higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ENGINEERING FABRICATION: BOILERMAKING
NQF LEVEL 4

(6031014)

28 November 2023 (X-paper)

09:00–12:00

Calculators may be used.

This question paper consists of 9 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
ENGINEERING FABRICATION: BOILERMAKING
NQF LEVEL 4
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. Use only a black or blue pen.
5. Sketches should be clear, neat and labelled and a pencil may be used.
6. Write neatly and legibly.

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SECTION A

QUESTION 1

1.1 Complete the following sentences by writing only the missing word next to the question number (1.1.1–1.1.10) in the ANSWER BOOK.

1.1.1 A … is a quick freehand drawing that shows the general idea.

1.1.2 The…is a two-dimensional or three-dimensional path generated by program code or a CAM system.

1.1.3 CNC machines require specialist computer technicians with access to the latest diagnostics …

1.1.4 From the definition of density, the mass of a given volume of a liquid is equal to the product of the density and the … .

1.1.5 Air is used to pressure test vessels because air does not …

1.1.6 Groove welds are designed in a straightforward way to have complete joint …

1.1.7 Artisans use engineering drawings to create mental …

1.1.8 The vertical and diagonal members that fill the space between the chords, are called web members or …

1.1.9 A/An … is used in a piping system when a pipe must be diverted past an obstacle that is in the way.

1.1.10 Fabrication is a … used to manufacture steel.

(10 × 1) (10)

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

COLUMN A		COLUMN B	
1.2.1	Angle calculation for part of circle ☆	A	chase
1.2.2	One of the terms used in piping offset	B	a diagram that show an object in three-dimensions
1.2.3	A shielded vertical shaft that houses pipes, ducts and drains	C	Y°
1.2.4	Oblique drawing	D	plate extension
1.2.5	Gusset	E	chamfer
		F	travel
		G	forms or shapes ☆
		H	gives information to machine on the kind of action to take

(5 × 1) (5)
[15]

TOTAL SECTION A: 15

SECTION B

QUESTION 2

2.1 ☆ Companies sometimes choose students to join their institutions for various reasons. Questions such as the following may be asked to test the students' knowledge before making their selection:

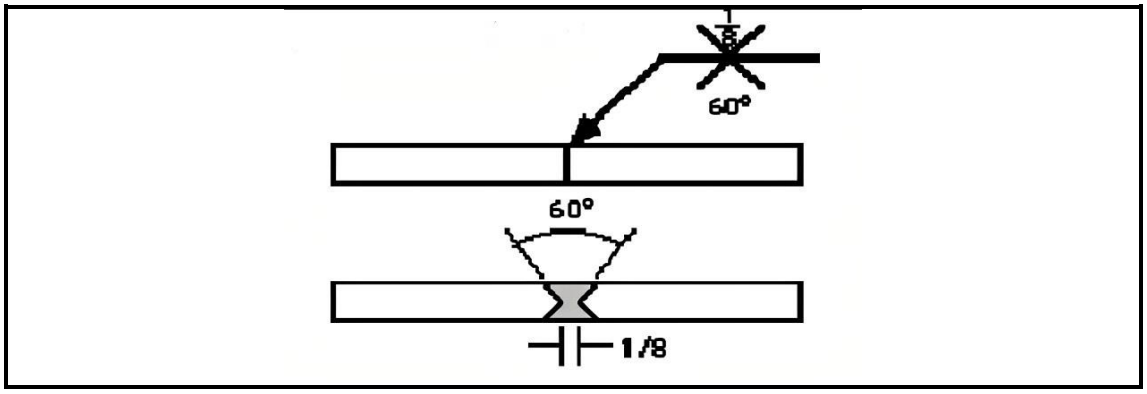


FIGURE 1

2.1.1 Name the type of welding joint shown in FIGURE 1. ☆ (1)

2.1.2 State the meaning of the information shown in the symbol. (3)

2.2 Your neighbor has a cylindrical tank big enough to store chicken feed and she needs a cone-shaped end to be joined to the cylinder to easily discharge the chicken feed.

2.2.1 Draw a simple, labelled sketch to illustrate your neighbour's idea showing both the cylindrical tank and cone-shaped end joined together. (5)

2.2.2 Use the dimensions given in FIGURE 2 to calculate the volume of the feed if the vessel is completely filled.

NOTE: Volume of vessel = volume of feed = $\frac{1}{3}\pi r^2 h$

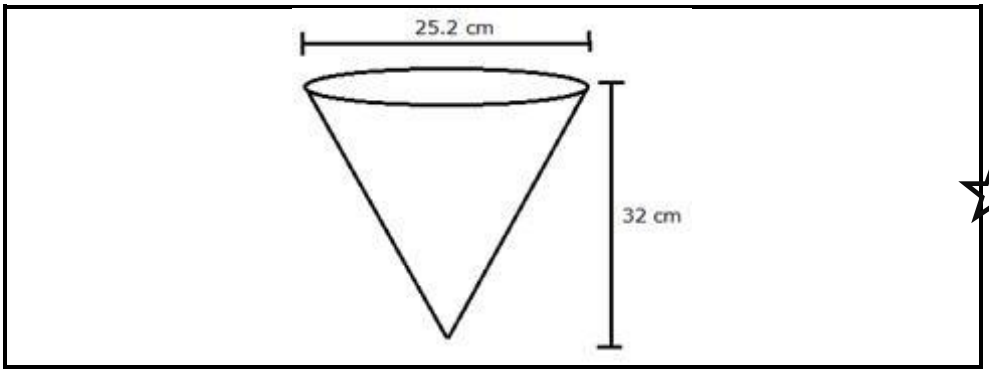


FIGURE 2 (4)

2.3 After the fabrication of a pressure vessel, tests should be carried out before the product is handed over to the client.

2.3.1 Explain what is meant by a *complete operational test of a pressure vessel.* (2)

2.3.2 Specific steps should be followed to carry out the test mentioned in QUESTION 2.3.1.

State these THREE steps. (3)
[18]

QUESTION 3

3.1

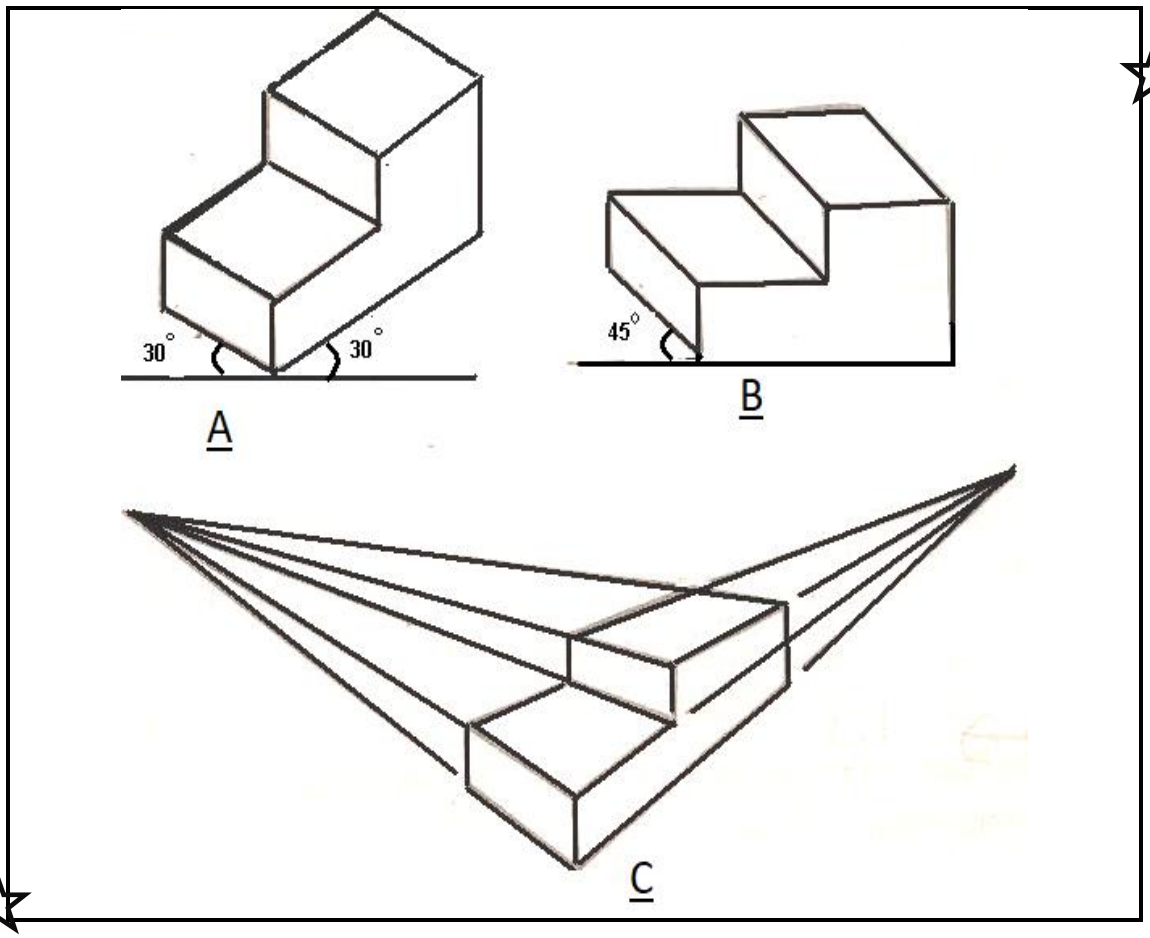


FIGURE 3

FIGURE 3 shows one object drawn in three different three-dimensional images.

3.1.1 Name each type of dimensional image by writing only the answer next to the letter (A–C). (2 × 3) (6)

3.1.2 State the difference between image 'A' and image 'C'. (2)

3.2 A chain hoist is shown in FIGURE 4. Chain hoists are lifting equipment that are used to lift heavy objects and are suited for different jobs.

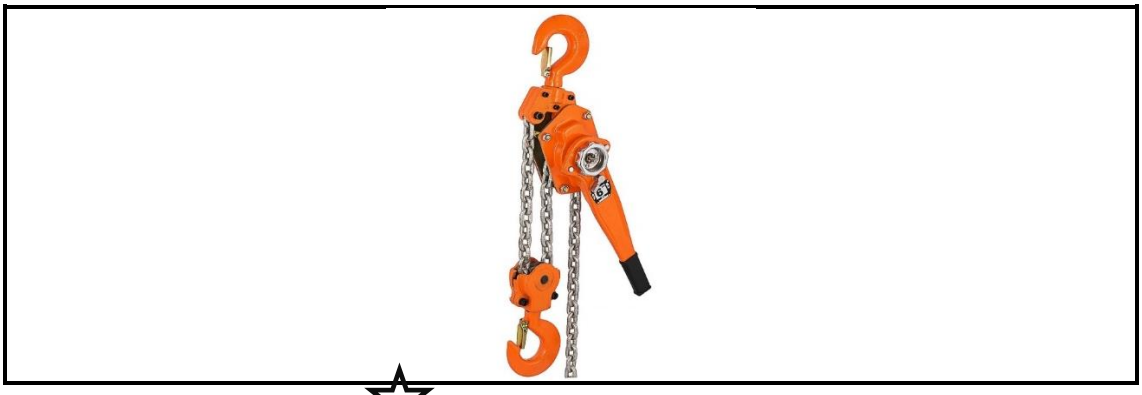


FIGURE 4

3.2.1 Name the hoist shown in FIGURE 4. (1)

3.2.2 State TWO uses of the hoist you mentioned in QUESTION 3.2.1 as opposed to a chain block. (2)

3.3 Before using hoisting equipment, ensure compliance with the rules set by the Occupational Health and Safety Act.

State SEVEN rules that must be adhered to. (7)
[18]

QUESTION 4

4.1 The most convenient way in which to write big or small numbers, is with the use of the power of ten notation.

Convert the following as indicated :

4.1.1 100 km to metres

4.1.2 1 000 cm to millimetres

4.1.3 25 mm^2 to m^2

4.1.4 1 hectare to square metres

(4 × 1) (4)

4.2 The tool shown in FIGURE 5 is used in different trades in engineering. It has three tube vials positioned in three different directions for measuring.

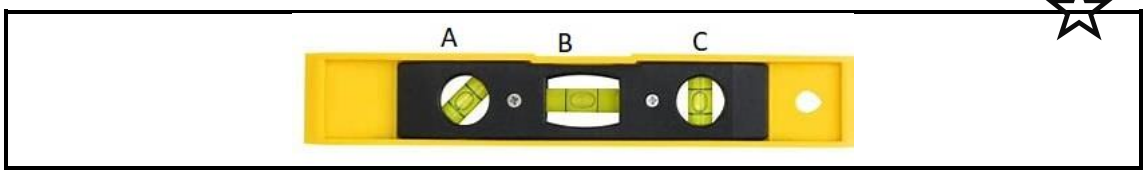


FIGURE 5

4.2.1 Name the tool shown in FIGURE 5. (1 × 2) (2)

4.2.2 State TWO uses of the tool shown in FIGURE 5. (2)

4.3 Use Pythagoras' theorem to calculate the travel of a pipe that has a 178 mm advance and a 127 mm offset. (4)

4.4 Reading and interpreting a pipework drawing is important.

State SIX important tasks that you would need to do before making and installing pipework. (6)
[18]

QUESTION 5

5.1 CNC machines have three main controls attached to them.

Explain each of the following CNC controls:

5.1.1 Software

5.1.2 Hardware

5.1.3 Algorithms

(3 × 1) (3)

5.2 Name FOUR components of a CNC lathe machine that are identical to a normal NC machine. (4)

5.3 FIGURE 6 shows a CNC drilling machine in action.

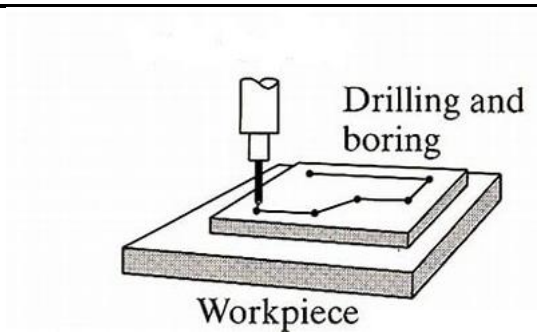


FIGURE 6

5.3.1 What type of toolpath movement is shown in FIGURE 6? (1)

5.3.2 Define the toolpath movement shown in FIGURE 6. (2)

5.3.3 Which toolpath movement has the same characteristics as the one shown in FIGURE 6? (2)

5.4 Briefly explain the JIT principle. (2)

5.5 State THREE steps that a CNC operator must follow when preparing a machine for use. (3)

5.6 As a regular CNC machine operator, which THREE devices would you use to back-up the programme stored in the CNC computer? (3)

5.7 Briefly describe the cleaning of a CNC machine after use under the following headings:

5.7.1 Removal of waste materials

5.7.2 Separate waste

5.7.3 Company's procedure on handling of waste

(3 × 2) (6)

5.8 The selection of tools when executing a job on a CNC machine is vital.

State THREE points to keep in mind when selecting tools before a job commences. (3)

5.9 Components produced from a CNC machine are measured for accuracy.

Name TWO very important instruments that are used to measure completed components from a CNC machine. (2)

[31]

TOTAL SECTION B: 85
GRAND TOTAL: 100

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