higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MATERIAL TECHNOLOGY
NQF LEVEL 3

(6021013)

13 November 2018 (X-Paper)
09:00–12:00

This question paper consists of 8 pages.

NCV

Copyright reserved

TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Write neatly and legibly.

NC(V)

QUESTION 1

1.1 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (1.1.1–1.1.5) in the ANSWER BOOK.

1.1.1 Compressive strength refers to the ability of a material to resist breaking when placed under tension.

1.1.2 Grey cast iron has excellent compressive strength.

1.1.3 Iron ore is converted into pig iron in a blast furnace.

1.1.4 The purpose of materials testing is to make the material harder and stronger.

1.1.5 During Brinell Hardness testing, all readings over 600 are discarded.

(5 × 1) (5)

1.2 Choose a/an word/item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–F) next to the question number (1.2.1–1.2.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.2.1	Process where steel is given a hard outer skin while the inner core is soft	A	Young's modulus
1.2.2	Used to indicate the elasticity of a material	B	case hardening
1.2.3	Results in ductility with little loss in strength	C	surface hardening
1.2.4	Uses a square-based diamond pyramid to measure the hardness of a material	D	tempering
1.2.5	When the surface of the steel is heated and exposed to carbon	E	Vickers Test
		F	Brinell Test

(5 × 1) (5)

NCV

1.3 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 number (1.3.1–1.3.5) in the ANSWER BOOK.

1.3.1 A property that can be affected when alloying steel:

A Stress
B Strain
C Machinability
D Young's modulus

1.3.2 Extensively used as electrical insulators:

A Ceramics
B Tufnol
C Boron
D Asbestos

1.3.3 Uses electrodes to melt the metal when electricity passes through them:

A Rotor furnace
B Kaldo converter
C Blast furnace
D Arc furnace

1.3.4 Calculated using the formula: $\frac{\text{Force (F)}}{\text{Area (A)}}$ **:**

A Percentage elongation
B Stress
C Strength
D Tenacity

1.3.5 Refers to the ratio of change in length divided by original length:

A Strain
B Force
C Pressure
D Ultimate strength

(5 × 1) (5)
[15]

NC(V)

QUESTION 2

2.1 Briefly define the following properties of metals:

2.1.1 Electrical conductivity

2.1.2 Colour

2.1.3 Plasticity

2.1.4 Melting point

2.1.5 Density

(5 × 2) (10)

2.2 State TWO uses of the following elements:

2.2.1 Manganese

2.2.2 Nickel

(2 × 2) (4)

2.3 Name the steel which is made up of the following elements: carbon, vanadium and iron. (1)

2.4 Stainless steel is specifically designed for a certain purpose.

2.4.1 State TWO main properties of stainless steel (2)

2.4.2 What are the TWO alloying elements contained in stainless steel? (2)

2.5 Explain THREE physical properties that can be affected by alloying metals. (3)

[22]

QUESTION 3

3.1 Name FOUR characteristics of PVC. (4)

3.2 Name FOUR general characteristics of non-metals. (4)

3.3 Name TWO characteristics of asbestos. (2)

3.4 Glass reinforced plastic is widely used in industry today.

3.4.1 Name ONE property of glass reinforced plastic. (1)

3.4.2 List FOUR uses of glass reinforced plastic. (4)

Copyright reserved

3.5 State FOUR uses of epoxy resin. (4)

3.6 Match the thermosetting plastic in COLUMN B to its use in industry in COLUMN A. Write only the letter (A–F) next to the question number (3.6.1–3.6.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.6.1	Car bodies	A	polyurethane
3.6.2	Waterproofing	B	phenolics
3.6.3	Car upholstery	C	urea formaldehyde
3.6.4	Electrical plugs	D	polyester resins
3.6.5	Used to make tufnol	E	silicone
		F	PVC

(5 × 1) (5)
[24]

QUESTION 4

4.1 Name ONE advantage and ONE disadvantage of a blast furnace. (2)

4.2 List the THREE main ingredients that are added to the blast furnace during the manufacture of pig iron. (3)

4.3 Explain the working principles of a blast furnace. (7)

4.4 State ONE advantage and ONE disadvantage of a bessemer converter. (2)

NCV

4.5 The graph in FIGURE 1 shows three different stages during the quenching process of metals.

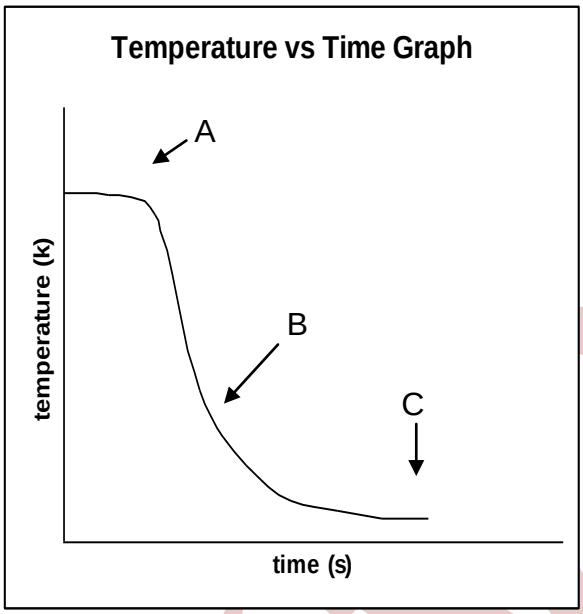

FIGURE 1

4.5.1 Label stages A, B and C. (3)

4.5.2 Describe what happens during stage A. (2)
[19]

QUESTION 5

5.1 List the THREE basic parts tensile testing machines require. (3)

5.2 Name FOUR types of tests that can be conducted on a test piece. (4)

5.3 What is the rockwell hardness number based on? (2)

5.4 Explain, with the aid of a diagram, what is meant by the angle of twist, during a torsional test. (6)

Copyright reserved

5.5 FIGURE 2 below, shows an image of a Brinell hardness tester. Label the parts A–E.

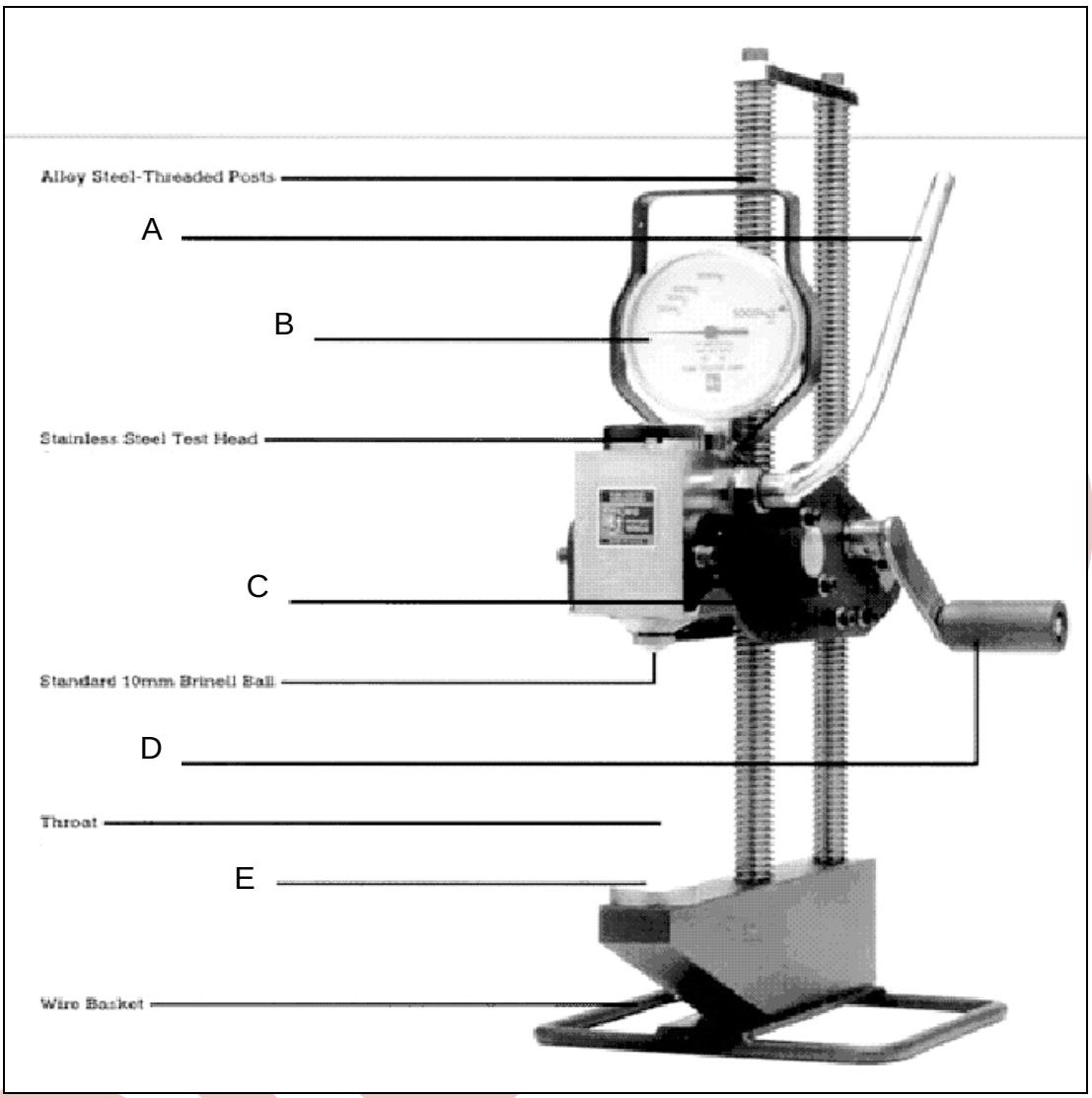

FIGURE 2

(5)
[20]

TOTAL: 100

Copyright reserved