

Metal and Engineering

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black or blue pen
Black pen is preferred
- Board-approved calculators may be used
- Write your Centre Number and Student Number at the top of pages 9, 13 and 17

Total marks – 80

Section I Pages 2–6

15 marks

- Attempt Questions 1–15
- Allow about 20 minutes for this section

Section II Pages 9–18

35 marks

- Attempt Questions 16–19
- Allow about 50 minutes for this section

Section III Page 19

15 marks

- Attempt Question 20
- Allow about 25 minutes for this section

Section IV Page 20

15 marks

- Attempt Question 21
- Allow about 25 minutes for this section

Section I

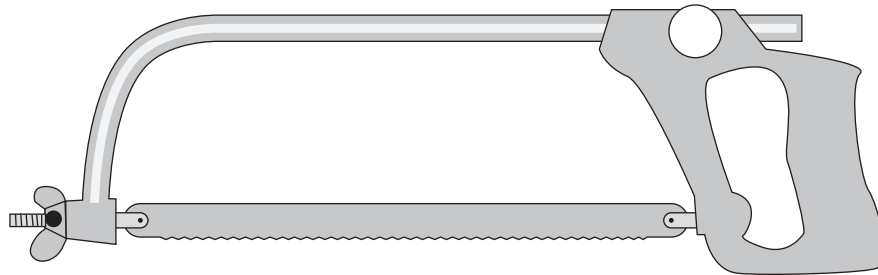
15 marks

Attempt Questions 1–15

Allow about 20 minutes for this section

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

1



What is the name of the tool shown?

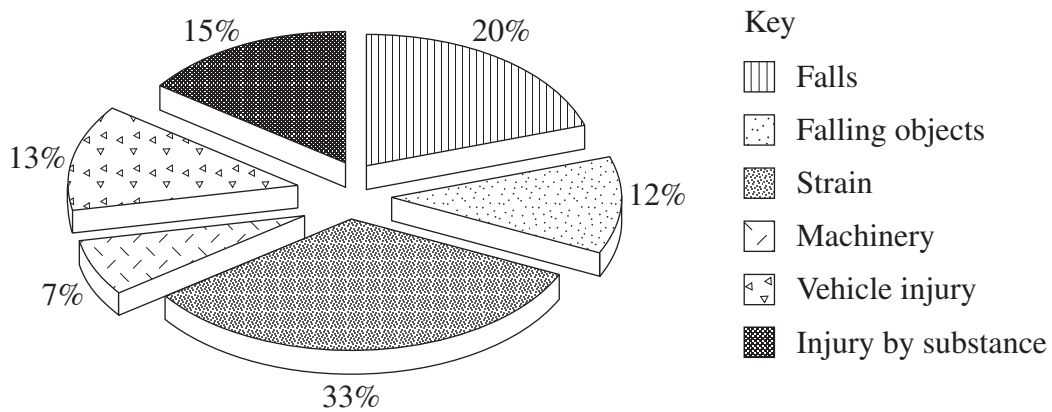
- (A) Bandsaw
 - (B) Coping saw
 - (C) Fret saw
 - (D) Hacksaw
- 2 Which of the following grades of file would be the fastest in removing material?
- (A) Bastard
 - (B) Dead smooth
 - (C) Second cut
 - (D) Smooth
- 3 The pitch of a hacksaw blade is defined by the
- (A) set of the teeth.
 - (B) shape of the teeth.
 - (C) number of teeth per inch.
 - (D) number of teeth on the blade.

4 A thread is to be finished into the bottom of a blind hole using a set of three taps.

Which tap should be used first?

- (A) Bottoming
- (B) Gun
- (C) Intermediate
- (D) Taper

5 The pie chart represents a record of 1000 injuries to workers by category.



One third of 'Injury by substance' injuries resulted from contact with chemicals.

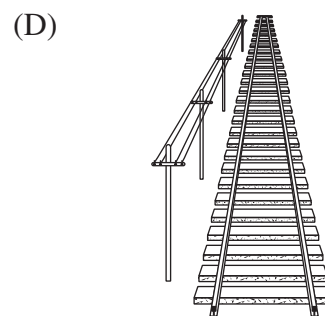
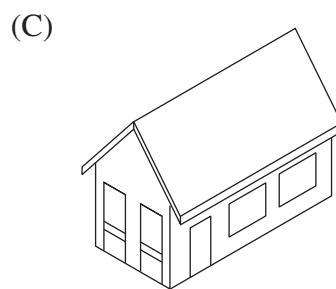
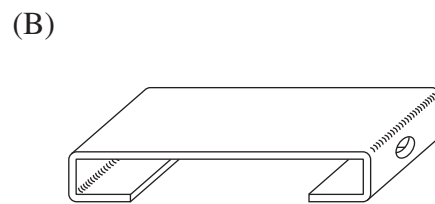
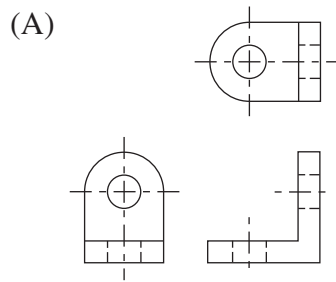
How many workers were injured by contact with chemicals?

- (A) 5
 - (B) 15
 - (C) 50
 - (D) 150
- 6 While operating a hand-held power jigsaw, you notice the electrical lead has been damaged.

What should now be done with the jigsaw?

- (A) Tag and record
- (B) Replace the lead
- (C) Return the jigsaw into storage
- (D) Tape up the lead and continue to use it

7 Which of the following is an isometric pictorial drawing?



8 A workplace injury, requiring the worker to have five days off work, occurred as a result of contact with a chemical substance.

What part of a worker's employment conditions would cover this absence?

- (A) Sick leave
- (B) Leave without pay
- (C) WorkCover insurance
- (D) Workers compensation

9 2500 mm of mild steel (MS) bar at a cost of \$1.20 per metre is needed to make a drainage grille. Of 85 grilles manufactured, 78 pass final inspection.

What is the cost to the manufacturer for the materials used in the grilles that failed the final inspection?

- (A) \$8.40
- (B) \$21.00
- (C) \$234.00
- (D) \$255.00

- 10** What information does the specification of a job provide to a worker?
- (A) Instructions to make the job
 - (B) Minimum conditions to ensure the job is usable
 - (C) The quality of workmanship required for the job
 - (D) A drawing depicting how the job is to be assembled

- 11** A metric micrometer is shown.



What is the name of the part indicated at X?

- (A) Ratchet
 - (B) Sleeve
 - (C) Spindle
 - (D) Thimble
- 12** Which document must be consulted to determine the personal protective equipment (PPE) that must be used when operating a piece of machinery?
- (A) The industry advisory code
 - (B) The manufacturer's handbook
 - (C) The material safety data sheet
 - (D) The standard operating procedure

- 13** What is the purpose of contingency planning when managing workloads within a team?
- (A) To allow for changes in project costs
 - (B) To prevent delays in work completion
 - (C) To ensure correct storage of required materials
 - (D) To improve the quality of communication techniques
- 14** What is the best way to implement quality assurance?
- (A) Inspect and test work samples
 - (B) Plan to meet work specifications
 - (C) Complete customer satisfaction surveys
 - (D) Check the correctness of completed work
- 15** Which of the following provides the clearest guidance for workers to manage a hazardous situation?
- (A) A code of practice
 - (B) A workplace directive
 - (C) A WorkCover regulation
 - (D) A piece of government legislation

BLANK PAGE

BLANK PAGE



Metal and Engineering

--	--	--	--	--

Centre Number

Section II

--	--	--	--	--	--	--	--	--

Student Number

35 marks

Attempt Questions 16–19

Allow about 50 minutes for this section

Detach the page at the end of the paper and use Drawing 2014–1, NUT CRACKER, to answer Questions 16 and 21.

Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.

Use Drawing 2014–1, NUT CRACKER, to answer Question 16.

Question 16 (8 marks)

- (a) Name the finish required for the datum surface E. **1**

.....

- (b) Calculate the tapping drill size for the two threaded holes in ITEM 2. Show all calculations. **2**

.....

.....

.....

.....

.....

Question 16 continues on page 10

Question 16 (continued)

- (c) Explain how the symbol at E6 in the title block determines how the multiple views of each of the items shown must be drawn. **2**

.....

.....

.....

.....

.....

- (d) Why are different line types essential for the preparation of engineering drawings such as Drawing 2014-1, NUT CRACKER? **3**

.....

.....

.....

.....

.....

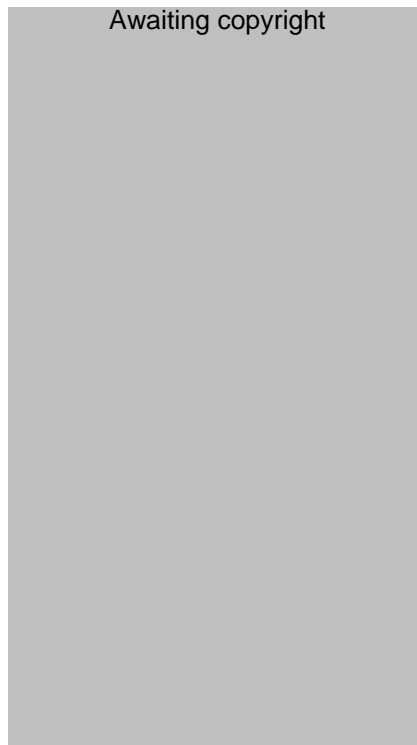
.....

.....

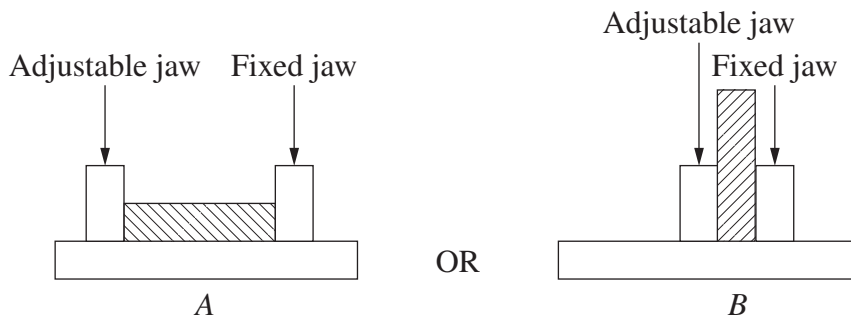
End of Question 16

Question 17 (9 marks)

A photograph of a cold saw is shown.



A steel frame is manufactured from 2700 mm of 50 × 6 mild steel (MS) bar. The 50 × 6 mild steel bar is to be held in the vice of the cold saw while being cut. Two possible orientations for this are graphically depicted below.



- (a) Explain why orientation *B* is the more appropriate clamping method for the cutting of this material. **2**

.....

.....

.....

.....

.....

Question 17 continues on page 12

Question 17 (continued)

- (b) A 2700 mm length of 50×6 MS is to be cut from an 8 metre length of stock material. **3**

Describe how the 8 metre length of material should be set up in the cold saw to allow for safe and effective cutting.

.....

.....

.....

.....

.....

.....

.....

.....

- (c) Recommend strategies which could be used to minimise the potential negative effects on the environment of using a cold saw. **4**

.....

.....

.....

.....

.....

.....

.....

.....

.....

End of Question 17



2014 HIGHER SCHOOL CERTIFICATE EXAMINATION

Metal and Engineering

--	--	--	--	--

Centre Number

Section II (continued)

--	--	--	--	--	--	--	--	--

Student Number

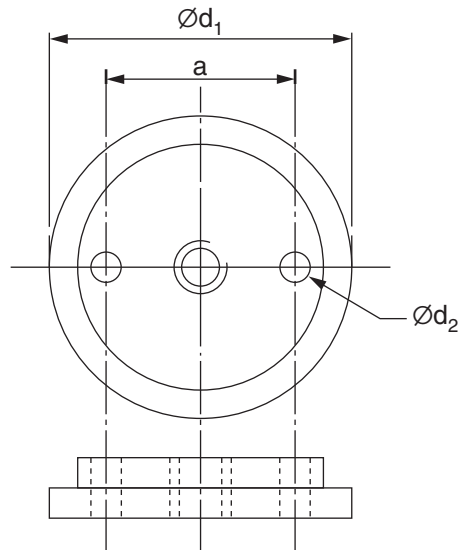
Question 18 (9 marks)

Please turn over

Question 18 (9 marks)

Measurements must be made of a disc retaining nut from an angle grinder, using a pair of vernier calipers.

A diagram of the disc retaining nut is shown.



- (a) The diameter of the retaining nut $\varnothing d_1$ is represented on the vernier scale pictured. **1**



What measurement is represented on the vernier scale?

.....

Question 18 continues on page 15

Question 18 (continued)

- (b) Outline the procedures that should be followed when packing away the vernier calipers after use. **2**

.....
.....
.....
.....

- (c) Describe a method for using vernier calipers to accurately determine the distance, (a), between the centres of the two locating holes in the retaining nut shown. **3**

.....
.....
.....
.....
.....
.....

- (d) Explain the advantages of using digital vernier calipers compared to analogue calipers. **3**

.....
.....
.....
.....
.....
.....

End of Question 18

BLANK PAGE

Metal and Engineering

--	--	--	--	--

Centre Number

Section II (continued)

--	--	--	--	--	--	--	--	--

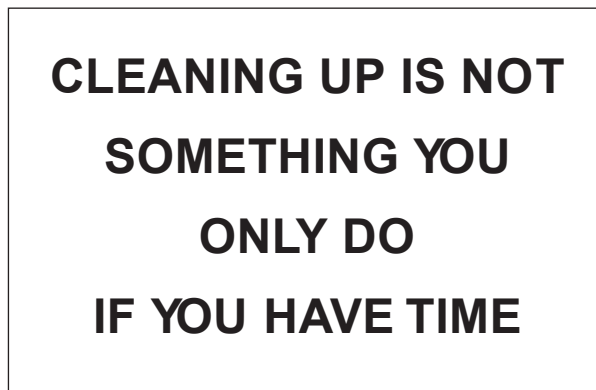
Student Number

Question 19 (9 marks)

- (a) Name the category of safety sign that shows a piece of personal protective equipment (PPE) as a white image on a blue background. 1

.....

- (b) 3



How does the meaning of this sign relate to workplace safety?

.....

.....

.....

.....

.....

.....

Question 19 Continues on page 18

Question 19 (continued)

- (c) Recommend strategies that management could use to improve the effectiveness of Work Health and Safety (WHS) signage displayed in the workplace. **5**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

End of Question 19

Metal and Engineering

Section III

15 marks

Attempt Question 20

Allow about 25 minutes for this section

Answer the question in a writing booklet. Extra writing booklets are available.

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

- demonstrate knowledge and understanding relevant to the question
 - communicate ideas and information using relevant workplace examples and industry terminology
 - present a logical and cohesive response
-

Question 20 (15 marks)

Explain how possessing and developing sound personal, interpersonal and communication skills contributes to the effectiveness of a worker as part of a work team.

Please turn over

Section IV

15 marks

Attempt Question 21

Allow about 25 minutes for this section

Use Drawing 2014–1, NUT CRACKER, to answer Question 21.

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

Question 21 (15 marks)

- (a) What information is contained on an engineering drawing that will determine the choice of marking-out tools for the task? **2**
- (b) Propose a sequence of steps to accurately mark out the PIVOT BRACKET, ITEM 3, from Drawing 2014–1. **4**
- (c) Prior to production of the NUT CRACKER, a worker should develop a plan to safely complete a routine manufacturing task. Describe the processes involved in developing this plan. **9**

Note: Do not describe how to manufacture the component parts of the NUT CRACKER.

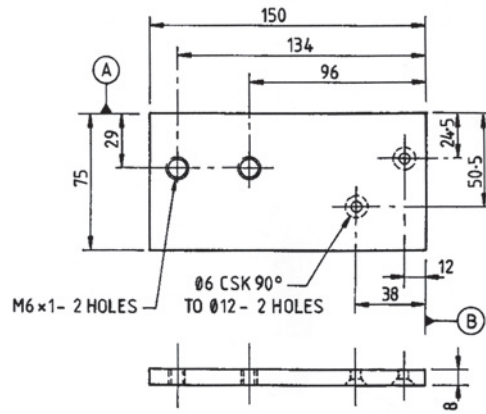
End of paper

Metal and Engineering

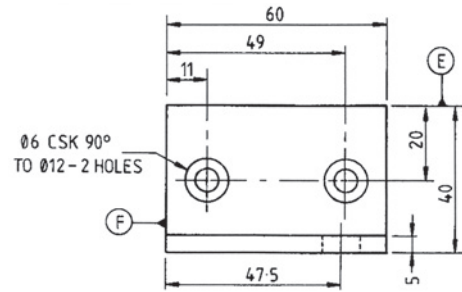
Detach this sheet and use Drawing 2014–1 to answer Questions 16 and 21.

Please turn over

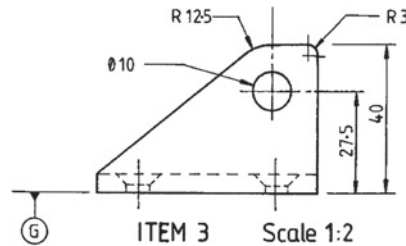
DO NOT SCALE



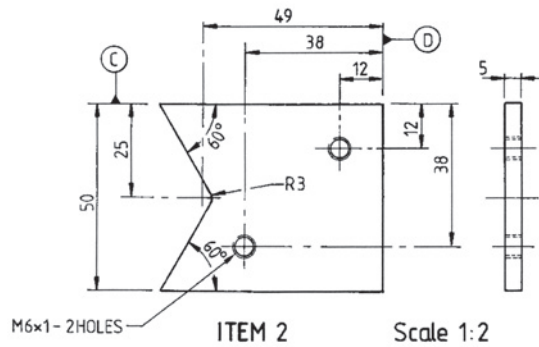
ITEM 1 Scale 1:4



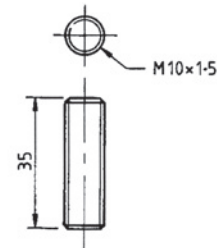
ITEM 3 Scale 1:2



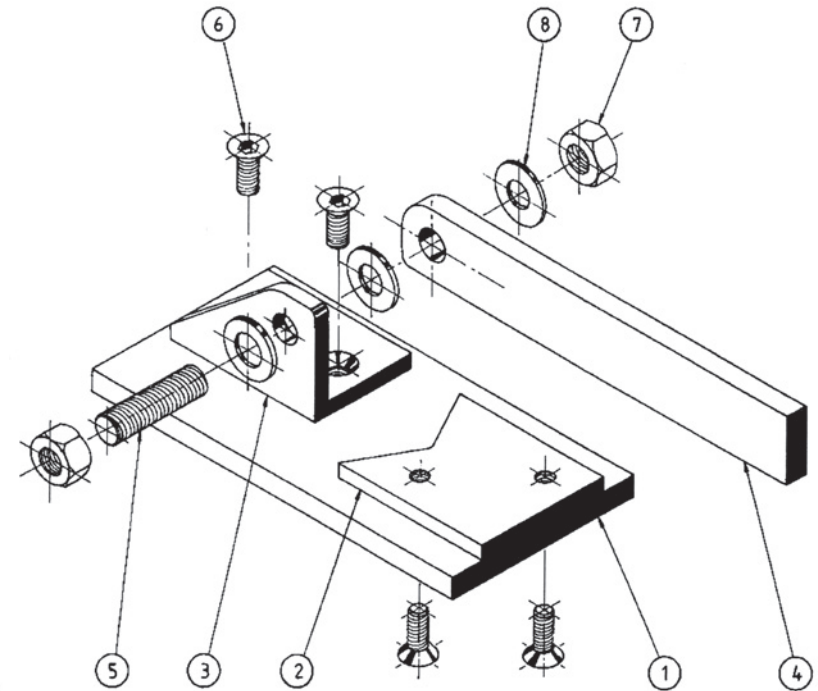
ITEM 4 Scale 1:1



ITEM 2 Scale 1:2



ITEM 5 Scale 1:2



8	Ø10 flat washer	Stock	3
7	M10 × 1.5 hex. nut	Stock	2
6	M6 × 1 countersunk socket screw × 12	Stock	4
5	Axle, Ø10 booker rod	Stock	1
4	Handle	MS	1
3	Pivot bracket, equal angle	MS	1
2	Strike plate	BMS	1
1	Base	BMS	1
ITEM	DESCRIPTION	MATL	REQ'D

BOARD OF STUDIES, TEACHING AND EDUCATIONAL STANDARDS NSW

TITLE
NUT CRACKER

REF: NSW HSC 2014

NOTES
Deburr all items prior to assembly
Item 6 to finish 0.5 mm below surfaces on items 1 & 3
Item 7 to be assembled finger tight
Datum surfaces B, D, E, F, G and J to be filed flat and square
Linear tolerances ± 0.2
Angular tolerance ± 1°

SCALE As indicated	SIZE A4	DRWG N ^o	2014-1	SHT 1
-----------------------	------------	------------------------	---------------	----------