

2502/106

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2509/106

**WORKSHOP TECHNOLOGY, MATERIALS
AND METALLURGY**

Oct./Nov. 2021

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

**DIPLOMA IN MECHANICAL ENGINEERING
(PLANT OPTION)**

**DIPLOMA IN AUTOMOTIVE ENGINEERING
DIPLOMA IN CONSTRUCTION PLANT ENGINEERING**

WORKSHOP TECHNOLOGY, MATERIALS AND METALLURGY

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Drawing instrument.

*This paper consists of **TWO** sections; **A** and **B**.*

*Answer **FIVE** questions taking **THREE** questions from section **A** and **TWO** questions from Section **B** in the answer booklet provided.*

Maximum marks for each part of a question are as indicated.

Candidates should answer the questions in English.

This paper consists of 4 printed pages.

**Candidates should check the question paper to ascertain that
all the pages are printed as indicated and that no questions are missing.**

SECTION A: WORKSHOP TECHNOLOGY

Answer any **THREE** questions from this section.

1. (a) Illustrate the features of a twist drill. (4 marks)

(b) With the aid of a sketch, describe each of the following drilling operations:

- (i) countersinking;
- (ii) counter boring.

(6 marks)

(c) (i) State **three** functions of cutting fluids in machining.

(ii) With the aid of a sketch, explain the procedure of parallel turning on a centre lathe machine. (10 marks)

2. (a) State **four** sheet metal materials. (4 marks)

(b) (i) State **two** types of heat treatment equipment.

(ii) State **four** objectives of heat treatment.

(6 marks)

(c) (i) Using sketches, explain the difference between punching and blanking.

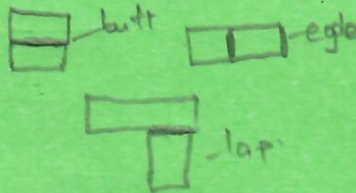
(ii) Sketch the following tools stating one use of each:

- (I) hand groove;
- (II) hallowing hammer.

(10 marks)

3. (a) Illustrate the following types of welded joints:

- (i) lap joint;
- (ii) butt joint;
- (iii) edge joint.



(6 marks)

(b) (i) State **two** causes of cracks in welds.

(ii) With the aid of diagrams, explain the following welding techniques citing an application of each:

- (I) leftward;
- (II) rightward.

(10 marks)

(c) Illustrate the following double row riveted lap joints:

- (i) zig-zag;
- (ii) chain.



(4 marks)

4. (a) (i) Define the following:

- (I) material handling;
- (II) quality control;
- (III) waste management.

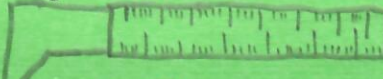
(ii) Explain the following types of maintenance:

- (I) preventive; *Done in order to prevent damage that may occur.*
- (II) breakdown. *Done*

(9 marks)

(b) (i) State **two** precautions to observe when using vernier callipers.

(ii) Illustrate a reading of 20.12 mm on a metric vernier scale of accuracy 0.02 mm.



(5 marks)

(c) Describe the following metal finishing operations:

- (i) lacquering;
- (ii) polishing;
- (iii) blueing.

(6 marks)

SECTION B: MATERIAL AND METALLURGY

Answer any **TWO** questions from this section.

5. (a) State **four** forms of supply of engineering materials. *Metal, Non metal, Natural nat, Synthetic material* (4 marks)

(b) State **two** functions and four properties of coke when used in a blast furnace. (6 marks)

(c) (i) State **four** types of iron ores. *Haematite, Magnetite, Limonite, Siderite*
(ii) With the aid of a sketch, explain the operation of the cupola furnace. (10 marks)

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Turn over

functions of coke.
act. as a fuel
used to provide heat.

Properties
strength

6. (a) Differentiate between thermoplastics and thermosetting materials citing an example and an application of each in engineering. (4 marks)

(b) State **three**:

- Thermoplastics - Can be softened again and again
Thermosetting - Can be hardened through non reversible
- (i) properties of white cast iron; - white
(ii) effects of impurities on cast iron. - Good machine ability
- Good compressive strength

(6 marks)

(c) Sketch the arrangement of atoms in the following unit cells and cite a metal example in each case:

- (i) face centred cubic; has 8 atoms
(ii) body centred cubic; - 14
(iii) close packed hexagonal cubic. - 17

(10 marks)

7. (a) (i) Define the term heat treatment.

(ii) State **four** methods of preventing corrosion.

Painting
Lacquering
Chromating

(6 marks)

(b) Explain the following mechanical properties of materials:

- (i) elasticity; - Ability of a material to regain original shape after removal of force
(ii) plasticity; - Ability of a material to undergo slow deformation
(iii) malleability.

(6 marks)

(c) (i) Differentiate between ferrous and non-ferrous materials.

ferrous - Have high amount of iron ore
(ii) State **four** types of plain carbon steels citing the percentage of carbon content in each type.
Mild - 0.08 - 0.12%

(8 marks)

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