Western Cape Government

Western Cape Education Department
Directorate: Curriculum FET

Electrical Technology

(Power Systems/ Electronics/Digitals)

REVISION BOOKLET
TERM 1

Grade 10

The aim of this booklet is to help you preparing yourself better for the final year end exams by revising critical content and skills covered in Grade 10. The booklet will also focus on typical mistakes learners make when answering questions. It will try and guide you to obtain maximum marks for questions asked in the Final exams.

This revision covers the following topics:

- Occupational Health and Safety
- Tools and Measuring Instruments
- Basic Principles of Electricity

It is important to prepare yourself by practice answering questions from past papers. You can ask your teacher to give you some previous year question papers to use as a guide to help you prepare for your final exam:
There are also lessons on various grade 10 topics on the WCED e-Portal (https://wcedeportal.co.za/)

GENERAL

Structure of the Final Exam paper and Important point to remember:

- The final paper consists of **EIGHT** compulsory questions.
- The weighting of the questions is as per the table below.
- It is important to remember that the final paper is out of 200 MARKS, and the time given is 3 HOURS ie 200 marks = 180 minutes.
- It is important to ensure that you manage your time properly when writing any test or exam. You don't want to run out of time because of bad time management.
- The following rough guide will help you manage your time a bit better. 1 Mark = 1 Minute (If a question is out of 10 marks, do not spend more than 10 minutes on that question)
- Try and start with the easiest question and work your way up to the more difficult questions.
- All questions and sub questions must be kept together. DO NOT MIX QUESTIONS
- Draw a line after each completed question.
- It is important that you read all instructions slowly and carefully before you start answering any question.
- Also, please note that you must receive a formula sheet with every test or exam you write, covering at least the topics of the test or exam.
- The questions are asked in such a way that it will differentiate in terms of subject knowledge. It might start with an easy question and end off with more challenging question in the different questions per topic.

Final Examination Weighting in Power systems:

Topic	**Grade 10 (Revised)**	
	Percentage	**Marks +/- 4**
Multiple choice	7.5%	15
Occupational Health and Safety	5%	10
Tools and measuring instruments	12.5%	25
Basic Principles of Electricity	20%	40
Power Sources	12.5%	25
Electronic Components	15%	30
Domestic Installations	15%	30
Principles of Magnetism	12.5%	25
Total	100%	200 Marks

BASIC SKILLS LINKED TO THE SUBJECT:

The following skills are tested in the paper:

- Ability to follow instructions
- Identifying labels/labelling/making drawings/diagrams/schematic representations
- Plotting and interpretation of graphs/data
- Working out and interpreting calculations
- Organizing/Recording and categorizing data
- Extraction and/or manipulation and/or evaluation of data

It is important that you have your own Scientific Calculator, and that you know how to use it. NEVER BORROR A CALCULATOR FOR ANY EXAMINATION!!!!!!!

TOPICS

NB!!!!! The mark allocation will indicate how you much information you are required to provide in your responses/ answers to questions.

TOPIC 1: Occupational Health and Safety

- This is a very open-ended type of topic and learners need to ensure that they read every question very carefully with understanding.
- Learners must make sure their answers are short and to the point. They must remember the examiner/marker must understand what they trying to say in their answer.
- Many learners do not look at mark allocation of questions and only give one fact for a two-mark question.
- The following concepts are not always answered well:
- Unsafe actions – this refers to a specific ACTION that can lead to an injury or cause damage.

Remember an unsafe action is any activity that is conducted that may threaten the health and safety of workers

- Unsafe conditions – this refers to a CONDITION that might lead to an injury or cause damage

An unsafe condition refers to a condition that is likely to cause harm, damage or injury to property or persons.

- You need to be familiar with general workshop rules -go through this and understand what it means
- You need to be familiar with workshop safety - go through this and understand what it means
- The different safety signs used in workshop is critical to know and understand – you need to know the different colour codes and types and shape of these signs.
- Emergency procedures including fire fighting is important to know.
- You need to know and understand General First Aid as well as Chemical Safety.

Theory questions and typical answers

1. What is meant by good housekeeping with respect to workshops? (2)

Housekeeping involves ensuring that the entire workspace is neat, clean, obstacle free, well- lit and ventilated. (A place for everything and everything in its place)

2. Give TWO examples of unsafe conditions.

- Faulty tools or equipment
- Poor or missing guard on machinery
- Congestion in the workshop
- Poor housekeeping
- Excessive noise
- Poor lighting and ventilation (Any 2)

3. A person is flung to the ground after shocking themselves on an exposed 240V cable. Which steps would you follow to assist the person. (3)

- Do not touch the person, they might still be connected to the supply
- Check that you insulated by standing on something non-conductive.
- Use a non-conductive item like a broom stick to gently remove the person from the cause of the shock.

4. Identify the following safety signs (3)

4.1 

4.2 

4.3 

4.1 First Aid
4.2 Use safety glasses/Wear eye protection
4.3 Fire extinguisher.

TOPIC 2: Tools and Measuring Instruments

This topic contains mostly theoretical questions with a few diagrams. This section of the work is about identification, function, care, correct use, and maintenance of different tools used in the electrical field. You must also know the safe use and care of measuring instruments such as the digital multimeter, Insulation tester (megger) and the oscilloscope.

- Theoretical questions are normally a challenge for many learners, and they struggle to answer it properly.
- You must read all question with understanding before trying to answer the questions.
- Theoretical answers should be short and to the point.
- The mark allocation is an indication about the number of facts that must be given.

Theory question and typical answers

1. Give TWO safety precautions to observe when using a soldering iron. (2)

- Use a soldering iron stand or rubber pad to prevent the hot iron from burning other materials.
- Clean the tip of the soldering iron regularly to remove dirt with a special sponge or damp cloth.
- Avoid using abrasive materials like sandpaper and files for leaning the tip because this damages the platting.
- Switch off the soldering iron when it is not used.
- Keep the cable away from the hot element and tip during use or when storing it after use. This usually burns the cable. (Any 2)

2. Explain why the handles of electrical tools must be insulated. (2)

   To minimise the chance of being electrocuted when accidentally working on a live conductor.

3. Identify the following tools and give one use for each tool. (3)

3.1 

3.2 

3.3 

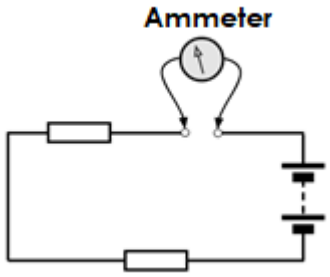
3.1. Side Cutter: Used for cutting of wires and component leads
3.2. Solder Sucker: Sucking up melted solder from a solder joint.

3.3. Hack Saw: Cutting of thin pieces of metal and small diameter pipes

4. State TWO safety precaution to be observed when using a Multi-meter to measure current in an electrical circuit. (2)

- Make sure the meter is connected is series.
- Make sure the meter it is set to the correct current setting

5. Show with the aid of a simple drawing how an Ammeter must be connected in a circuit to measure current flow. (2)



6. State the function of an insulation resistance tester. (2)

It is used for measuring the insulation resistance between coils as well as between the coils and earth.

7. State the minimum acceptable reading for an insulation resistance test. (1)

1MΩ

8. Name TWO applications/uses for an oscilloscope (2)

- Determine phase angles between waveforms
- Measuring frequency of waveforms
- Measuring peak/peak voltages
- Measuring of duty cycles (Any 2)

TOPIC 3: Basic Principles of Electricity

This topic contains theoretical questions as well as calculations.

- Theoretical questions are normally a challenge, and many learners struggle to answer it properly.
- Learners must read all question with understanding before trying to answer the questions
- Theoretical answers should be short and to the point.
- The mark allocation is an indication about the number of facts that must be given.
- This section starts with basic atomic theory, the difference between an insulator, conductor, and a semi-conductor as well as the different kind of current flows. (Electron flow and conventional current flow)
- You will also be dealing with the concept of resistance, different types of resistors as well as determining resistor values by using the colour codes as well as measuring it.
- You will also be dealing with Ohm's law and Kirchhoff's voltage and current laws and related calculations.
- The calculation of series and parallel resistances will also be dealt with in this chapter.
- The chapter is concluded by discussing electric power and doing power calculations.

Calculations

- Always write down all the given information.
- All calculations count 3 marks (in a few instances calculations were 4 or 5 marks) 1 mark is for the correct formula, 1 mark for the correct substitution and 1 mark for the correct answer and unit. Please note if an answer does not have a unit, no marks will be given for the answer.
- Please also note that when substitutions of values are made that the correct prefixes are used with the numbers eg. 10 mA = 10 x 10^{-3} A or 0,010 A
- Mastering calculations is all about PRACTICE, PRACTICE

Typical questions and answers

1. State the polarity of the following atomic particles: Electrons and Protons

Electrons – negative charge
Protons – positive charge

2. Briefly explain the difference between conventional current flow and electron flow. (4)

Conventional current flow: this is the movement of the positively charged particles (protons) from the positive to the negative terminal of the battery

Electron flow: this is the movement of the negatively charged particles (electrons)from the negative to the positive terminal of the battery

3. Define the following terms:
   3.1 Insulator (2)
   3.1 Conductor (2)

Insulator: This is a material that will NOT allow current to flow through it.
Conductor: This is a material that allows current to freely flow through it.

4. State the following laws:
   4.1 Ohms Law
   4.2 Kirchoff's Voltage Law

Ohm's Law: The current flowing through a circuit is directly proportional to supply voltage and inversely proportional to the resistance if the temperature is kept the same.

(Directly proportional means if the one quantity increases the other quantity will also increase)
Inversely proportional means if the one quantity increase, the other quantity will decrease and vice versa)

Kirchoff's Voltage Law: The sum of the electrical potential differences around any close circuit equals zero. Or the sum of the voltage drops in a closed circuit equals to the supply voltage.

5. Give TWO examples of an Insulator (2)

Copper, Silver, Gold, Aluminium, Steel etc.

6. What is the difference between conventional current flow and electron flow? (2)

In electron flow, electrons flow from the negative side of battery to the positive and in conventional current flow, current flow from positive to negative.

7. Define Ohm's Law. (3)

The current flowing in a closed circuit is directly proportional to the supply voltage and inversely proportional to the resistance in the circuit.

Know this definition, its very important and its used up to grade 12

8. Give the colour code for the following resistors:

   100Ω +- 10% and 330kΩ +- 5%

100Ω +- 10% = brown, black, brown, silver

330kΩ +- 5% = Orange, orange, yellow, gold

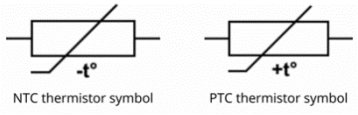
9. What is the main difference between a ¼ Watt resistor and a 2-Watt resistor? (2)

The 2-Watt resistor will be able to handle (dissipate) much more current. (More current will be able to flow through it before it will be damaged)

10. Give the symbol for the following components and briefly explain how they work. (6)

Thermistor and Light dependant resistor (LDR)

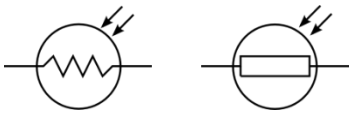
Thermistor: This is a special type of resistor whose resistance changes with a change in temperature.



NTC: increase in temperature results in drop in resistance.

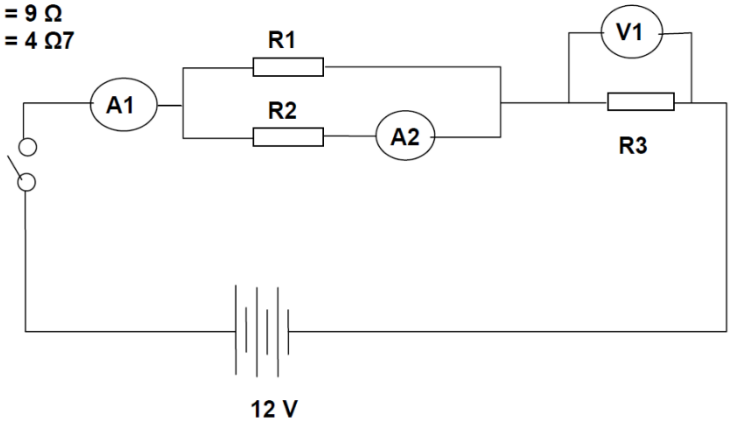
PTC: increase in temperature results in an increase in resistance.

LDR: This is a special type of resistor whose resistance changes with a change in light intensity.



11. Answer the following questions with reference to the circuit shown below:

R1 = 12 Ω
R2 = 9 Ω
R3 = 4 Ω7



11.1 Calculate the total resistance of the circuit. (6)

11.2 Calculate the reading on each of the following meters:

11.2.1 A1 (3)

11.2.2 V1 (3)

11.2.3 A2 (5)

11.3 What must the minimum power rating of R3 be to ensure that it is not destroyed? (4)

11.4 If R1 was removed from the circuit, how would this affect the total resistance of the circuit? Explain your answer. (2)

11.1 $$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$= \frac{1}{12} + \frac{1}{9}$$

$$= \frac{9+12}{108}$$

$$= \frac{21}{108}$$

$$\therefore R_P = \frac{108}{21}$$

$$= 5{,}14\ \Omega \rightarrow$$

Remember the following points when doing calculations:

- Always select correct formula
- Do the correct substitution
- Write down correct answer and correct unit

$$R_T = Rp + R_3$$
$$= 5{,}14 + 4{,}7$$
$$= 9{,}84\ \Omega \rightarrow$$

11.2.1 A_1 is the total current = I_T

$$I_T = \frac{V_T}{R_T}$$
$$= \frac{12}{9{,}84}$$
$$= 1{,}22A \rightarrow$$

11.2.2

Method A (Used when learner uses V_{RP} but learner does not receive extra credit for this mehod)

$$V_1 = V_{R3}$$
$$V_{R3} = V_T - V_{RP}$$
$$= 12 - 6{,}27$$
$$= 5{,}73\ V \rightarrow$$

Method B

$$V_1 = I_T \times R_3$$
$$= 1.22A \times 4.7\Omega$$
$$= 5.734V \rightarrow$$

11.2.3 A_2 is the current in R_2 = I_{R2}

$$V_{R2} = V_{RP}$$
$$V_{RP} = I_T R_P$$
$$= 1{,}22 \times 5{,}14$$
$$= 6{,}27\ V \rightarrow$$

All answers must have a correct unit as well to get 1 mark

$$I_{R2} = \frac{V_{R_2}}{R_2}$$
$$= \frac{6{,}27}{9}$$
$$= 0{,}7A \rightarrow$$

11.3 Method A

$P_{R3} = (I_{R3})^2 \times R_3$

$= 1{,}22^2 \times 4{,}7$

$= 7\ W$ →

Method B

$P = V \times I$

$= 5.73V \times 1.22$

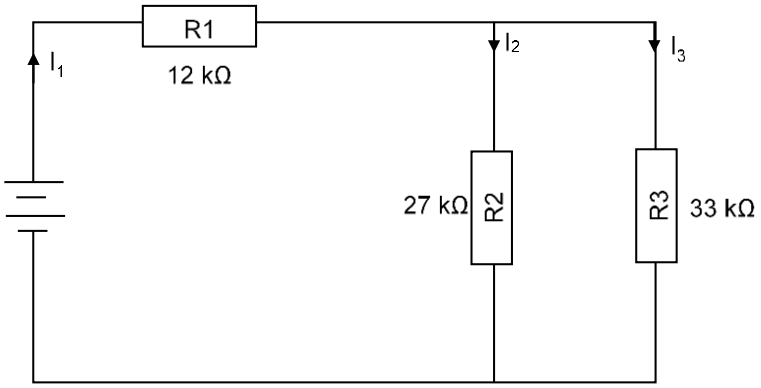
$= 6.995Watt$

$= 7Watt$

11.4 If R1 were removed from the circuit the total resistance of the circuit would increase.

Motivation: In a parallel circuit the equivalent resistance decreases as more resistors are added in parallel and visa versa.

12. Study the circuit below carefully and then answer the questions that follow.



12.1 Calculate the total resistance of the circuit. (6)

12.2 Determine the current flowing through R2 if the voltage drop across R2 is 13.5 V. (3)

12.3 What would happen to the current flowing through R1 (hence, the supply current) if the resistance of R1 is halved? (3)

12.1

$\frac{1}{R_p} = \frac{1}{R_2} + \frac{1}{R_3}$ ✓

$\frac{1}{R_p} = \frac{1}{27\,000} + \frac{1}{33\,000}$ ✓

$R_p = 14.85\ k\Omega$ ✓

$R_T = R_1 + R_p$ ✓

$R_T = 12\,000 + 14\,850$ ✓

$R_T = 26.85\ k\Omega$ ✓

Remember the following points when doing calculations:

- Always select correct formula
- Do the correct substitution
- Write down correct answer and correct unit

12.2

$I_{R2} = \frac{V_{R2}}{R_2}$ ✓

$I_{R2} = \frac{13.5}{27\ 000}$ ✓

$I_{R2} = 05mA$ ✓

12.3

If R1 decreases, R_T will decrease. ✓

When R_T decreases, I_T will increase. ✓

I_T flows through R1, so the current flowing through R1 will increase. ✓

13. A current of 3 ampere flows through a lamp with a resistance of 150 ohm, calculate the power dissipated by the lamp. (3)

$P = I^2R$
$= (3)^2 \times 150$
$= 1350$Watts or 1.35kW

The success of calculations is to do as many examples as possible.
It's about PRACTICE, PRACTICE, and more PRACTICE