



Western Cape  
Government

Western Cape Education Department

**Directorate: Curriculum FET**

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# **MECHANICAL TECHNOLOGY**

## **REVISION BOOKLET**

**2023 TERMS 3 & 4**

**FITTING & MACHINING TECHNOLOGY**

**Grade 10**

This revision program is designed to assist you in revising the critical content and skills that you have covered during the term. The purpose is to prepare you to understand the key concepts and to provide you with an opportunity to establish the required standard and application of knowledge necessary to succeed in the examination.

The revision program covers the following topics:

## INDEX PAGE

2023 NATIONAL R-ATP: GRADE 10 – TERM 3 &amp; 4: FITTING &amp; MACHINING

## TECHNOLOGY

TERM 3	Content	Topics /Concepts, Skills, and Values	Page
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**Materials (Generic)**

**WEEK** Characteristics, composition and use of:

**1 - 2** Ferrous metals and alloys:

- Low carbon steel
- Medium carbon steel
- High carbon steel
- Cast iron:
- Grey cast iron
- White cast iron
- Stainless steel (manganese, chrome, vanadium, titanium, tungsten, molybdenum and cobalt)

**Non-ferrous elements:**

- Copper, tin, lead, zinc, aluminium, nickel

**Non-ferrous alloys:**

- Brass, bronze, phosphor bronze, white metal, duralumin and solder

**Practical:**

Collect a sample of 5 non-ferrous elements and 5 non-ferrous alloys.

Give 2 uses for each sample collected.

**SYSTEMS AND CONTROL: DRIVE SYSTEMS (SPECIFIC)**

**WEEK** MECHANICAL:

**3 - 4** Identify different drive systems referring to application.,

- Spur gears
- Pulleys and belt drives
- Chain drives

**Identification and application on the following screw threads****(Properties, uses, profiles and angles):**

- ISO Metric V-thread (fine and coarse)
- Square thread
- Acme thread

**Practical:**

Identify the most suitable mechanical drive system for various applications

**MACHINING (SPECIFIC)****TERM Simple readings on:**

- 4**
- Vernier callipers
  - Outside, inside and depth micrometers

**Week Lathe:**

- 1 - 3**
- Classification
  - Types of bed: V and flat and gap
  - **Functions of:**
    - Feed shaft
    - Head stock
    - Lead screw
    - Tail stock
    - Carriage

**Function and purpose of the 3- and 4-jaw chuck****Coolants (Application and advantages and disadvantages)****Cutting tool (high speed steel):**

- Clearance angles
- Cutting angles
- Differentiate between high-speed steel cutting tools and tungsten tip tools
- Tool holders and boring bars (Types and uses)

**Apply cutting procedures for diameter turning and facing****Taper turning (Methods, Advantages and disadvantages):**

- Compound slide
- Tail stock
- Taper turning attachment
- Cutting tool

**Screw cutting (Compound slide – Theory only):**

- Characteristics and elements of metric V-thread
- Parallel
- Half of the included angle of the thread
- Use of the screw thread pitch gauge and screw cutting gauge

**Practical:**

Use the abovementioned measuring instruments and demonstrate the measurement of given sizes.

Facing and parallel turning of a work piece on the centre lathe.

Machining of an outside taper using the compound slide only on the same work piece used for the facing and parallel turning

**FITTING & MACHINING – GRADE 10****TERM 3 & 4**

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.6) in your ANSWER BOOK, e.g., 1.7 E.

- 1.1 The definition for case hardening:
- A To produce a wear-resistant surface over a tough core.
  - B To produce an extremely hard surface over a softcore
  - C To produce a high carbide surface over a hardcore
  - D Not one of the above-mentioned (1)
- 1.2 Inside the blast furnace, impurities from the ore become trapped in which element?
- A Cupola
  - B Stove
  - C Molten limestone
  - D Carbon monoxide (1)
- 1.3 Which of the following is NOT a property of metals?
- A Metallurgy
  - B Machinability
  - C Malleability
  - D Ductility (1)
- 1.4 What are the electrodes of an electric-arc furnace made off?
- A Copper
  - B Stainless steel
  - C Carbon
  - D Cast Iron (1)
- 1.5 What is smelted in a blast furnace?
- A Rocks
  - B Iron ore
  - C Pig iron
  - D Carbon (1)

- 1.6 Which ONE of the following is an important property of the material used to manufacture a hammerhead?
- A Plasticity
  - B Malleability
  - C Brittleness
  - D Toughness (1)
- 1.7 Which element is used to make coke used in a blast furnace?
- A Limestone
  - B Dolomite
  - C Coal
  - D Iron ore (1)
- 1.8 Hardness refers to the material's ability to ...
- A resist penetration.
  - B be permanently shaped.
  - C stretch.
  - D absorb forces. (1)
- 1.9 Which of the following is a heat treatment process?
- A Annealing
  - B Hardening
  - C Tempering
  - D All the above. (1)
- 1.1 What is the purpose of case hardening steel?
- 1.2 Name TWO common methods of casehardening.
- 1.3 State TWO safety precautions when conducting heat-treatment of steel.
- 1.4 State TWO quenching media used to give different rates of cooling.

1.5 What is the function of a pyrometer?

## **MATERIALS (Generic)**

### **Function of the following elements used in a blast furnace:**

- Iron ore: Raw material for producing iron.
- Coke: Acts as a fuel to provide heat for smelting.
- Limestone or dolomite: Serves as a fluxing agent and binds with impurities.

### **Electric arc furnace**

- Uses an electric current to reach the high temperature required for melting.
- It is useful in the production of stainless steel, other high-alloy steels, or special steels requiring very close metallurgical control of grain or other structural qualities.

### **Advantages of rotor plant**

- The molten metal is protected by a layer of slag.
- The oxidation of iron and other elements is minimised.
- The melting loss is lower than that of the cupola furnace.

### **Bessemer converter furnace**

- It is used to convert molten pig iron to steel by the Bessemer process.
- Bessemer steel is used for nails, screws, wire, rails and building materials such as beams.

### **Open –hearth furnace**

- Is used to convert scrap metal and other alloying elements into different kinds of steel, steel is then drawn from the furnace into a ladle and poured into tall moulds to form ingots.

### **Cupola furnace**

- Cylindrical blast furnace used in foundries for re-melting iron or other metals

### **Open-hearth Furnace**

- Large, rectangular basins

### **Basic Oxygen Furnace**

- Large bottle-shaped container that holds about 80 tons of metal.

## **Properties of Metals**

**Hardness:** The material's ability to resist penetration, scratching, abrasion, indentation, and wear. Unfortunately, the harder carbon steel tools are made, the more brittle they become; so, sometimes hardness must be sacrificed in exchange for toughness in the tempering process. Hardness can be increased by heat-treating or work hardening

### **Ductility**

The ability of a metal to change shape by stretching it along its length without breaking or drawing it into wire form e.g gold, silver, copper.

### **Malleability:**

Ability to deform permanently under compressive forces or hammering without developing defects.

### **Plasticity:**

The material's ability to change in shape permanently, it is the reverse of elasticity. E.g., a solid piece of metal being bent or pounded into a new shape displays plasticity as permanent changes occur within the material itself. Plastic deformation which is irreversible is observed in most materials, particularly metals, soils, rocks, concrete, foams.

### **Elasticity:**

The material's ability to absorb forces and flex in different directions and return to its original shape when the load is removed. Deformation is reversible.

### **Brittleness:**

The material's behaviour when fractures occur with little or no deformation. E.g., glass, cast iron. Hardness and brittleness are closely related, since hard metals are more brittle than soft metals.

### **Toughness**

The ability of a metal to resist penetration, cracking bending, breaking, or stretching and remain intact after continual bending in opposite directions.

**General comments on the answering of questions**

1. Learners must always start each question on a new page as indicated in the instructions.
2. Learners have difficulty expressing themselves when responding to describe/explain type of questions. It is important to explain/describe concepts in a logical sequence.
3. Learners should be careful not giving general responses that are incorrect instead of specific responses. E.g., learners responded by indicating that workers should wear PPE instead of a specific item, like safety goggles.
4. In a question that counts two marks, learners only provided one response instead of two. Learners must provide answers in line with the mark allocation of the question.
5. Learners should not only rely on activities that are in the textbooks but alternative questions on all cognitive levels for all the topics and should consult past question papers
6. Learners must work do all the topics and all the activities to make sure consolidation and understanding.
7. Ensure that you write down the correct units and label the drawings correctly.