

GENERAL CERTIFICATE OF EDUCATION BOARD

Technical and Vocational Education Examination

Materials Technology and Workshop Processes 2
5130

JUNE 2022

INTERMEDIATE LEVEL

Specialty Name and Acronym	AUTOMOBILE REPAIR MECHANICS (ARM)
Subject Title	Materials Technology and Workshop Processes
Subject Code No.	5130
Paper No.	2

Duration: 2 Hours, 30mins

INSTRUCTIONS:

This Paper is made up of NINE (09) Questions.

Answer Any FIVE (05) by choosing THREE (3) from Section A and TWO (2) from Section B.

All questions carry equal marks.

You are reminded of the necessity for good English and orderly presentation in your answers.

00/5130/2

© 2022GCEB

Turn Over

SECTION A MATERIALS TECHNOLOGY

Answer any three (03) questions from this section

1. PRODUCTION OF IRON AND ITS APPLICATION

In not more than five (05) lines,

- Explain the process of obtaining pig iron. (3.5 marks)
- Name THREE types of cast iron. (3 marks)
- Reproduce the table below and fill the spaces by giving the appropriate material of the vehicle components.

N°	Name of Component	Material (0.5mark x7)
1	Piston rings	
2	Crank shaft	
3	Fly wheel	
4	Gaskets	
5	Timing gear	
6	Stud and bolt	
7	Main bearing	

2. MANUFACTURING PROCESSES

Casting is the act of pouring molten metal into a refractory mould cavity and allowing it to solidify.

- Name TWO types of casting processes. (1x2=2mark)
- Give the name of one automobile part that is obtained by casting. (2 marks)
- Give TWO precautions when carrying out casting process. (1.5x2=3marks)
- Define forging. (1mark)
- Give TWO advantages of forging a component over casting. (2marks)

3. STANDARD DESIGNATION AND TESTING OF MATERIALS

- Explain the following designations (1x3=3marks)
 - EN-GJL 150,
 - E295, C45,
 - 36Ni Mo 14
- Define hardening. (1mark)
- Justify why 36Ni Mo14 presents good corrosion resistance characteristics. (2marks)
- List TWO (2) materials that can resist penetration and two that can resist shock. (1x4=4marks)

4. CLASSIFICATION AND PROPERTIES OF MATERIALS

- Draw a block diagram to explain the classification of engineering materials. (3 marks)
- Give FOUR factors that qualify a material for engineering application. (2 marks)
- Explain the following: (1x5=5markS)
 - Machinability,
 - Hardness,
 - Weldability,
 - Ductility and
 - Brittleness.

5. STEEL PRODUCTION AND ITS APPLICATIONS

Steel is produced from pig iron by a refining process whereby all the five elements, carbon, phosphorus, sulphur, manganese and silicon, are either reduced to particular levels or completely taken off.

- What is the meaning of the term "oxidation" in steel production? (1mark)
- Name THREE methods used for steel production. (3marks)
- The diagram below shows the effects of carbon on the properties of steel. (3marks)
-

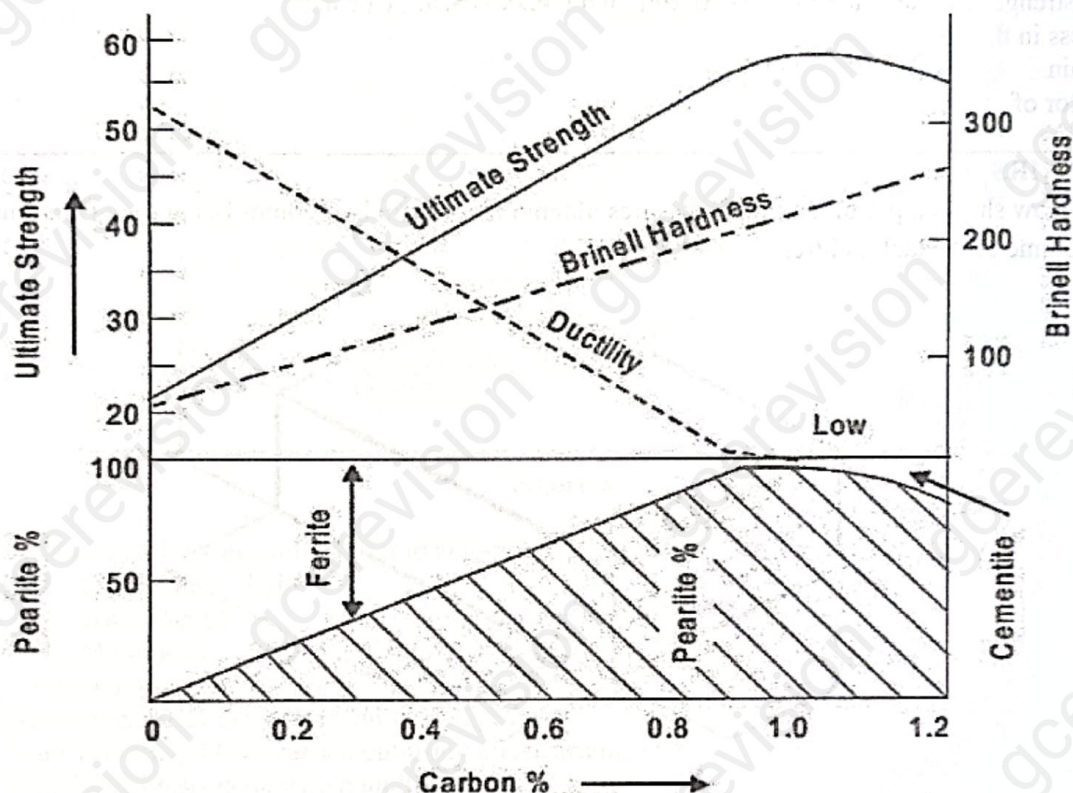


Figure 1

Carefully study the above diagram and state the effects of carbon on the following properties of steel:

- Its ductility.
 - Its Ultimate Strength.
 - Its Brinell Hardness.
- e) There are various types of carbon steels. There are used for the production of various automobile components. Copy the table below and complete it with the missing information (two uses of it in each case). (1x3=3marks)

Type of steel	Percentage of carbon	Its uses for automobile construction and tools production
Mild steel	0.1 to 0.33	General body works(cabin construction; doors, etc)
Medium carbon steel	0.15 to 0.8	
High carbon steel (HCS)	0.8 to 1.5	
Tool steel	0.9 to 1.1	
	1.1 to 1.3	Shears, hand files, wire -drawing dies

SECTION B

WORKSHOP PROCESSES

Answer two (02) questions from this section.

6. STRENGTH OF MATERIALS

A tie bar 5m long has a cross-sectional area (CSA) of 415mm^2 and is designed to support an axial load of 50kN . If the ultimate tensile strength for the material is 500MN/m^2 and $E=200\text{GN/m}^2$, calculate:

- a) The stress in the bar. (3marks)
- b) The strain. (4marks)
- c) The factor of safety. (3marks)

7. WELD REPAIRS

- a) The figure below shows a petrol tank that measures 400mm by 600mm by 200mm . Using the given dimensions (in mm), find the volume of the tank in litres. (4marks)

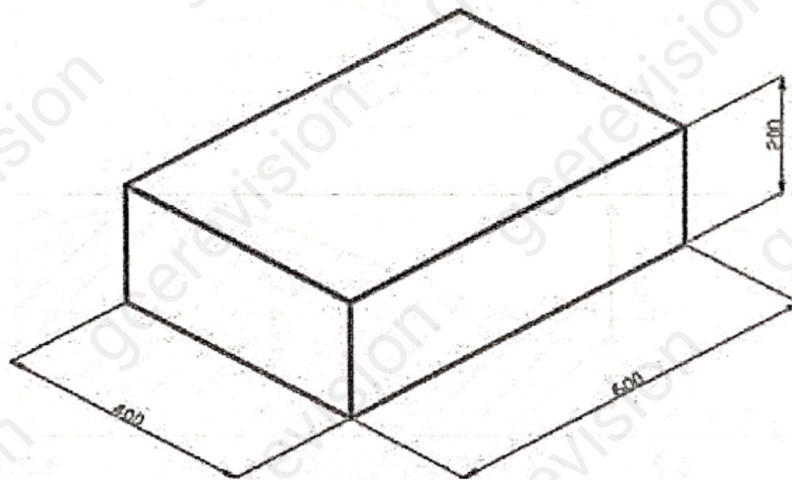


Figure 2

- b) As a technician, you are called upon to repair a punctured fuel tank. Give THREE safety precautions to be observed when carrying out welding on a petrol tank. (3marks)
- c) State TWO types of welding processes that can be used to remedy the problem in question (b). (1x3=3marks)

8. MANUFACTURING PROCESSES

A quantity of 2500 tool holders is to be produced. With respect to the quantity, sand moulding is used to obtain the rough pieces.

- a) Give TWO advantages of sand moulding. (1x2=2marks)
- b) Explain the principles of sand moulding. (4marks)
- c) Draw and label the mould used for sand moulding. (4marks)

9. DIAGNOSTICS TOOLS

5

Figure 3 below shows an instrument used in a motor mechanic workshop.

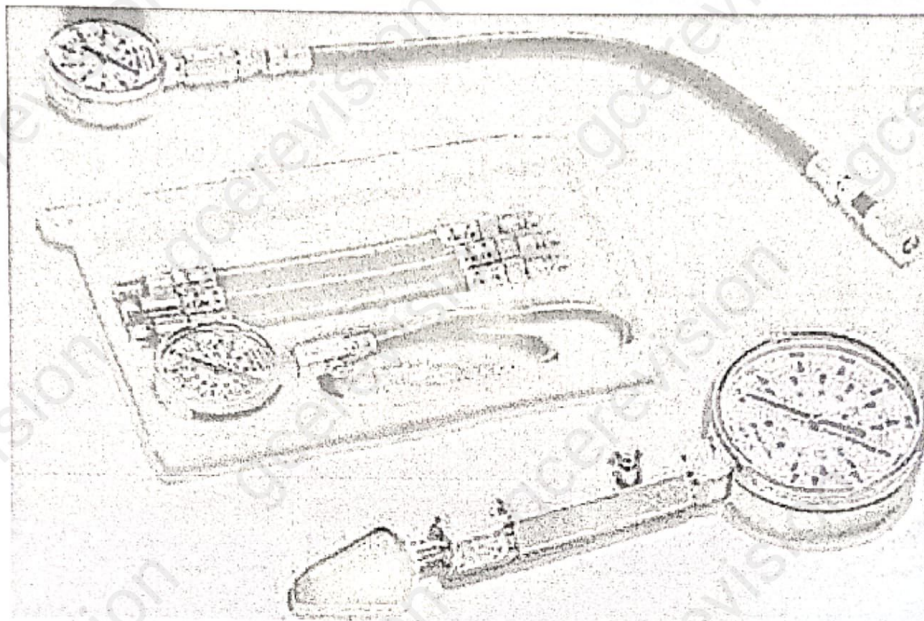


Figure 3

a. Define the following with respect to automotive diagnostics:

(1x4=4marks)

- i) Check engine light.
- ii) Oscilloscope.
- iii) Multimeter.
- iv) Gas analyzer.

b. Give the name of the instrument in Figure 3

(1mark)

c. State THREE (3) tests carried out using this instrument.

(3marks)

d. State FOUR tests done with a multimeter.

(2marks)