higher thermal efficiency.

ACTIVITY 9

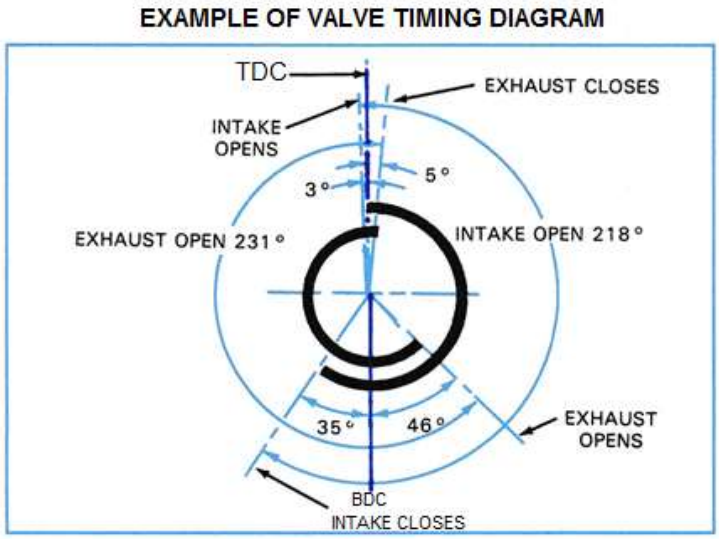
Grade 11	Term: 1	Week No:	8	Class	
Topic: Engines	**Camshaft arrangements and followers**				

Instructions	**Answers/Record of work completed**
1. List the types of camshaft arrangements that are available in the automotive workshop.	**ANSWERS WILL DEPEND ON WHAT THE TYPES OF ENGINES IN THE AUTOMOTIVE WORKSHOP** **1.** **1.1** _____ . **1.2** _____ . **1.3** _____ . **1.4** _____ .
2. Explain where each camshaft is mounted in the engine. (E.g. 1.1 and 1.2 must match)	**2.1** _____ . **2.2** _____ . **2.3** _____ . **2.4** _____ .
3. What are the advantages of a hydraulic cam follower/lifter to the adjustable and non-adjustable followers?	**3.** • Precise timing with which it opens and closes engine valves. • Silent operation

4. Why does valve timing remain more accurate with the use of a hydraulic valve follower? Explain. 5. Explain the function of a cam follower.	**4.** The hydraulic lifter maintains very accurate valve clearances, thus maintaining accurate timing of when valves open and close. **5.** Cam followers carry rotary movement from the camshaft to reciprocating movement of the engine valves.

ACTIVITY 10

Grade 11	Term: 1	Week No:	8	Class	
Topic: Engines	**Valve timing diagram**				

Instructions	**Answers/Record of work completed**
1. Do research on one specific vehicle and draw a valve timing diagram for that specific vehicle. Vehicle make and model must be mentioned. Attach specifications of vehicle.	**1. Valve timing diagram and specifications**  Engine specifications:

ACTIVITY 11

Grade 11	Term: 1	Week No:	9	Class	
Topic: Engines	• **Variable valve timing** • **Timing drive gear**				

Instructions	**Answers/Record of work completed**
1. Explain the purpose of variable valve timing.	**1.** • Use to improve performance of vehicle under all conditions. • Improve fuel consumption. • Improve emissions level to less harmful.
2. Do research on the various methods that can be used to achieve continuous variable valve timing. Discus at least **TWO** methods on how this can be achieved. The vehicle on which research was done must be mentioned.	**2.** REASEARCH TASK TO BE DONE BY LEARNER **Method 1** _____ _____ _____ _____ . **Method 2** _____ _____ _____ _____ .
3. What is the advantage of timing chain drive over a belt drive?	**3.** • **Chain drives** generally have a longer life span than a belt drive. Same **belt drives** have a very short life span that if it fails can lead to engine damage.
4. What are the disadvantages of timing chain drives?	**4.** • It can be a complicated system especially with double overhead cam drive • Rollers wear and the chain stretches which becomes noisy.

	• This can affect the cam timing.

TERM 2

ACTIVITY 1

Grade 11	Term: 2	Week No:	1	Class	
Topic: Systems and Control	**Final drives**				

Instructions	**Answers/Record of work completed**
1. Describe the difference between a spiral bevel and a hypoid type final drive.	**1.** • **Spiral bevel type** uses spiral teeth with the pinion gear placed exactly on the horizontal centre line of the crown wheel. • **Hypoid type** also uses spiral teeth, but pinion gear placed below the horizontal line of the crown wheel.
2. Explain the functions of the differential?	**2.** • Distribute the torque evenly to the drive wheels even when there is a difference in speed between the two drive wheels.
3. Why does a spiral bevel differential have such a quiet operation?	**3.** • There is contact of more than one tooth at a time between pinion and crown wheel that ensures a very quiet operation. (large tooth contact area)
4. Explain the advantage of the limited slip differential if compared to the conventional differential.	**4.** • A standard differential applies the same amount of torque to both wheels, when one start slipping the torque is transferred to the slipping wheel. • With the limited slip differential torque will be supplied to the non-slipping wheel.
5. Witch parts are found in the limited slip differential that is not in the conventional differential.	**5.**

	• In limited slip differentials of the clutch type, a set of multi-plate clutches and spring pack could be found.

ACTIVITY 2

Grade 11	Term: 2	Week No:	2	Class	
Topic: Systems and Control	**Drive systems**				

Instructions	**Answers/Record of work completed**
1. Do research on a minimum of TEN vehicles and list: 1.1 The type of drive system of each. 1.2 TWO Advantages obtained from the particular drive system for each of the TEN vehicles	**LEARNER TO DO RESEARCH AND COMPLETE THIS SECTION** **1.1 Names of vehicles:** **1.** _____ . **2.** _____ . **3.** _____ . **4.** _____ . **5.** _____ . **6.** _____ . **7.** _____ . **8.** _____ . **9.** _____ . **10.** _____ . **1.2 Advantages of each drive system (two each):** **1.** _____ _____

	_____ _____ _____ . 2. _____ _____ _____ _____ _____ . 3. _____ _____ _____ _____ _____ . 4. _____ _____ _____ _____ _____ . 5. _____ _____ _____ _____ _____ . 6. _____ _____ _____ _____ _____ .

	7. _____ _____ _____ _____ _____ . 8. _____ _____ _____ _____ _____ . 9. _____ _____ _____ _____ _____ . 10._____ _____ _____ _____ _____ .

ACTIVITY 3

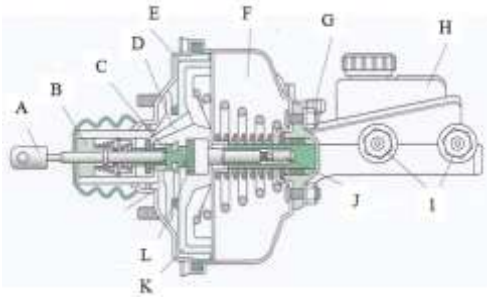
Grade 11	Term: 2	Week No:	3	Class	
Topic: Systems and Control	**Hydraulic Brakes** **Master Cylinder**				

Instructions	**Answers/Record of work completed**
1. Dismantle a dual brake master cylinder. Investigate all components and write a condition report on the master cylinder and all components. When task is completed, master cylinder must be assembled.	**1. Learner to do condition report below on all components:** _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ .
2. What is the purpose of the check valve in the master cylinder? 3. Explain the operation of a dual master cylinder when the brakes are applied.	**2.** Check valve will keep a constant pressure on system to prevent air entering the system**.** 3. **…**Then pushrod forces the primary piston towards the front.

4. If you experience binding brakes, what could be the possible reason/s?	• The primary washer on the primary piston shuts off the relief port and pressure builds up between pistons. • The secondary piston moves forward, and the primary washer shuts off the relief port in this section as well. • Further movement of the brake pedal and push rod increases the pressure in both sections and this pressure is transmitted to the brake fluid in the pipes and wheel cylinders. • Should the system that is connected to the rear pressure chambers fail, the primary piston will move up against the secondary piston. The pistons then move forward as a unit and pressure builds up in the front pressure chamber. In this case, excessive movement for the brake pedal will be experienced and efficiency will be decreased correspondingly. • Should the system that is connected to the front pressure chambers fail, the primary piston will move towards further to build up sufficient pressure in the rear pressure chamber. Again, efficiency will be decreased, and excessive movement of the brake pedal will be experienced. **4.** • To little free play between pushrod and piston. • If vehicle uses rear drum brake system, incorrect adjustment between shoes and drum.

ACTIVITY 4

Grade 11	Term: 2	Week No:	4	Class	
Topic: Systems and Control	**Hydraulic Brakes** **Brake Boosters**				

Instructions	**Answers/Record of work completed**
1. Below is a sketch of the brake servo/booster. Label all the components.  	**1.** **A.** Pushrod **B.** Air filter **C.** Control valve assembly **D.** Vacuum passage **E.** Rubber diaphragm **F.** Vacuum chamber **G.** Vacuum pipe to intake manifold **H.** Master cylinder **I.** Fluid outlets **J.** Pushrod **K.** Diaphragm support/valve body **L.** Reaction disc
2. Explain the operation when in rest/released position. Do this in point form.	**2.** • Brake pedal at rest. • Control valve in rest position. • Control valve pushed by spring keeping atmospheric port open. • This allows atmospheric pressure to be on both sides of the diaphragm assembly. • Diaphragm in rest position.
3. How would you test if the brake servo is working?	**3.**

	• Before engine of vehicle is started, press the brake pedal hard. • Start the vehicle engine and brake pedal becomes softer moving downwards to a certain distance. • If pedal does not move down, brake servo could be faulty.

ACTIVITY 5

Grade 11	Term: 2	Week No:	4	Class	
Topic: Systems and Control	**Hydraulic Brakes** **ABS brakes**				

Instructions	**Answers/Record of work completed**
1. Explain why antilock braking systems (ABS) was developed for motor vehicles.	**1.** • When one or more of a vehicle's wheels lock during braking, it can have serious consequences so that a driver may lose control of a vehicle. • Stooping distance is also increased when traction is lost between the tyre and the road surface. • Vehicle must be controllable even when braking. **ABS was developed to overcome the problems that occur when wheel lock occur.**
2. Vehicles fitted with an ABS system all have an ABS warning light (monitoring system) that comes on and switches off when there is no problem with the system once the vehicle has been started. Why is there a need for a monitoring system on vehicles? Explain.	**2.** • If the ABS system becomes faulty, the driver must be informed so that he/she can adjust their driving style to allow for longer stopping distances in an emergency. • Every time the ignition is switched on, a self-test is performed to determine if the system is operating.
3. Although ABS braking systems consist of many components, there are THREE that all systems have as listed below.	**3.** Function of ABS components.

Explain the function of each of these components. 3.1 Wheel speed sensors 3.2 Electronic control unit 3.3 Hydraulic modulator 4. ABS operates mostly in THREE modes. Explain what happens during each of the operating modes below 4.1 Isolation mode 4.2 Dump mode	**3.1** • Produce a signal that correspond to wheel and tyre speed. • Rapid decrease in the sensors signal frequency indicate that a tyre is starting to lose traction. • An electric signal is sent to the hydraulic modulator to pulsate hydraulic pressure to that wheel to prevent lock up. **3.2** • Information received from the wheel speed sensors by the ECU will calculate the best course of action for the hydraulic modulator. • An ABS ECU normally uses two microprocessors that run independently from each other. **3.3** • The hydraulic modulator will regulate the fluid pressure to each wheel during ABS operation. **4.** **4.1** • Tyre slip is detected by the control module.

4.3 Reapply mode	• The control module energises a modulator solenoid to isolate the hydraulic circuit from the other brake lines. • Fluid is trapped in the wheel brake at the currently applied pressure. **4.2** • The control module senses that a tyre is still slowing down. • The module energizes a solenoid to release fluid pressure to the wheel that continues to slip. • Tyre speed will increase. **4.3** • The control module detects that the tyre speed has increased, and more braking is needed. • The control module de-energizes the dump and isolation solenoid to allow fluid pressure to build up in circuit again, restoring braking effort. • Remember this control happens at a fraction of a second much faster than a human can react.

ACTIVITY 6

Grade 11	Term: 2	Week No:	5	Class	
Topic: Systems and Control	**Front and rear axles**				

Instructions	**Answers/Record of work completed**
1. Identify the type of axle below. 	**1.** Type of axle: Solid beam front axle / I beam axle
2. State one disadvantage of the type of front axle in point no 1.	**2.** Disadvantage: • Not strong to resist torque reactions • Wheel cannot move independently from each other
3. **3.1** Identify the type of rear axle in Figure 3.2.	**3.1 Semi** floating rear axle
3.2 Label the components of the rear axle in figure 4.2.	**3.2** **A.** Oil seal **B.** Backing plate for brakes **C.** Bolts **D.** Ball bearing **E.** Retaining collar for bearing **F.** Half shaft or drive shaft **G.** Axle housing

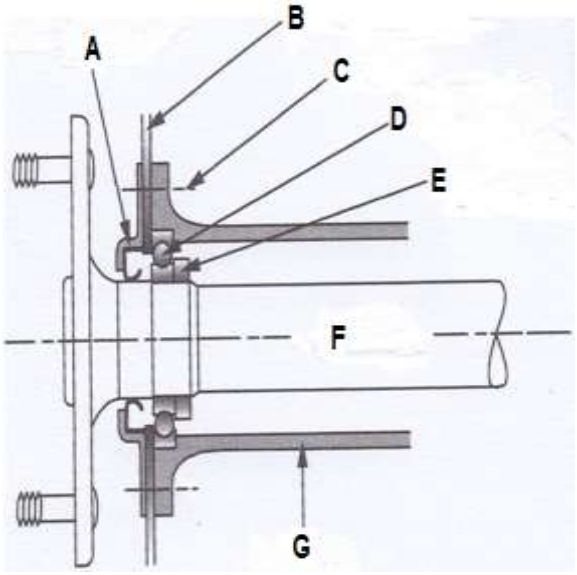


Figure 4.2

4. State THREE advantages of a full floating rear axle.

4.Advantages of full floating axle:

- Axle shaft can be removed without removing wheel.
- Does not carry any weight, only transmits torque.
- Load carrying capacity much higher than a semi-floating axle.

ACTIVITY 7

Grade 11	Term: 2	Week No:	6-7	Class	
Topic: Systems and Control	**Steering systems** **Manual steering boxes**				

Instructions	**Answers/Record of work completed**
1. Identify the type of steering box below. 	**1.** Type of steering box: Rack and Pinion steering
2. State ONE advantage and One disadvantage of this type of steering box.	**2.** Advantage: • Compact steering system • Fewer components than conventional steering box • More direct steering feel • Short turning circle Disadvantage: • Because of direct feel it can transfer more vibrations of road surface to driver
3. Explain the function of the steering box.	**3.** Function of steering box. (gearbox): • Provide precise control of vehicle. • To convert rotary motion of the steering wheel into reciprocating (to and from) of wheels. • Supply a favourable gear ratio for easier steering. • Provide road feel to driver. • Absorb road shocks.
4. Explain what a reduction ratio is.	**4.**

5. Name THREE types of steering boxes besides the rack and pinion type. 6. What is the function of the pitman arm?	• Reduction ratio is using a small input gear on a bigger gear to give advantage. **5.** • Worm and gear. • Hourglass worm and sector. • Cam and roller. • Worm and nut with recirculating balls. **6.** • Transfer the movement from the steering box to the draglink or steering linkages.

ACTIVITY 8

Grade 11	Term: 2	Week No:	6-7	Class	
Topic: Systems and Control	**Steering systems** **Hydraulic and electric power steering**				

Instructions	**Answers/Record of work completed**
1. Name the TWO types of power steering systems generally in use. (Hydraulic)	Type of steering systems: • Integral type – normally using worm type boxes. • Semi-external system using external ram. • Rack and pinion system.
2. Name the main components of a power steering?	**2.** • Adapted power steering box or rack and pinion type. • Fluid reservoir. • Hydraulic pump. • High pressure hydraulic pipes. • Spool valve or control valve.
3. Describe the operation of the power steering when the wheels are turned.	**3.** • As soon as steering wheel is moved to turn wheels. • Spool valve or rotary valve will be activated. • Pressure will be directed to the correct side of the piston thus assisting driver to turn steering wheel.
4. Do research on electric power steering and explain why so many manufacturers are taking this rout	**Learner completes his/her own research below**:

above the conventional hydraulic power steering. 5. Why must “steering characteristics” remain under all speeds? Explain. 6. Name THREE advantages of electric power steering to the conventional hydraulic power steering under the following headings: **6.3** Safety **6.4** Comfort **6.5** Steering 7. Explain the function of the torque sensor.	**4.** _____ _____ _____ _____ _____ _____ _____ **.** **5.** • During slow speeds, there should be more assistance to the driver. • During high speeds, this assistance must be much less so that the driver can have the normal road feel through the steering. **6.** **6.1** Safety: A fully electric power steering can have the following safety features built in: • Stabilisation functions. • Lane departure warning e.g., new Passat. • Obstacle avoidance assistance. **6.2** Comfort: • Straight line running correction. • Lane keeping assistant. • Variable assistance. **6.3** Steering: • Steering performance and feel are adapted to all road conditions.

8. What does it mean when manufacturers call electric power steering a modular design?

9. What is the average gear ratio for a steering gearbox?

10. When diagnosing a fault on the EPS there is normally a SIX stage process. Draw a line diagram to show the SIX stages.

11. What is the function of the spool control valve on the hydraulic power assisted steering?

- Steering noise is reduced (Hydraulics can be noisy).
- Uses less space due to the modular design.

7.

- All electric power steerings use some sort of torque sensor to measure driver effort on the steering wheel. The torque sensor will relay to the ECU how much assistance is needed by driver to turn the wheels.

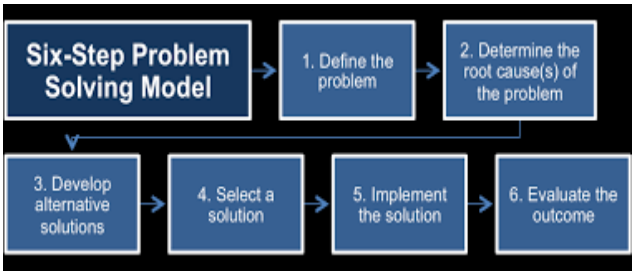
8.

This means that all systems/components are packed into one unit.

9.

16:1 – 24:1 ratio

11. Six stages of diagnosing faults:



11.

- The spool valve consists of ports of varying sizes. This will allow fluid pressure to the correct fluid line (hydraulic circuit) depending on amount of assistance the driver needs to turn the wheels with the minimum effort. If no torque comes from the steering, then

	spool valve will be in centre position with no hydraulic assistance rendered to driver.

ACTIVITY 9

Grade 11	Term: 2	Week No:	7	Class	
Topic: Systems and Control	**Steering systems** **Steering control components**				

Instructions	**Answers/Record of work completed**
1. Explain the purpose of the drag link. 2. Would a rack and pinion type steering make use of a drag link? 3. Explain the function of tie rod assemblies. 4. Explain the function of ball joints/ball sockets. 5. When a component has been replaced on the suspension, what would need to be checked? 6. What is a quick method to determine if a ball joint or tie rod end is worn?	**1.** Connects pitman arm and steering arm to enable wheels to move left and right through all steering linkages. **2.** • No **3.** • Fasten the steering knuckles to the centre link. • Allows for toe-in or toe-out adjustment. **4.** • Allows for motion between two connected parts in any direction. **5.** • Wheel alignment angles. **6.** • Placing a vehicle on a four-poster lift/over a pit, one person moving the steering left and right the person underneath should be able to see excessive movement on ball joints or tie rod ends.

ACTIVITY 1

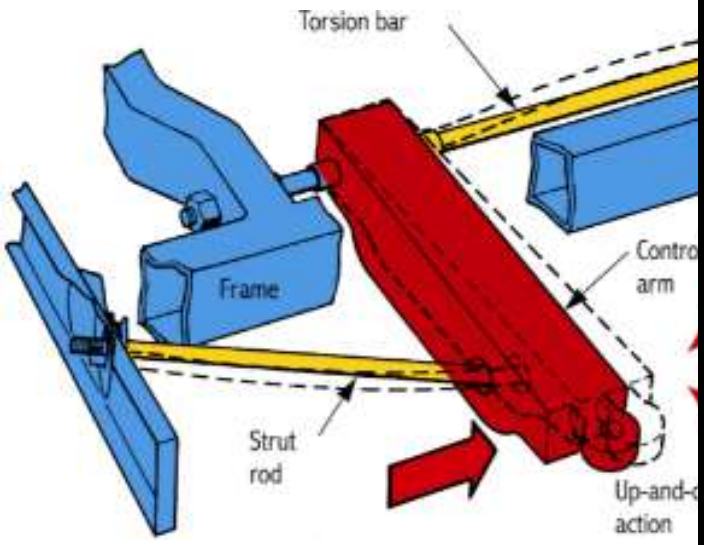
Grade 11	Term: 3	Week No:	1	Class	
Topic: System and Control	**Steering systems** **Steering control components**				

Instructions	**Answers/Record of work completed**
1. Define sprung mass. 2. Define unsprung mass. 3. State methods to reduce unsprung mass.	1. The parts of a vehicle resting on top of the suspen such as body engine etc. are called the sprung mass of a vehicle. **2.** The parts not resting on the suspension like the wheels, axles etc. are called the unsprung mass of the vehicle**.** **3.** • Use of an independent suspension. • Suspension components made from light weight material. • Light weight wheel rims • Inboard brake systems can also reduce the unspr mass.

ACTIVITY 2

Grade 11	Term: 3	Week:	1	Class	
Topic: Syste and Control	**Suspension lay outs**				

Instructions	Answers/Record of work completed
1. State one advantage of leaf springs versus coil spring.	**1.** • Can carry high vertical loads. • Sturdy connection between body and axle
2. State TWO disadvantages of leaf springs.	**2.** • Difficult to fine tune a suspension with leaf springs. • Reduced ride comfort on most motor vehic
3. Which type of vehicles would norm make use of leaf springs?	3.Heavy duty vehicles for load carrying capacity.
4. Why are anti-sway bars needed fo spring suspension?	4. To reduce body roll or body sway when the vehicle moves around a corner.
5. What does the term suspension tra refer to?	5. The vertical travel of the spring when a veh hits a full bump.
6. State FIVE advantages of torsion b suspension.	6. *Torsion bars are lighter than leaf springs. *They require no lubrication, provided that their fr ands pass through a rubber bush on the frame. *They are quiet in operation. *The riding height or ground clearance can be eas adjusted to compensate for sagging. *Suspension stresses are transferred to the centr the chassis, allowing lighter body structures at the front. *Drive axles (for 4WD) can be easily fitted to independent front suspensions because coiled sp

7. Draw a neat labelled sketch to sho torsion bar suspension.	between upper and lower suspension members d have to be relocated. **7.** 

ACTIVITY 3

Grade 11	Term: 3	Week	1	Class	
Topic: Syste and Control	**Control** **Shock absorbers**				

Instructions	**Answers/Record of work completed**
1. Explain the purpose of the shoc absorber.	**1.** Shock absorbers are used to control spring reactions. When the wheel hits a bump, the spring is compressed. This can lead to the spring oscillating up and down uncontrollable. The telescopic shock absorber will control compression and rebound o spring.
2. Explain the compression stroke shock absorber.	**2.** • When the spring is compressed the piston in the inner cylinder m downward. • Because fluid cannot be compressed it is displaced through the ports of the valve to the chamber above the piston of the inner cylinder • Because the volume below the piston becomes smaller some flu displaced through the fluid ports of the valve to the outer cylinder • The upward movement of the wheel is partially dampened by the being forced through the valves and small fluid ports
3. Explain the rebound stroke of th shock absorber.	**3.** • During the rebound stroke the spring return with a great force • The piston moves up in the inner cylinder • The pressure on the fluid above the piston opens the lower pisto valve and fluid is transferred back to the inner cylinder below the piston • At the same time the upper valve at the bottom cylinder opens a fluid is transferred through the fluid ports from the outer cylinder to the i cylinder • Because the fluid ports are smaller for the rebound stroke the sp is dampened to prevent it from oscillating. • This will prevent the body of the vehicle to bounce up and down uncontrollably

4. What is the difference between a hydraulic and gas fil shock absorber? 5. What are the dangers of worn sho absorbers? 6. Explain the difference between a anti-sway bar and a stabilizer.	**4.** Gas filled shock absorbers are similar to the twin tube system, but the f placed under pressure by gas to prevent the oil from overheating and foaming. This will ensure that the shock absorbers perform to its maximum unde conditions. **5**. • Spring will oscillate out of control with body bouncing up and dov vehicle will be difficult to control • Poor road holding • Because tyre loses contact with road surface more often it will w more uneven • Poor braking • More wear on suspension components • Soft ride over small bumps and firm control over larger bumps **6** • An anti-sway bar dampens the sway of a vehicle especially whe cornering. Prevents lifting on opposite side when cornering. • The stabiliser bar keeps the wheels stable under the vehicle to prevent it from sliding sideways. especially used on rear suspensions w coil springs

ACTIVITY 4

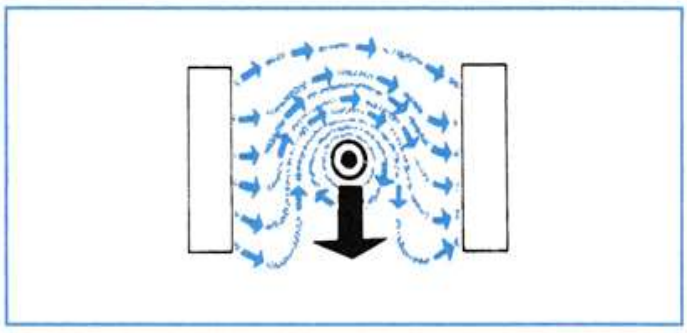
Grade 11	Term: 3	Week	2	Class	
Topic: Syste and Control	**Conventional Ignition system (Contact points system)**				

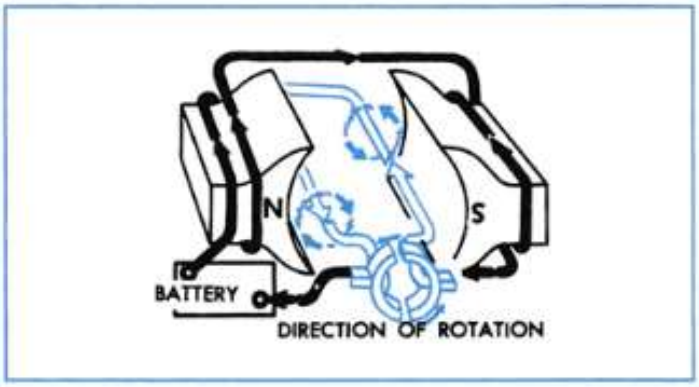
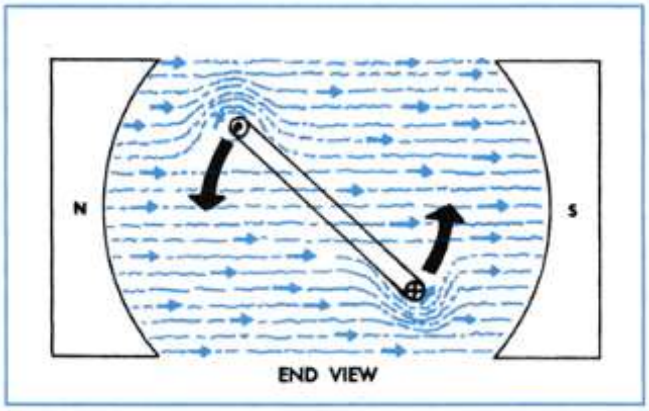
Instructions	Answers/Record of work completed
1. Examine the following components of the conventio ignition system and answer th questions that follow.	**1**. Function of components:
• **Ignition switch**	• **Ignition switch** As soon as ignition is switched on power is supplied from the battery
• **Ignition coil**	• **Ignition coil** Enables voltage to be stepped up to approximately 25000 volt
• **Distributor compone**	• **Distributor components**
○ **Contact points**	○ **Contact points** Break the circuit
○ **Condenser**	○ **Condenser** Store electric current to be released when needed
○ **Distributer shaft**	○ **Distributor shaft** Will open contact points at correct time and correct number of for engine cylinders
○ **Distributer cap**	○ **Distributor cap** Distribute high voltage from rotor to HT leads
○ **Mechanical advance**	○ **Mechanical advance** Will advance the spark as engine speed increases and retard engine speed decreases
○ **Vacuum advance**	○ **Vacuum advance** Retard spark as cylinder load or charge increases and advanc spark as load decreases
○ **HT leads**	○ **HT leads**

○ **Sparkplug** 2. The ignition coil is one the components capable of increasing the 12 volts input t the battery to about 25000 vo be delivered across the air ga the spark plug. Explain how this increase in voltage is possible. 3. Why is a spark plug he range important? 4. What does ignition tim refer to in a for stroke petrol engine?	Carry the high voltage to the spark plugs ○ **Spark plugs** Supply an air gap where the spark will jump to earth to ignite t fuel mixture **2.** • The ignition coil consists of two sets of windings around laminated iron core • The one has about 200 windings and the other about 2 windings. Primary and secondary coils • When contact points close current flow through both se winding or coils • A magnetic field is formed around both coils • As soon as contact points open primary circuit is switch and magnetic field collapses • Because of the high number of windings in the seconda coil and the magnetic field cutting through it due to the collaps high voltage is induced to produce the spark at the spark plug **3.** • Heat range is important because it depends on engine design and running temperature of the engine • To hot plugs or to cold could lead to engine not burning fuel mixture correctly **4.** • The time when the spark ignites the fuel mixture

ACTIVITY 5

Grade 11	Term: 3	Week No:	3	Class	
Topic: Syste and Control	**Starting circuit**				

Instructions	Answers/Record of work completed
1. Vehicle manufactu opt more and more for ke ignition. Do some researc this and explain one disadvantage of the keyle system? 2. Discuss the constr of the starter motor. 3. Use simple sketch explain the operation of th starter motor.	**1.** Some keyless systems are passive systems where the driver just to have the key on him, thus no buttons have to be pressed to unl the driver's door. The door is for example automatically unlocked the door handle is lifted. Battery life can be a problem because th transmitting signal must be strong enough to communicate with th vehicle. The key must be able to identify whether it is friend or foe approaching the vehicle. **2.** The starter motor consists of: • One armature • Four copper brushes to carry high amperage • Four heavy duty field coils • Solenoid • Housing • Gear • Bendix drive • Diesel engine stator motor will use more field coils and hea gauge wire to supply sufficient torque to turn the engine against th high compression. **3.** 

4. What makes it pos that a started motor can h sufficient torque to turn a car engine?	When a current –carrying conductor is placed in a magnetic field, conductor will tend to move in the direction indicated.  A simple electric motor with one loop of wire for an armature is sh Direction that current is flowing through armature will turn it anti clockwise. The field coils and conductor are connected in series. Current flowing through field coils at same time as it flows through conductor. The magnetic fields that are created will turn the conductor that w the armature in the starter motor to start the vehicle. The basic principal of operation is like magnetic poles repel one another and unlike poles attract each other this push pull action will turn the armature. The next drawing show how lines of force react to the distortion of magnetic fields and one conductor has a upward thrust and the ot downward thrust.  End view showing push and pull action.

	4. The small gear of the starter to the ring gear on the flywheel gives gear reduction to with sufficient torque to turn the motor.

ACTIVITY 6

Grade 11	Term: 3	Week:	3	Class	
Topic: Syste and Control	• Supplementary Systems • Traction control				

Instructions	Answers/Record of work completed
1. Do research on traction control use the modern motor vehicle and answer the questions that follow.	**1.**
1.1 Explain the function of traction con	**1.2** "Steerability" is lost if wheels are losing tra when accelerating severely. Traction control has developed to prevent wheels from spinning. Traction control has been developed as supplement to ABS. Traction control must not be confused with an Electronic stability program.
1.2 Various methods can be used to c traction of the motor vehicle. Discuss this under the following headings:	**1.2.1**
1.2.3 Throttle control	Throttle control could be via an actuator which wi simply move the accelerator cable to prevent whe spin. If the vehicle uses a drive by wire system, th wheel spin will be controlled in conjunction with th engine management system. This throttle control act independent from the drivers pedal position. T throttle control method can be slow sometimes.
1.2.2 **Ignition control**	1.2.2 With ignition control, ignition timing will be retarded to prevent wheel spin. This can happen in a short space of time. Throttle
1.2.3 **Braking effect**	control and ignition timing can both control wheel simultaneously. In conjunction with the ABS hydra modulator wheel spin can be controlled. **1.2.3** In conjunction with the ABS hydraulic modu wheel spin can be controlled by applying brake pressure to the wheel that wants to spin.

	This happens without the driver touching the brak pedal.

ACTIVITY 7

Grade 11	Term: 3	Week No:	3	Class	
Topic: Syste and Control	• Supplementary Systems • Air bags				

Instructions	Answers/Record of work completed
1. Air bags are classified a passive systems. Explain the difference between an active a passive system.	**1.** • Passive safety systems need no intervention by drive activate. • Active safety system needs to be activated by driver passenger for example the safety belt.
2. Why is it important that bag system is monitored in a vehicle?	**2.** The air bag cannot be deployed to be tested; an air bag syst thus needs to be monitored for malfunction.
3. Name any FIVE compon of a basic air bag system.	**3.** • Airbags • Warning light • Passenger seat switches • Pyrotechnic inflator • Igniter • Crash sensors • Electronic control unit • Passenger airbag off switch
4. Give a brief description air bag construction.	**4.** • Airbags are manufactured mostly from nylon material can be coated with silicone or neoprene. Many manufacture uncoated air bags. • Passenger air bags are normally bigger in volume tha driver's side • Design must be in such to inflate within milliseconds a deflate just as rapidly to prevent injury

5. Why are seat switches u for the passenger seats of a m vehicle? 6. Name TWO types of cra switches that can be used.	**5.** A seat switch is necessary so that are bag will not de nobody is sin the passenger seat. **6.** • Mechanical type crash sensor • Electronic type crash sensor

ACTIVITY 8

Grade 11	Term: 3	Week No:	4	Class	
Topic: Maintenance	**Engine lubrication Oil Pumps**				

Instructions	**Answers/Record of work completed**
1. Identify the oil pump below:  2. Investigate this type of pump and determine if there is any wear. 3. Identify the type of oil pump below:  4. Describe the operation of this type pump.	**1.** Gear type oil pump **2.** Learner record findings: _____ _____ _____ _____ _____ _____ . **3.** Rotor type oil pump

	4. • The pump consists of an inner and outer ro • As the inner rotor rotate it turns the outer r the same direction. • Where the space between the inner and ou rotor enlarges oil is sucked in and as the rotor rot and space becomes smaller oil is carried betwee inner and outer rotor to the outlet • Pressure is repeated at each point of the r

ACTIVITY 9

Grade 11	Term: 3	Week No:	4	Class	
Topic: Maintenance	**Engine lubrication** **Oil filter systems** **Oil control methods**				

Instructions	**Answers/Record of work completed**
1. Describe the difference between a flow system and a by-pass system. 2. Investigate where the following components are found on the engines in y workshop. 2.1 Oil pump 2.2 Oil pressure relief valve 3. Explain the function of the oil press relief valve.	**1. Full –flow system** • Oil is pumped through the filter before mov through main oil channel to various components **By-pass system** • Not all oil passing through filter to main oil channel and various components, but eventually will pass through the filter **2.** Learner record findings below: **2.1** _____ _____ **2.2** _____ _____ **3.** • AS engine speed increases oil pressure increases. If oil pressure is not controlled, it could reach abnormally high pressure that the engine c not handle and cylinders could be flooded with oil • The relief valve will control pressure during speeds

ACTIVITY 10

Grade 11	Term: 3	Week No:	5	Class	
Topic: Maintenance	**Vehicle servicing**				

Instructions	**Answers/Record of work completed**
1. Vehicles must be regularly service perform to its optimum. Learners to choose any TWO makes of ve and do research on the routine work that agents will carry out on during a major se	**1. Learners will record their research belo** 1.1 **Vehicle 1** _____ _____ _____ _____ _____ _____ . 1.2 **Vehicle 2** _____ _____ _____ _____ _____ _____ .

ACTIVITY 11

Grade 11	Term: 3	Week No:	6 - 7	Class	
Topic: Forces	**Work, Power and Torque**				

Instructions	**Answers/Record of work completed**
1. Define the following terms and the unit of measurer	**1.**
1.1 Work	**1.1 Work** is done when a force of 1 Newton is expended through a dist of 1 meter in the direction of force. One joule of work would have been
1.2 Power	accomplished. Unit is J and 1 joule is equal to 1 N.m
	1.2
	• Is the rate or speed at which work is accomplished within a unit time. The unit of time is second. Unit is watt or kW.
	$\text{Power (P)} = \frac{\text{force (N) x distance (m)}}{\text{time (s)}}$
	$\text{Power (P)} = \frac{work(J)}{\text{time (s)}}$
1.3 Torque	1 W = 1 J/s = 1 N.m/s
	1.3
	• Torque (T) is the moment of force at a certain distance around a certain point and is measured in N.m. T = F x R

ACTIVITY 12

Grade 1	Term: 3	Week N	7	Class	
Topic: Force	**Compression ratio**				

Instructions	**Answers/Record of work completed**
1. Define the following terms:	**1.**
1.1 Compression	**1.1** Compression ratio is swept volume plus the combustion chamber volu divide by the combustion chamber volume. $\text{Copression ratio} = \frac{\text{swept volume} + \text{combustion chamber volume}}{\text{combustion chamber volume}}$
1.2 Swept volum	**1.2** Swept volume is the volume displaced by the piston from bottom dead centre to top dead centre.
1.3 Clearance vo or combustion cham volume	**1.3** Volume of the combustion chamber measured in cm^3
2. Do measuren of **Stroke length** an **Cylinder bore** in an engine in the worksh and **calculate the Compression Ratio** calculating the Swep Volume. You can us water in a pipette to measure the **Cleara Volume.**	**2.** Learners calculation inserted here: L = _____ . B = _____ . SV = CV = _____ . CR =

TERM 4

ACTIVITY 1

Grade 11	Term: 4	Week No:	1-2	Class	
Topic: Terminology	**Workshop Administration**				
Learner:	• Complete work sheet below				
Learner Name:		**Learner: Surname:**			

Instructions	**Answers/Record of work completed**
5. Draw a workshop layout for a general garage	**1. Learner must include areas such as:** Reception Area, Waiting Room, Managers Office, Accountants and Cashiers offices, Service Section Major Repairs area , Vehicle Lifts, Electrical Repair area, Spares section, Machine Shop, Cloak Rooms, Toilets, Workshop Staffroom, Washing Bay, Parking Area, etc.