higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

MATERIAL TECHNOLOGY
NQF LEVEL 3

17 November 2023

This marking guideline consists of 6 pages.

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QUESTION 1

1.1
1.1.1 K
1.1.2 A
1.1.3 E
1.1.4 G
1.1.5 C
1.1.6 I

(6 × 1) (6)

1.2 1.2.1 Ferrous metals are alloys that contain iron as the base metal.

1.2.2 Non-ferrous metals are metals not based on iron.

(2 × 2) (4)

1.3
- Wrought iron
- Cast iron
- Steel (3)

1.4
- Zinc
- Aluminium
- Copper
- Chromium
- Titanium (Any 3 × 1) (3)

1.5
- To increase strength
- To increase corrosion resistance
- To reduce costs
- To increase hardness (4)

1.6
- Improved machinability
- Increased or decreased hardness
- Increased compressive or tensile strength
- Improved resistance to heat, wear or corrosion
- Increased elasticity, toughness, malleability or plasticity
- Reduced grain size
- Improved cooling rates when hardening and tempering (Any 5 × 1) (5)

[25]

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QUESTION 2

2.1
2.1.1 True
2.1.2 True
2.1.3 False
2.1.4 False
2.1.5 True
2.1.6 False
2.1.7 True
2.1.8 False

(8 × 1) (8)

2.2
- Glass fibre
- Boron
- Plastics
- Rubber
- Ceramics
- Oxygen
- Carbon
- Phosphorus

(Any 5 × 1) (5)

2.3
- Brittle, not malleable
- Not ductile
- Poor conductors of heat and electricity
- Weak
- Have low melting and boiling points
- Are soluble in some mechanical or organic solvents
- Have low densities compared to metals
- Are not sonic

(Any 5 × 1) (5)

2.4
- Some glass fibre is made into cloth that is used for fireproof curtains.
- Most glass fibre is used as reinforcing material in plastic and non-textile products.
- Glass fibre in the form of cloth is used for insulation and filtering.
- Very pure glass is made into fibres that transmit light over long distances.
- Glass fibre wool is used in buildings, appliances and plumbing.
- Glass fibre is used for electrical insulators. (Any 5 × 1) (5)

2.5
- In glassmaking and ceramics
- In making fibreglass
- As a cleansing fluid
- As a water softener, insecticide, herbicide and disinfectant
- As a mild antiseptic and a flame retardant (Any 2 × 1) (2)

[25]

QUESTION 3

3.1
3.1.1 Allotropic
3.1.2 Reduction
3.1.3 Limestone
3.1.4 Annealing
3.1.5 Carburising

(5 × 1) (5)

3.2
- The rotor furnace is used for the manufacturing of high-quality steel.
- The cylindrical furnace rotates slowly at approximately one revolution per minute.
- It can tilt to ease loading and discharge.
- A primary jet of oxygen blows directly into the molten pool of metal.
- Together with rotation, this ensures an economical and even treatment of the molten metal.

(5)

3.3
A – Burning carbon monoxide
B – Steel covering
C – Slag
D – Steel
E – Tuyères (5 × 1) (5)

3.4
- The scrap steel that you use can be oily, wet or contaminated.
- It is very efficient.
- It is quite simple and you can easily find the raw materials that you need.
- It is a cheap method of producing cast iron.
- It can be operated intermittently to suit casting requirements. (5)

3.5
- Carburising is the process by which carbon is introduced into a metal.
- The carbon diffused into the surface makes the surface harder and more abrasion-resistant.
- Because too great a concentration of carbon makes metal brittle and unworkable, metals are also often decarburised.
- Carburisation of steel involves a heat treatment of the metallic surface using a gaseous, liquid or solid source of carbon.
- Early carburisation used a direct application of charcoal packed onto the metal. (5)

[25]

QUESTION 4

4.1

4.1.1	A
4.1.2	B
4.1.3	C
4.1.4	D
4.1.5	B

(5 × 1) (5)

4.2 4.2.1

- A bending test is carried out to ensure that a metal has enough ductility to withstand bending without fracturing.
- It is also used to check the influence of the different types of heat treatments and whether the carbon and phosphorus content is too high.
- The bending test is often used to test the ductility of welds.
- The bending test will demonstrate the quality of the specimen and its overall ductility.
- When defects exist in material bent to these limits, the material will tear. (5 × 1) (5)

4.2.2

- The first thing to do when doing a tension test is to prepare the test material.
- The shape of the test piece is important, because the material must not break in the area where it is being held.
- There are standard shapes, lengths and diameters that can be used when doing a tension test.
- The shapes that are normally used for the test materials are solid and round or flat.
- The standards were developed to ensure that the break occurs in the gauge length by decreasing the diameter of the piece in this length. (5 × 1) (5)

4.3

- In a torsion test, the shearing properties of a material can be accurately determined.
- A special strainometer can be attached to find the proportional limit and yield strength in shear.
- Shearing resilience and rigidity can also be determined.
- The ductility of the material can be found by the amount of twist it takes before rupture.
- Brittle materials such as cast iron cannot be tested in this way. (5 × 1) (5)

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4.4
- The objective of the test
- The material being tested
- The method of testing
- A summary of the test results, including tables, diagrams, graphs, data sheets, etc.
- The findings of the test, including comparisons to specifications
- The name of the person carrying out the test
- The date of the test (Any 5 × 1) (5)

[25]

TOTAL: 100

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