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**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;
- (II) breakdown.

(9 marks)

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

(ii) Illustrate a reading of 29.12 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. (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.
(ii) With the aid of a sketch, explain the operation of the cupola furnace. (10 marks)

- 6.
- (a) Differentiate between thermoplastics and thermosetting materials citing an example and an application of each in engineering. (4 marks)
- (b) State **three**:
- (i) properties of white cast iron;
 - (ii) effects of impurities on cast iron.
- (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;
 - (ii) body centred cubic;
 - (iii) close packed hexagonal cubic.
- (10 marks)
- 7.
- (a) (i) Define the term heat treatment.
- (ii) State **four** methods of preventing corrosion.
- (6 marks)
- (b) Explain the following mechanical properties of materials:
- (i) elasticity;
 - (ii) plasticity;
 - (iii) malleability.
- (6 marks)
- (c) (i) Differentiate between ferrous and non-ferrous materials.
- (ii) State **four** types of plain carbon steels citing the percentage of carbon content in each type.
- (8 marks)

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