

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

2009

**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 pages 9 and 13

Total marks – 80

Section I Pages 2–6

15 marks

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

Section II Pages 9–16

35 marks

- Attempt Questions 16–19
- Allow about 45 minutes for this section

Section III Page 17

30 marks

- Attempt TWO questions from Questions 20–22
- Allow about 1 hour for this section

Section I

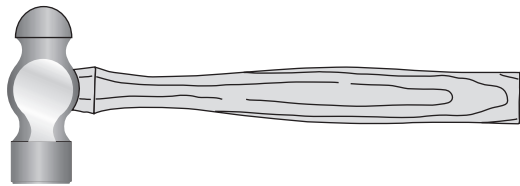
15 marks

Attempt Questions 1–15

Allow about 15 minutes for this section

Use the multiple-choice answer sheet for Questions 1–15.

- 1 What type of common metalworking hammer is shown?

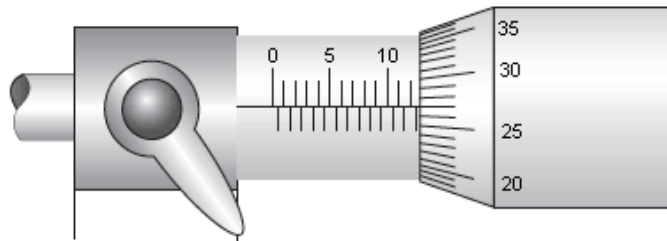


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- (A) Claw
(B) Ball pein
(C) Soft-faced
(D) Warrington
- 2 A large hexagonal nut has been over-tightened onto a bolt.
Which tool would be the most appropriate to loosen and undo the nut?
- (A) Ring spanner
(B) Stillson wrench
(C) Tension wrench
(D) Shifting spanner
- 3 What is the basic unit of measurement that has been adopted for most manufacturing and engineering applications?
- (A) Micrometre
(B) Millimetre
(C) Centimetre
(D) Metre

- 4 What is the name given to a multi-view drawing that shows how all the component parts fit together?
- (A) Detail drawing
 - (B) Sectional drawing
 - (C) Assembly drawing
 - (D) Perspective drawing

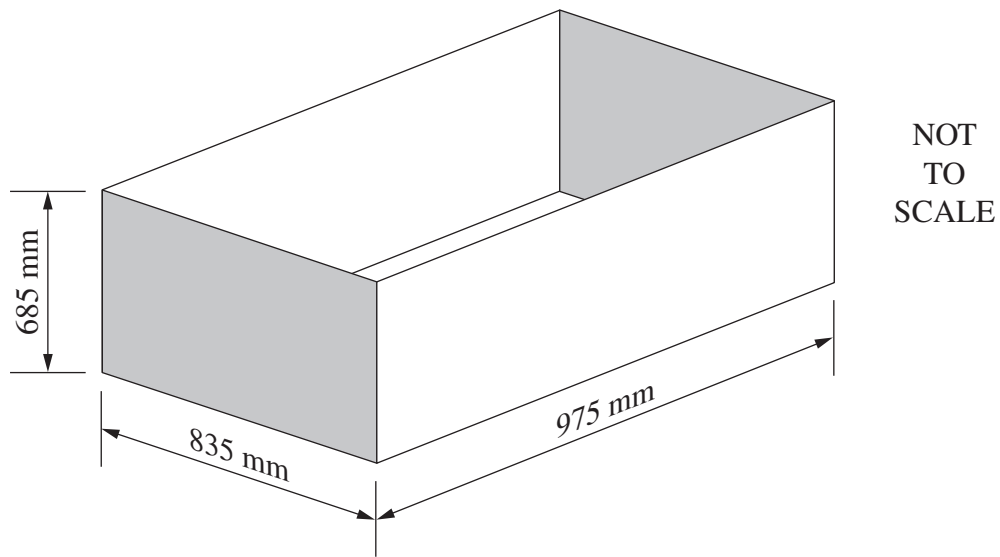
- 5 What is the reading on the micrometer shown?



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- (A) 12.27
 - (B) 12.57
 - (C) 12.67
 - (D) 12.77
- 6 Which of the following is the first step in planning the manufacture of a job?
- (A) Sequencing production tasks
 - (B) Selecting tools and equipment
 - (C) Interpreting the drawing provided
 - (D) Locating materials and parts required
- 7 Alex arrives at his workplace to find a machine with a *DO NOT OPERATE* tag attached.
- Who has the authority to remove this tag?
- (A) The operator, Alex
 - (B) A workplace supervisor
 - (C) The person who put it there
 - (D) An Occupational Health and Safety (OHS) representative

- 8 The two shaded ends of the open-topped steel tank shown are to be attached by welding externally.



What is the total length to be welded?

- (A) 2205 mm
 - (B) 4410 mm
 - (C) 6080 mm
 - (D) 6360 mm
- 9 What type of error occurs if a micrometer is not zeroed and properly adjusted?
- (A) Parallax
 - (B) Reading
 - (C) Alignment
 - (D) Calibration

10 What does this symbol indicate on an engineering drawing or sketch?



- (A) Datum
 - (B) Fillet weld
 - (C) Morse taper
 - (D) Surface finish
- 11** A manufacturer of a hazardous substance provides a document to users detailing its appropriate handling and use.
- What is this document called?
- (A) WorkCover codes
 - (B) OHS Committee guidelines
 - (C) Safe work method statement
 - (D) Materials safety and data sheet
- 12** What is the appropriate method of determining if a hand-held angle grinder is electrically safe to use?
- (A) Look at the compliance plate
 - (B) Read the power tool log book
 - (C) Check for a current appliance test tag
 - (D) Plug it in and switch on to see if it works
- 13** The skills of prioritising and negotiating are key components of which metal and engineering practice?
- (A) Task management
 - (B) Conflict resolution
 - (C) Standard operating procedures
 - (D) Equal opportunity employment

- 14** What key component within the title block allows a reader to determine if a technical drawing is current?
- (A) The drawing version
 - (B) The drawing number
 - (C) The drawing tolerances
 - (D) The drawing instructions
- 15** Which of the following best describes *quality control*?
- (A) A series of checks to ensure customer requirements are met
 - (B) A process for ensuring that customers are in control of quality
 - (C) A strategy for ensuring that customers are sold products on time
 - (D) A plan that assists a manufacturer to meet customer requirements

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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 16–19

Allow about 45 minutes for this section

Detach page 20, and use Drawing 2009–1, DRILL CRANK, to answer Questions 16–17.

Answer the questions in the spaces provided.

Question 16 (10 marks)

Refer to Drawing 2009–1 to answer parts (a) to (e).

- (a) What type of drawing is shown? 1

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- (b) How many 5 mm diameter holes are required to produce the DRILL CRANK? 1

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- (c) Calculate the maximum clearance between the KNOB and the ARM when the DRILL CRANK is assembled. Show all working. 2

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- (d) Complete the materials list by filling in the missing spaces. 3

N°	N° Off	Description	Length	Width	Thickness	Material
1	1	ARM	80	13		MS
2	1	FERRULE	6	Ø12	NA	
3	1	KNOB	30		NA	WOOD
4	1	PIVOT	36.5	Ø9	NA	BRASS

Question 16 continues on page 10

Question 16 (continued)

- (e) Describe a suitable method that could be used to permanently fix the PIVOT to the ARM. **3**

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End of Question 16

Question 17 (8 marks)

(a) In the table provided, propose a sequence of steps that could be followed to mark out and manufacture the double hole at the top of Item 1–ARM, location B2. For each step, list the tools required.

6

<i>Sequence of steps – marking out</i>	<i>Tools</i>
<i>Sequence of steps – manufacture</i>	<i>Tools</i>

(b) Outline a checking procedure to ensure that the double hole is manufactured accurately.

2

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Metal and Engineering

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Centre Number

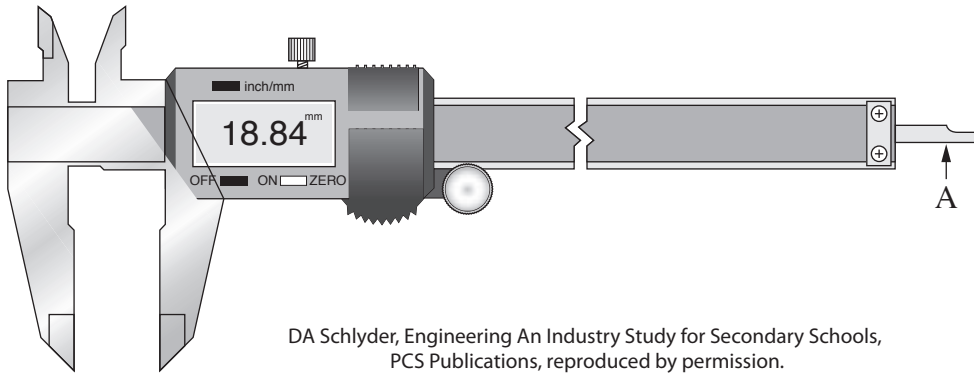
Section II (continued)

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Student Number

Question 18 (8 marks)

(a) The figure shows a digital vernier caliper.



(i) To what accuracy can this digital vernier caliper display a measurement? **1**

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(ii) What is the part labelled A used to measure? **1**

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(b) Outline issues that should be considered when storing a measuring device with a digital display. **3**

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Question 18 continues on page 14

Question 18 (continued)

(c) Outline the advantages of applying digital technology to measuring devices. **3**

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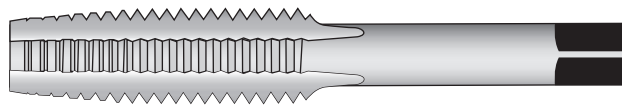
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End of Question 18

Question 19 (9 marks)

- (a) Name the tap shown, and give ONE specific application.

2



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Name:

Specific application:

- (b) A piece of mild steel 10 mm thick requires a hole with an internal thread, M12 × 1.25.

Tap Chart – Metric Threads

Tap Size	Major diameter (mm)	mm per thread	Drill size (mm)
M8 × 1.25	8	1.25	6.8
M8 × 1	8	1	7
M10 × 1.5	10	1.5	8.5
M10 × 1.25	10	1.25	8.8
M12 × 1.75	12	1.75	10.2
M12 × 1.25	12	1.25	10.8
M14 × 2	14	2	12
M14 × 1.5	14	1.5	12.5

- (i) From the table provided, select the appropriate drill size for this thread.

1

Drill size = mm

- (ii) Calculate the speed at which the selected drill (from part (b) (i)) should rotate, using a cutting speed of 45 metres per minute. Show all working.

2

$$\text{Revolutions per minute} = \frac{\text{Cutting speed (m/min)} \times 300}{\text{Diameter of drill (mm)}}$$

Question 19 continues on page 16

Question 19 (continued)

- (c) What precautions should be taken to prevent taps from breaking when producing internal threads? Give reasons to support your answer. **4**

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End of Question 19

Metal and Engineering

Section III

30 marks

Attempt TWO questions from Questions 20–22

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
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Question 20 (15 marks)

Explain how the use of quality improvement strategies can benefit both a metal and engineering company and its customers.

In your response, refer to planning, controlling the production process, inspection and testing.

Question 21 (15 marks)

Explain how the personal attributes of employees can contribute to an effective and productive workplace.

In your response, refer to appropriate workshop conduct, safety and communications.

Question 22 (15 marks)

Explain how hazards and the risk of injury are reduced through the application of appropriate control measures when using a portable electric power drill.

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Metal and Engineering

Detach this sheet and use Drawing 2009–1 to answer Questions 16–17.

Please turn over

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