higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ENGINEERING FABRICATION – BOILERMAKING
NQF LEVEL 4

(6031014)

22 November 2024 (X-paper)
09:00–12:00

Calculators may be used.

This question paper consists of 8 pages.

453Q1N2422

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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. Write neatly and legibly.

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SECTION A

QUESTION 1

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

1.1.1 CNC machines are … numerically controlled.

1.1.2 The symbol … in CNC programming means that the workpiece must be finished by grinding.

1.1.3 A sketch is a quick free hand … to show the general idea.

1.1.4 … is a residual waste product of material working from welding.

1.1.5 Gas cylinders must be stored in a … position for safety standards.

1.1.6 … theorem applies to any right-angle triangle.

1.1.7 An acetylene gas cylinder contains … gas under pressure.

1.1.8 The welding work area must always be well ventilated, and all fumes must be …

1.1.9 A … shows every individual structure member and component on the job.

1.1.10 A framing square is also called a … or a steel square.

(10 × 1) (10)

1.2 Choose a description from COLUMN B that matches a term 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	Line datum	A	to protect the welder's eyes from ultra-violet rays
1.2.2	Container in which you transport liquid or gas	B	the program that tells the computer how to do a particular job
1.2.3	Helmet	C	represented by the centre point of a circle
1.2.4	Misalignment	D	not lined up properly
1.2.5	A post-processor	E	heats or cools the air
		F	pressure vessel

(5 × 1) (5)

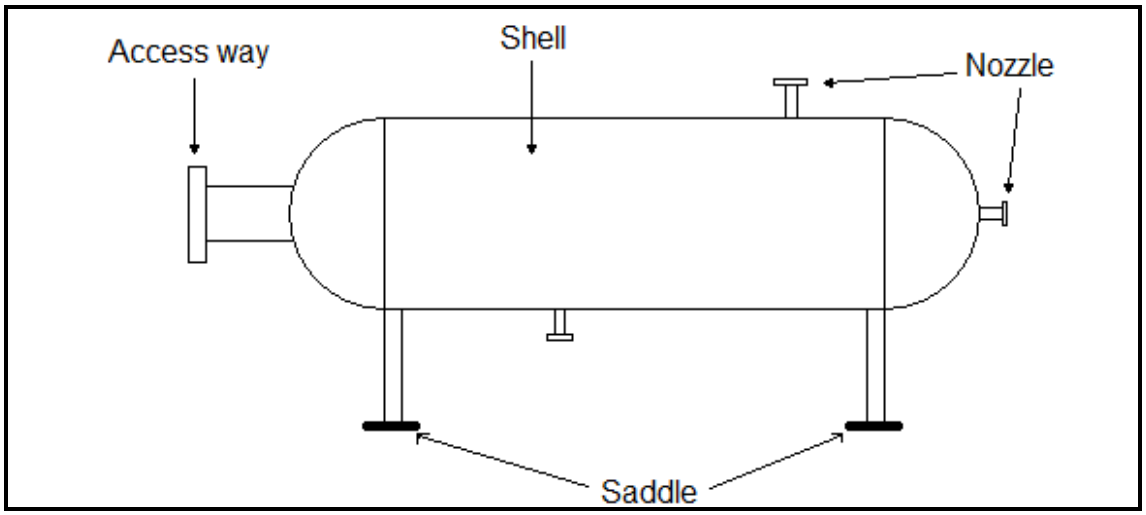
[15]

TOTAL SECTION A: 15

SECTION B

QUESTION 2

2.1 Give a short description on the FOUR identified parts of the pressure vessel in FIGURE 1 below.



(4)

FIGURE 1

2.2 The silo in FIGURE 2 below is used by a farmer to feed poultry and the volume of the cylindrical shape is known. As a level 4 student, use the data below to assist the farmer to calculate the volume of the remaining cone-shaped vessel for procuring the correct amount of feed.

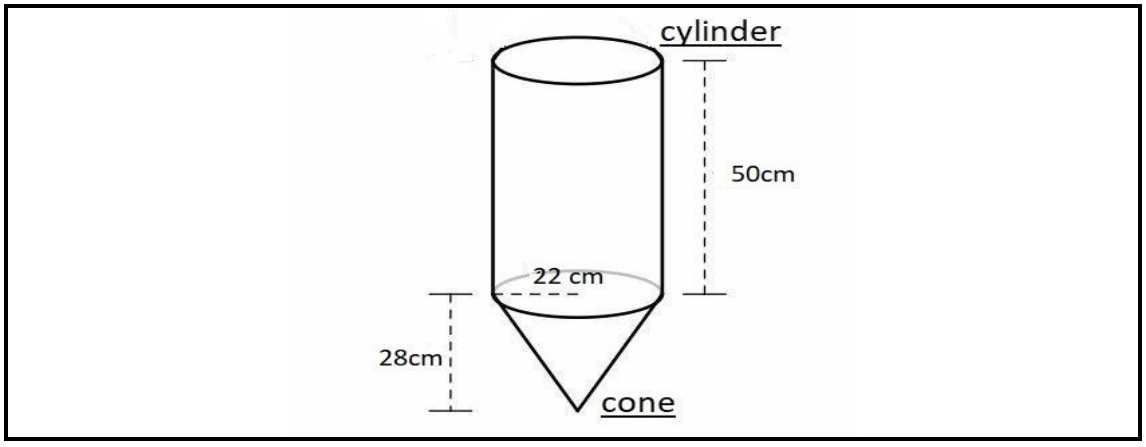


FIGURE 2

NOTE: Diameter = 22 cm
Height = 28 cm

Volume of feed in the vessel = $\frac{1}{3}\pi r^2 h$ (3)

2.3 State any FOUR workshop safety rules that must be observed when working on pressure vessels. (4)

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2.4 There are safety standards set for all pressure vessels.

2.4.1 Give ONE understanding for a 'safe maximum working pressure' of a pressure vessel. (1)

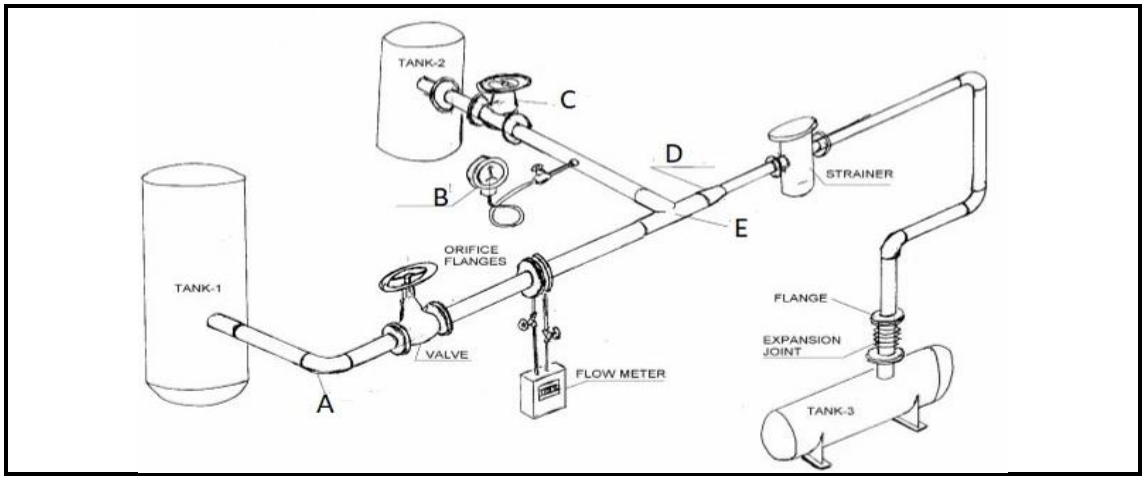
2.4.2 State THREE factors on which a maximum pressure vessel depends. (3)

2.5 Calculating a plate length of part of a circle requires a formula. Write down a formula that can assist you in calculating the plate of part of a circle. (3)
[18]

QUESTION 3

3.1 FIGURE 3 below shows the pipe fittings and components used in pipe work.

Name any THREE fittings and components without labels, marked A–E. Write only the correct name next to the letter (A–E) in the ANSWER BOOK.



(3)

FIGURE 3

3.2 A centre finder is a tool used to find the centre of the pipe.

3.2.1 Give another name for a centre finder. (1)

3.2.2 State the procedure you would follow to mark the top dead centre on a pipe using a centre finder. (4)

3.3 Make a neat, labelled drawing of how to square a flange to a pipe using a framing square. (4)

3.4 Calculate the offset of a pipe if the travel length is 1 200 mm and the advance is 350 mm. (3)

3.5 Your sister, who recently joined you at a TVET college, does not understand conversion factors, and she needs your assistance.

Prove to her that $30\ mm^3 = 30 \times 10^{-9}\ m^3$ (3)
[18]

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QUESTION 4

4.1 Study FIGURE 4 below and answer the questions that follow.

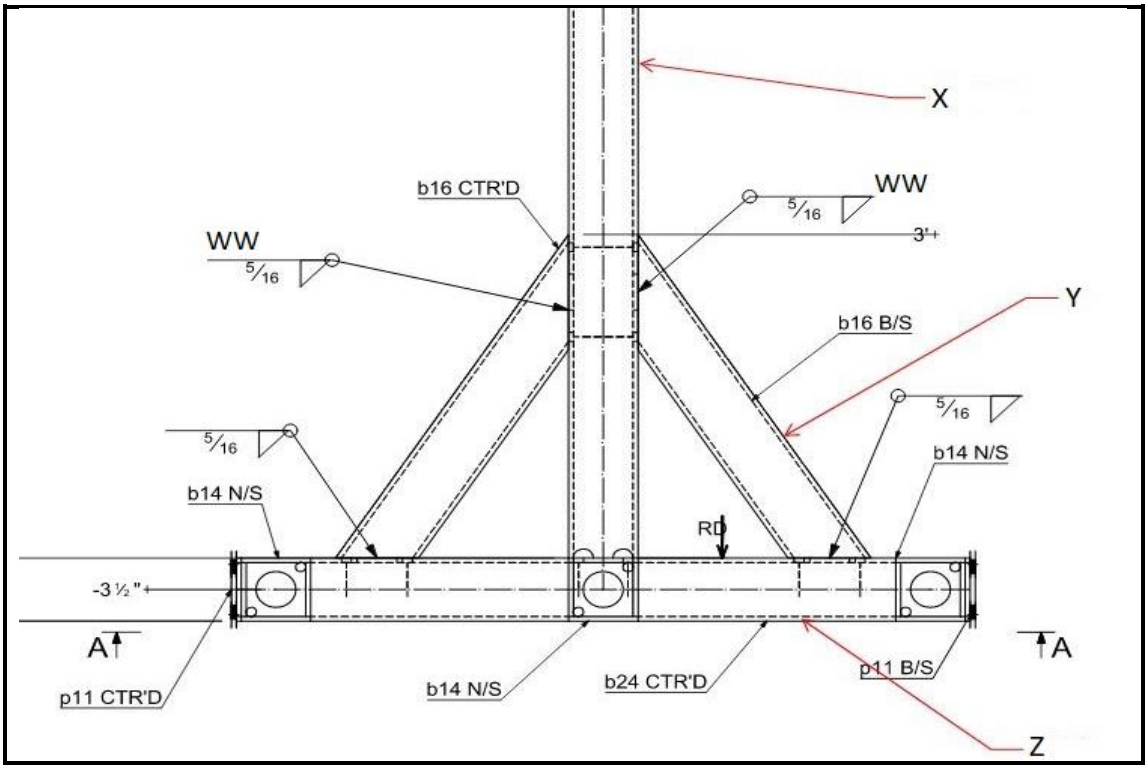


FIGURE 4

4.1.1 FIGURE 4 shows three members (X; Y and Z) joined together. In your ANSWER BOOK, write the name of the following members next to the letter indicating each member as they appear on FIGURE 4. (3)

brace; beam; column

4.1.2 The symbol 'WW' shows the joining method to join members together. Explain how you would join the members together based on the symbol 'WW'. (3)

4.2. Assembly marks are very important for structural assembly.

4.2.1 Give ONE reason for punching an assembly mark on steel components. (1)

4.2.2 If mark 'B1' indicates beam mark number 1, what does 'C1' and 'BR1' indicate? (2)

4.3 List any THREE informative facts that can be obtained from a detail drawing. (3)

4.4 Draw and label a typical roof truss showing any THREE of the following members: rafter, node point, vertical bracing strut, bottom chord, and bracing. (3)

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4.5 FIGURE 5 below shows two views of a first angle orthographic projection (i.e. side and top views) of an object.

4.5.1 State ONE reason why this is a first angle orthographic projection. (1)

4.5.2 From the TWO given views, neatly draw the remaining front view A only without using a scale to show your drawing skills. (3)

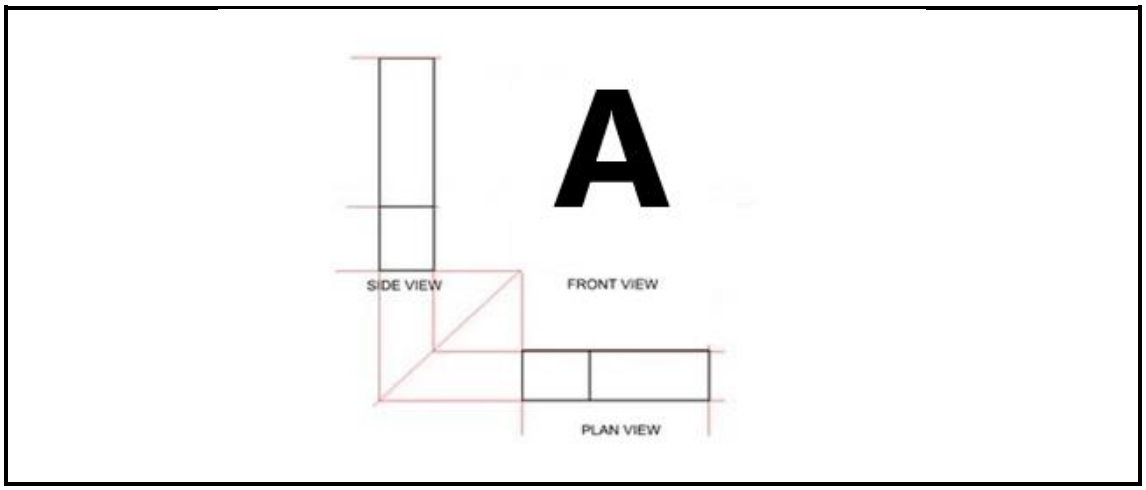


FIGURE 5

[19]

QUESTION 5

5.1 What does the acronym CNC, used in industry, stand for in full? (3)

5.2 State THREE linear axes used in CNC lathe machines with reference to the right-hand rule. (3)

5.3 The machinist must interpret machine shop drawings and find information he or she needs to enter into the CNC program before he or she can start the process. Name FOUR important pieces of information needed for this process. (4)

5.4 Study the definition: 'A three-dimensional drawing method used to show one side of an object flat on, while also showing two of the other two sides'.

5.4.1 To which drawing does the above definition (5.4) refer? (1)

5.4.2 The definition in QUESTION 5.4 differs from the definition for isometric drawing. State THREE facts in which they differ. (3)

5.5 Briefly define each of the following toolpaths generated by CAM system of a CNC machine.

5.5.1 Point-to-point

5.5.2 Continuous path

(2 × 1) (2)

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5.6 State SIX steps that the CNC operator must follow when preparing the machine for use. (6)

5.7 Name THREE different industries that use CNC machines. (3)

5.8 On a CNC lathe machine, most workpieces are clamped in a chuck, but smaller workpieces and long workpieces offer a challenge.

How would you deal with each of the following on a CNC lathe machine when clamping:

5.8.1 Smaller workpieces

5.8.2 Long workpieces

(2 × 1) (2)

5.9 Study the diagram in FIGURE 6 below and answer the questions that follow.

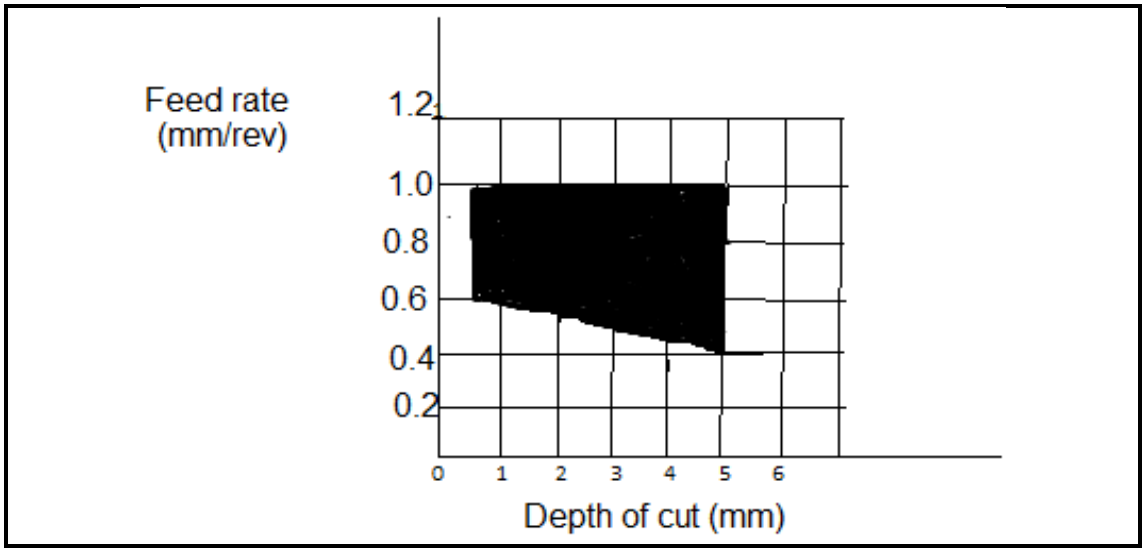


FIGURE 6

5.9.1 Identify the maximum depth to which this insert can cut.

5.9.2 Identify the feed rate range for this insert.

5.9.3 If the depth cut is 2,5 mm, what would the range of the feed rate be?

(3 × 1) (3)

[30]

TOTAL SECTION B: 85
GRAND TOTAL: 100

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