

B O A R D O F S T U D I E S
NEW SOUTH WALES

2002

**HIGHER SCHOOL CERTIFICATE
EXAMINATION**

Metal and Engineering

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black or blue pen
- Board-approved calculators may be used
- Write your Centre Number and Student Number at the top of page 9

Total marks – 80

Section I Pages 2–7

15 marks

- Attempt Questions 1–15
- Allow about 15 minutes for this section

Section II Pages 9–17

35 marks

- Attempt Questions 16–20
- Allow about 45 minutes for this section

Section III Pages 19–21

30 marks

- Attempt TWO questions from Questions 21–23
- Allow about 1 hour for this section

Section I

15 marks

Attempt Questions 1–15

Allow about 15 minutes for this section

Use the multiple-choice answer sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9
A B C D

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A B C D

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word *correct* and drawing an arrow as follows.

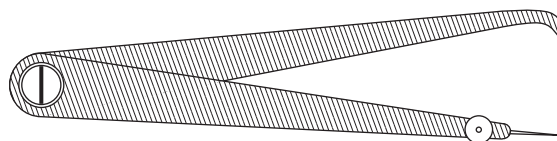
A B C D
correct ↙

- 1 Within the workshop, what is the most appropriate method of conveying accurate dimensions for the manufacture of an item?
- (A) Letter
 - (B) Verbal
 - (C) Signage
 - (D) Drawing

- 2 Name the power hand tool shown in the picture.

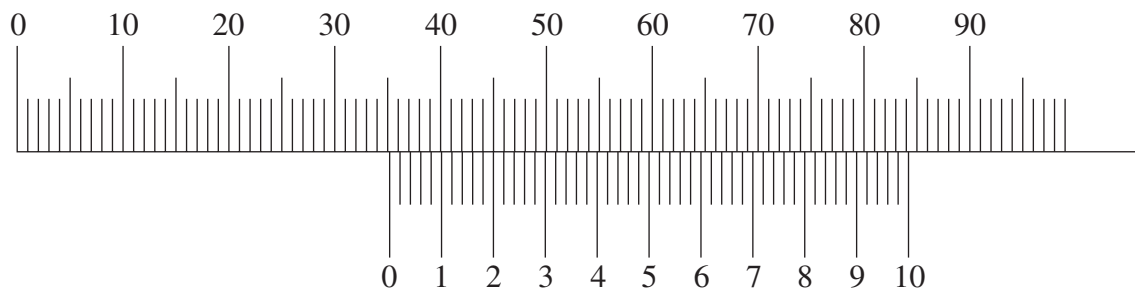


- (A) Nibbler
 - (B) Hand drill
 - (C) Angle grinder
 - (D) Impact wrench
- 3 What is the name of the tool illustrated?



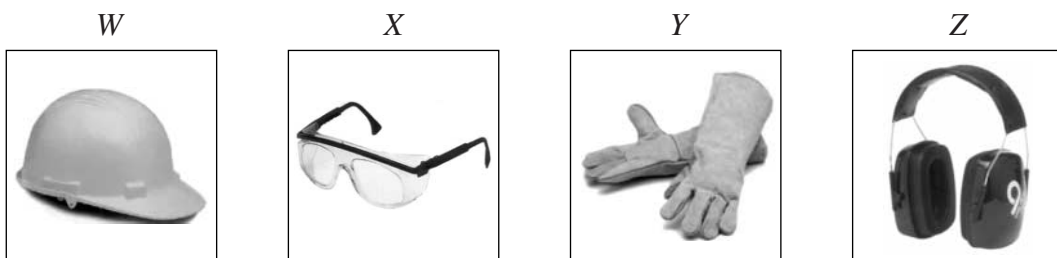
- (A) Dividers
- (B) Jenny calipers
- (C) Inside calipers
- (D) Outside calipers

- 4 The diagram shows the reading on a vernier caliper.



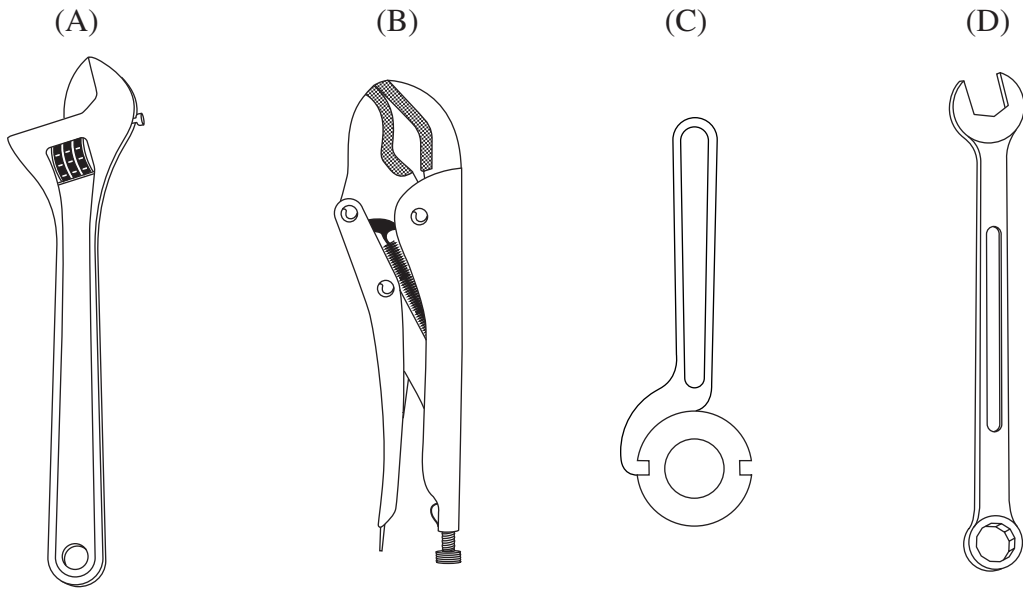
What is the reading?

- (A) 35.00
(B) 35.20
(C) 45.20
(D) 84.20
- 5 What personal protective equipment should be supplied to the tradesperson to operate a hand-held drill in a noisy area?

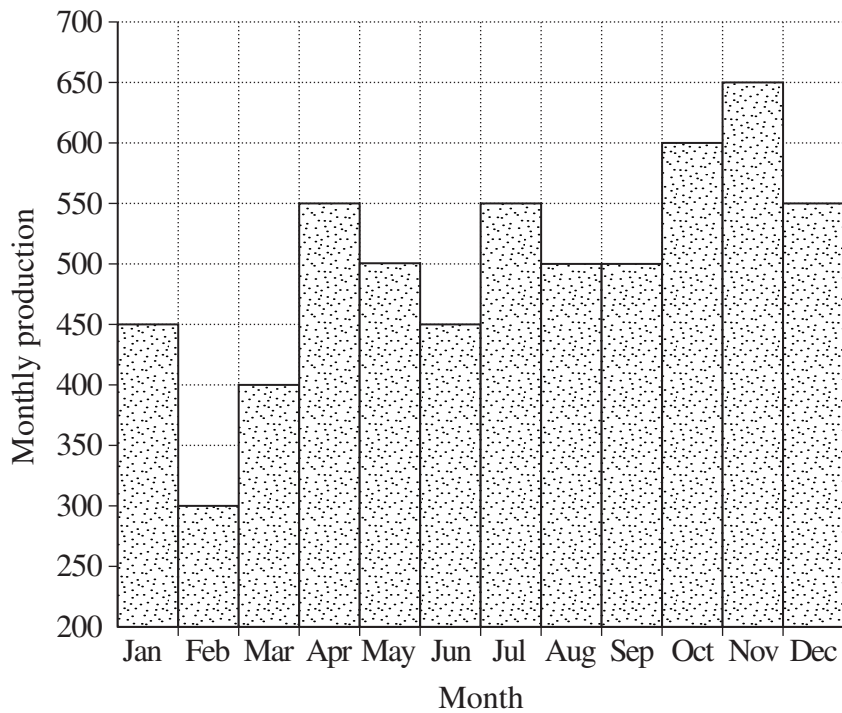


- (A) W and Y
(B) X and Y
(C) X and Z
(D) Y and Z

6 Which of the following is the most appropriate tool to tighten a standard hexagonal nut?



7 A company's monthly production figures are shown.



Calculate the AVERAGE monthly production.

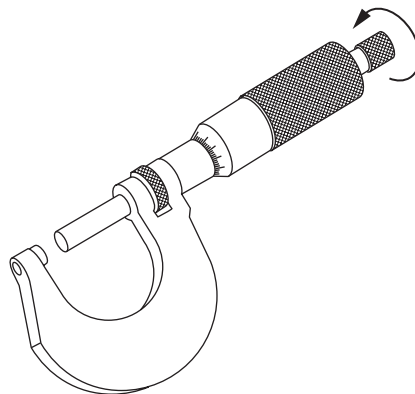
- (A) 500
- (B) 600
- (C) 1000
- (D) 6000

- 8** Who is responsible for providing an employee with personal protective equipment?
- (A) The employee
 - (B) The employer
 - (C) The Occupational Health and Safety (OHS) committee
 - (D) The WorkCover representative
- 9** What is the most appropriate method of determining if a hand angle grinder is electrically safe to use?
- (A) Check the name plate.
 - (B) Check the compliance plate.
 - (C) Check the power tool tagging.
 - (D) Check the power tool log book.
- 10** A shaft is to be manufactured to the following specifications

$$\begin{array}{r} + 0.02 \\ \varnothing 244.50 \\ + 0.00 \end{array}$$

- Which tool is the most appropriate to use to check that the manufactured shaft conforms to these specifications?
- (A) Feeler gauge
 - (B) Dial indicator
 - (C) Vernier caliper
 - (D) Outside calipers
- 11** A person is injured at work and has five days off. Under what section of an industrial award would the person be entitled to be paid for the time off?
- (A) WorkCover
 - (B) Leave with pay
 - (C) Recreation leave
 - (D) Workers compensation

- 12 An electrical switch-box in a workshop begins to smoulder and catch fire. After evacuation of the area, what action should be taken?
- (A) Isolate the power.
 - (B) Notify the Occupational Health and Safety (OHS) committee.
 - (C) Spray with a fire extinguisher.
 - (D) Smother the fire with a fire blanket.
- 13 What is the name of the drawing that shows all the dimensions required to manufacture a single component?
- (A) Detail drawing
 - (B) Assembly drawing
 - (C) Perspective drawing
 - (D) Subassembly drawing
- 14 The reading on a metric micrometer is 16.83 mm.



- What will be the new reading after one complete turn of the thimble in the direction of the arrow as shown?
- (A) 15.83 mm
 - (B) 16.33 mm
 - (C) 16.73 mm
 - (D) 17.73 mm
- 15 Which of the following best describes a quality procedure?
- (A) A process for ensuring that some products are inspected
 - (B) A process for ensuring that the output of products is of the same standard
 - (C) A process for ensuring that customers are sold products of a high standard
 - (D) A process for ensuring that all products are produced to a specified standard

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Metal and Engineering

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Centre Number

Section II

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Student Number

35 marks

Attempt Questions 16–20

Allow about 45 minutes for this section

Answer the questions in the spaces provided.

Question 16 (6 marks)

Please turn over

Question 16 (6 marks)

A client of your engineering firm has supplied you with a freehand sketch of a trolley wheel subassembly as shown in Figure 1.

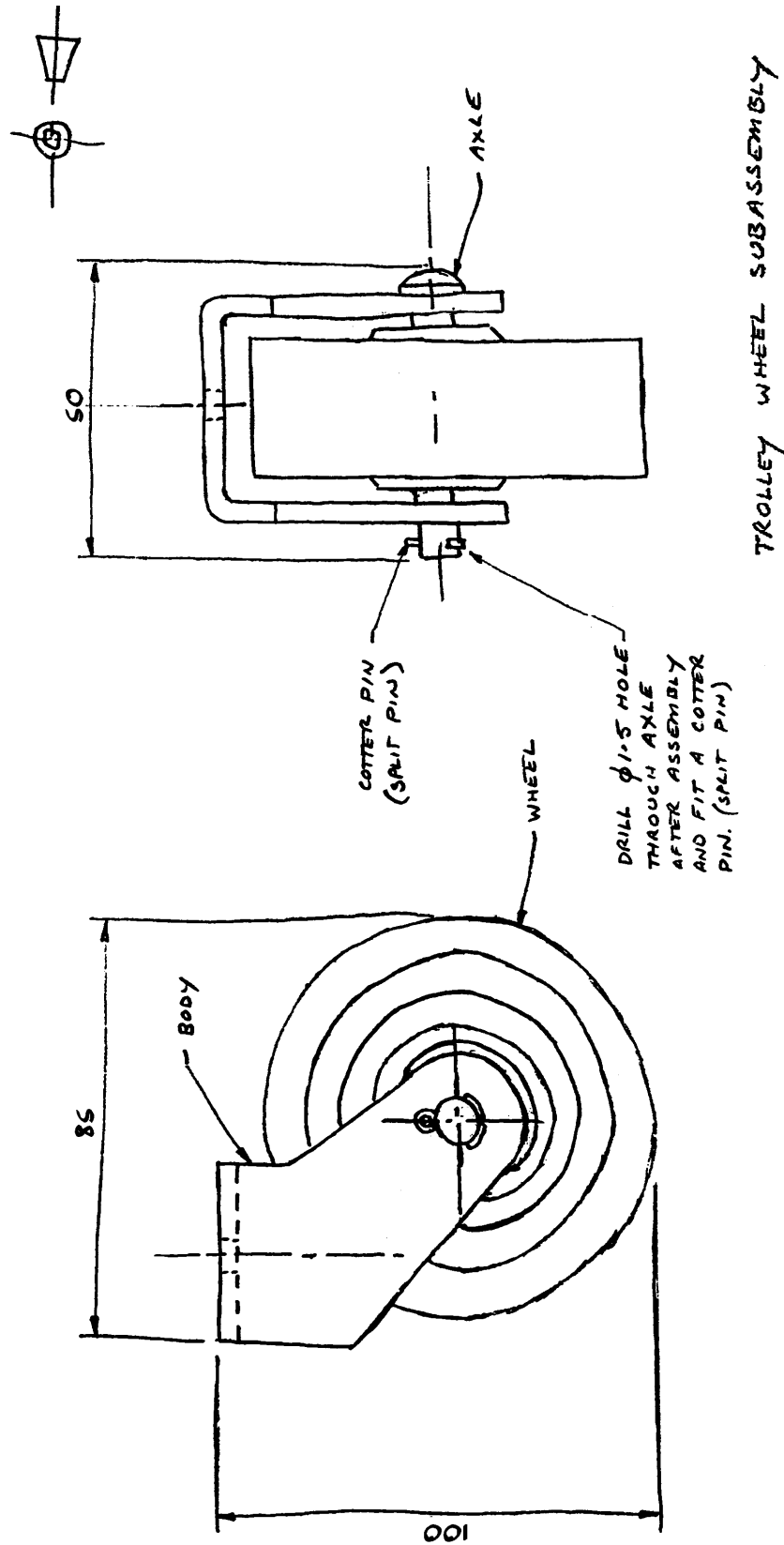


Figure 1

Question 16 continues on page 11

Question 16 (continued)

(a) The freehand sketch in Figure 1 on page 10 is drawn in which angle of projection? **1**

.....

(b) How many items make up the trolley wheel subassembly? **1**

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(c) Why is the freehand sketch used? Would this sketch enable the manufacture of the trolley wheel subassembly? Justify your response. **4**

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End of Question 16

Please detach page 17 and use Drawing 2002–1 to answer Questions 17 and 18.

Question 17 (9 marks)

- (a) Name the drawing representation used. **1**
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- (b) The PIN is manufactured from MS. What does MS indicate? **1**
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- (c) Refer to NUT, location B4. What does the notation M6 indicate? **2**
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- (d) What is the total overall length of the PIN, Item 3? Show all working. **2**
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- (e) Refer to Items 1 and 3, the BODY and PIN. The $\varnothing 8$ hole in the BODY has a slot 3 wide. Explain the functions of the $3 \times 45^\circ$ SNUG. **3**
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Question 18 (6 marks)

The WHEEL, Item 2, should rotate freely on the PIN, Item 3. For this, a clearance fit between these two items is required.

The drawing office has supplied the following sizes:

Item 2 Wheel bore $\varnothing 8.000$ $+ 0.015$
 $+ 0.000$

Item 3 Pin diameter $\varnothing 8.000$ $- 0.018$
 $- 0.035$

(a) Complete the table based on the information above.

4

	<i>Wheel bore</i>	<i>Pin diameter</i>
Nominal size	8	8
Basic size	8.000	8.000
Upper limit	8.015	
Lower limit	8.000	
Tolerance		

(b) What precision measuring tool should be used to ensure that the PIN conforms to the required sizes? Justify your answer.

2

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Question 19 (8 marks)

A small item to be drilled in the drill press could be set up as shown in Figure 2.

- (a) Name the components of Figure 2 in the spaces provided. **3**

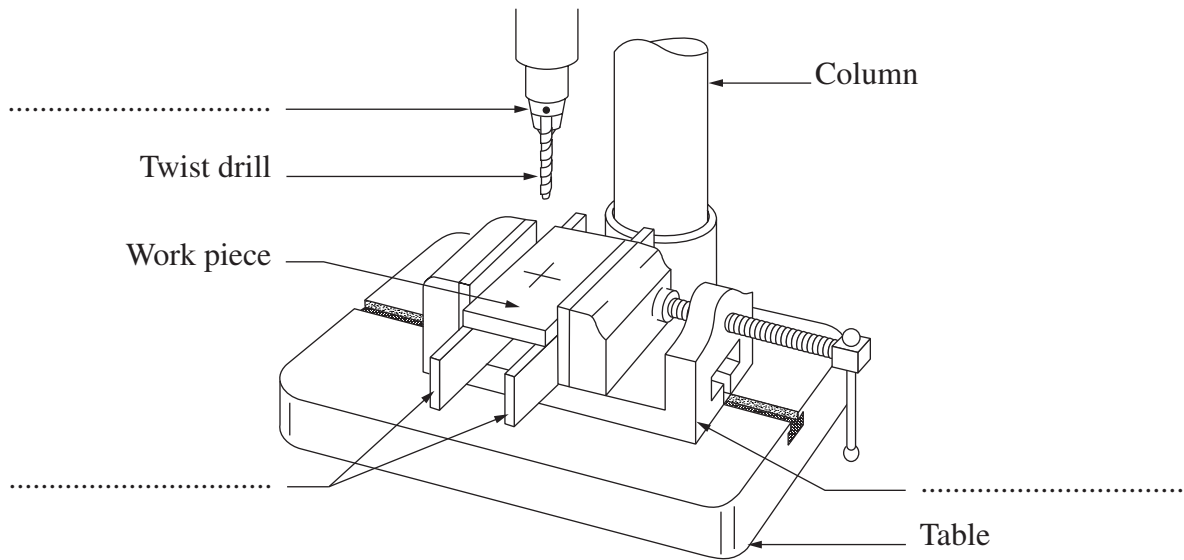


Figure 2

- (b) Outline the personal safety requirements and identify a range of procedures to protect the operator, the drill press and accessories. **5**

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Question 20 (6 marks)

When using a drill press to drill a hole, the drill speed should be set to suit the material being drilled and the diameter of the drill.

- (a) A drill press has a four-step vee belt cone pulley drive as shown in Figure 3. **2**
 The four speeds available on the drill are 525, 1000, 1660 and 2250 revolutions/minute.

Using Figure 3, draw the vee belt in a position to give a drill speed of 1000 revolutions/minute.

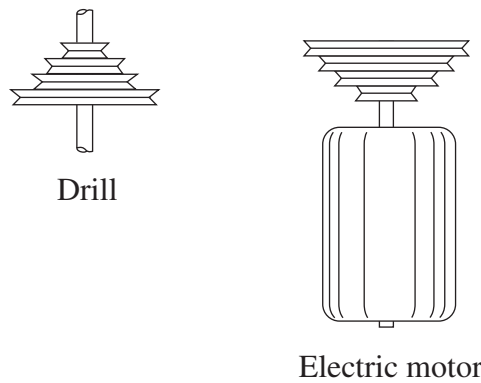


Figure 3

- (b) A $\varnothing 12$ hole is to be drilled in a piece of mild steel using a cutting speed of 20 metres/minute. **4**

Using the two formulas given, calculate the speed at which the drill should rotate. Show all working.

$$\text{Circumference} = 2\pi r$$

$$\text{Revolutions/minute} = \frac{\text{Cutting speed} \times 1000}{\text{Circumference of drill in mm}}$$

..... revolutions/minute

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Please detach this page and use Drawing 2002-1 to answer Questions 17 and 18.

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Metal and Engineering

Section III

30 marks

Attempt TWO questions from Questions 21–23

Allow about 1 hour for this section

Answer each question in a SEPARATE writing booklet. Extra writing booklets are available.

In your answers you will be assessed on how well you:

- demonstrate relevant knowledge and understanding
 - communicate ideas and information, using precise industry terminology and appropriate workplace examples
 - organise information in a well-reasoned and cohesive response
 - solve proposed issues or problems
-

Question 21 (15 marks)

Employees training in the metal industry may be either apprentices or trainees. Their training is regulated by state and/or federal industry awards, which involve responsibilities for employers and employees, training plans and indentures.

Describe the key features of traineeship and apprenticeship arrangements in New South Wales and discuss their advantages and disadvantages.

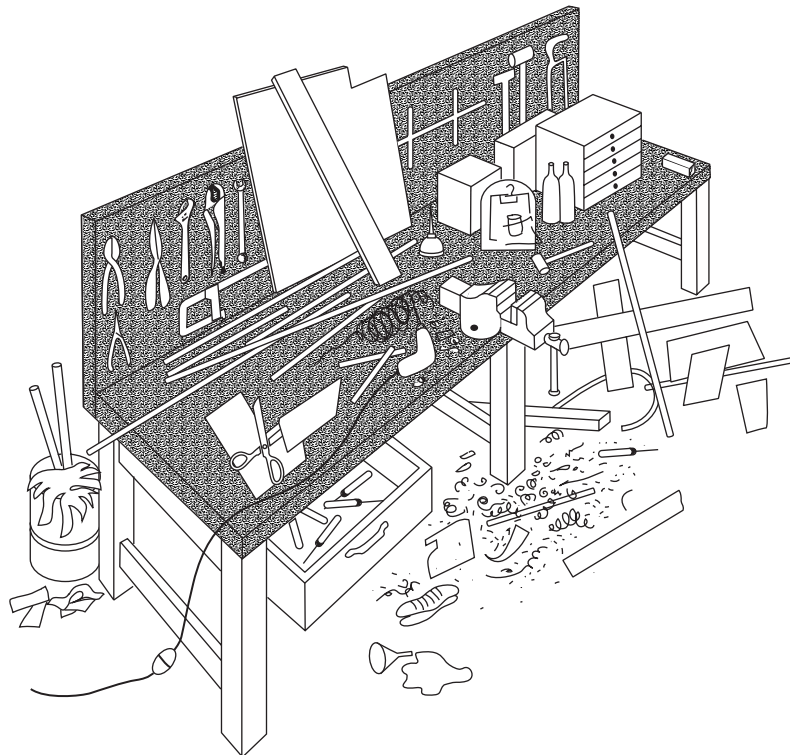
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In your answers you will be assessed on how well you:

- demonstrate relevant knowledge and understanding
 - communicate ideas and information, using precise industry terminology and appropriate workplace examples
 - organise information in a well-reasoned and cohesive response
 - solve proposed issues or problems
-

Question 22 (15 marks)

Some examples of unsafe practices are shown.



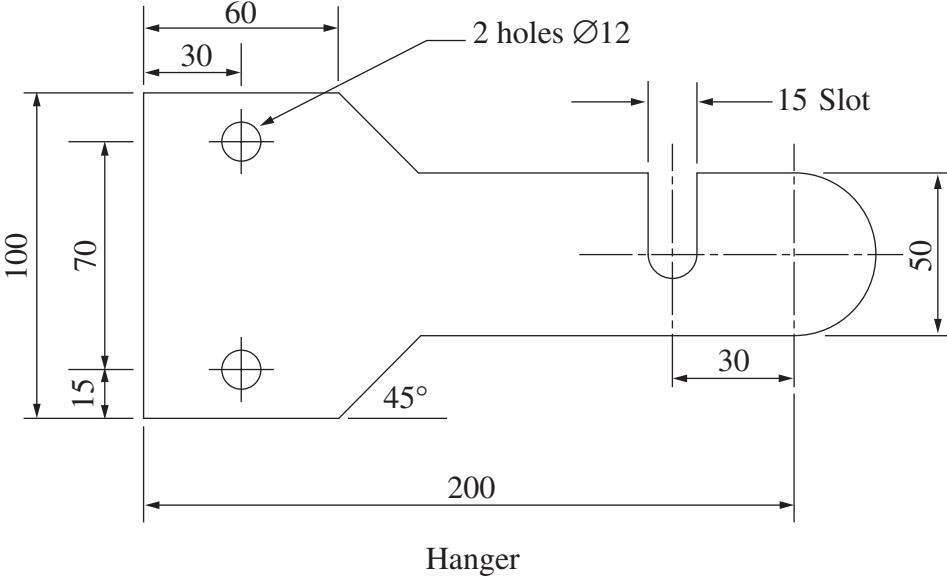
Workshop bench area

Discuss, using the examples of unsafe practices shown, the roles and responsibilities of employees, employers and Occupational Health and Safety (OHS) committees in the reduction or elimination of unsafe practices.

Evaluate the impact of OHS legislation in changing workplace practices and culture.

Question 23 (15 marks)

A hanger is to be made, as shown below, using hand tools and power tools. The material available is 250 × 100 × 3 MS.



All sizes ± 0.5 mm.

Develop a production plan that identifies the appropriate tasks and equipment required to produce the hanger. Include checking procedures to ensure that the hanger has been produced to specification.

End of paper

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