VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2007

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

									Letter
Figures									
Words									

VCE VET ENGINEERING STUDIES CERTIFICATE II

Written examination

Wednesday 21 November 2007

Reading time: 9.00 am to 9.15 am (15 minutes)
Writing time: 9.15 am to 10.45 am (1 hour 30 minutes)

QUESTION AND ANSWER BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	15	15	15
B	4	4	15
C	2	2	15
D	12	12	15
E	4	4	40
			Total 100

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, a protractor, a set square and aids for curve sketching.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.
- A scientific calculator is allowed in this examination.

Materials supplied
- Question and answer book of 25 pages.
- Answer sheet for multiple-choice questions.

Instructions
- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- All written responses must be in English.

At the end of the examination
- Place the answer sheet for multiple-choice questions inside the front cover of this book.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

SECTION A – VBN 771 Apply electrotechnology principles in an engineering environment

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** or that **best answers** the question.
A correct answer scores 1, an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.

Question 1
The ohm is the unit for electrical
A. conductance.
B. amperage.
C. voltage.
D. resistance.

Question 2
A battery is designed to provide a source of electrical
A. resistance.
B. pressure.
C. opposition.
D. displacement.

Question 3
An electric motor rotates due to the
A. magnetic effect of current.
B. heating effect of current.
C. chemical effect of current.
D. physiological effect of current.

Question 4
The most suitable application for piezo electric devices would be for
A. voltage amplifiers.
B. gas ignition systems.
C. battery chargers used in remote areas.
D. measuring high temperatures.

Question 5
A solar cell converts
A. radiant energy to electrical energy.
B. chemical energy to electrical energy.
C. electrical energy to radiant energy.
D. mechanical energy to electrical energy.

Question 6

A capacitor is a device which is capable of storing an electric

A. voltage.
B. resistance.
C. charge.
D. current.

Question 7

Devices that rely on magnetism for their operation are

A. relays and resistors.
B. resistors and capacitors.
C. capacitors and transformers.
D. transformers and relays.

Question 8

A power resistor has 6R8 stamped on its body.
This indicates a resistance of

A. 0.68 Ω
B. 6.8 Ω
C. 68 Ω
D. 680 Ω

Question 9

A 4.7 kΩ resistor has tolerance of 10%.
Its acceptable resistance range is from

A. 4230 to 5170 Ω
B. 4465 to 4935 Ω
C. 3760 to 5640 Ω
D. 4000 to 5400 Ω

Question 10

Power used in an electrical circuit is measured in

A. volts.
B. watts.
C. amps.
D. ohms.

Question 11

Power in a live DC circuit can be determined by combining the readings from two separate instruments.
These are the

A. voltmeter and wattmeter.
B. ammeter and wattmeter.
C. ohmmeter and voltmeter.
D. ammeter and voltmeter.

Question 12

A voltmeter is always placed

A. in series with electrical components.

B. in parallel with electrical components.

C. so that total electric current flows through it.

D. in series with power-consuming devices.

Question 13

A low resistance in a circuit will cause

A. a high voltage drop.

B. a low current.

C. a high current.

D. the current to fall to zero.

Question 14

Excessive current in a circuit will cause a fuse to

A. open.

B. short.

C. reverse polarity.

D. conduct to earth.

Question 15

A circuit breaker is a switch that operates automatically when

A. normal rated current flows.

B. circuit current is less than the set rating of the circuit breaker.

C. circuit current is greater than the set rating of the circuit breaker.

D. an open circuit condition occurs.

END OF SECTION A

SECTION B – VBN 773 Produce engineering sketches and drawings

Instructions for Section B

Answer **all** questions in the spaces provided. All dimensions are in mm (millimetres).

Question 1

Figure 1 shows two views of an object. **Complete and label** view 2 to show a full-sectioned view of A–A.
Note: Both holes go all the way through and are parallel.

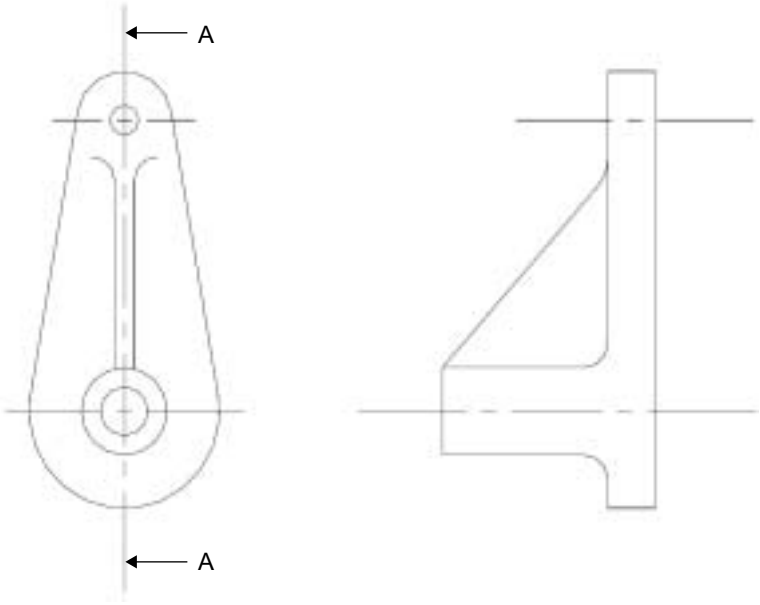
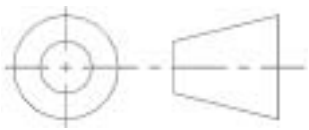


Figure 1

3 marks

Question 2

What does the symbol below mean?



_____

1 mark

Figure 2 is an isometric drawing of a baseplate. Use this drawing to answer the questions which follow.

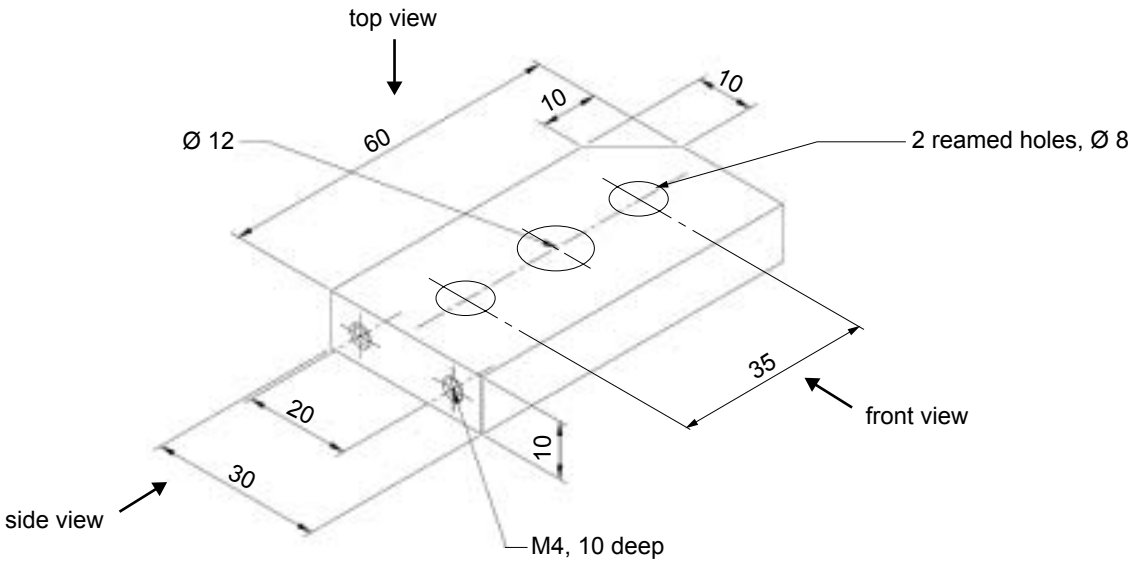


Figure 2. Baseplate

Question 3

a. What size thread is used for the two tapped holes shown in Figure 2?

_____

1 mark

b. If the general tolerance for length for this drawing is ±0.25, what would be the maximum and minimum length you could machine the **baseplate**?

maximum _____ minimum _____

2 marks

c. Prior to **hand reaming** the holes, what size drill would you use?

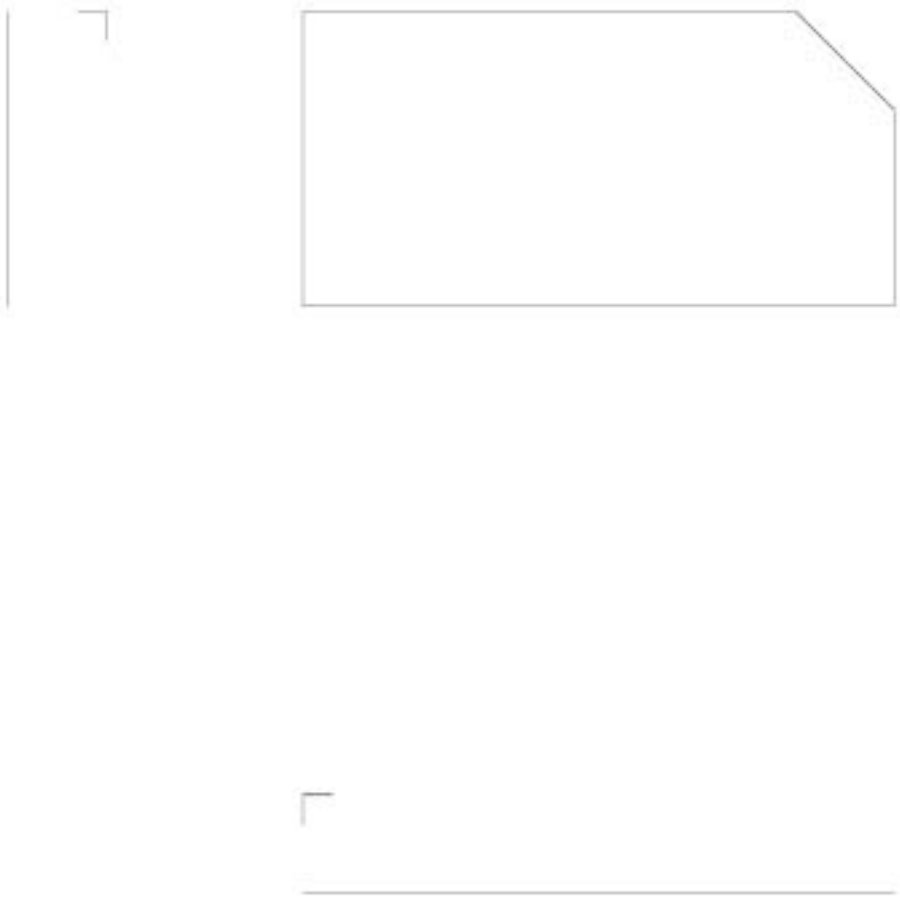
_____

1 mark

Question 4

Below is the beginning of an orthogonal drawing of the baseplate shown in Figure 2. Complete the orthogonal drawing showing the **top**, **front** and **side** views in third-angle projection.

- The drawing is not to scale.
- Use conventional orthogonal drawing systems.
- All dimensions must be shown.



7 marks

Total 15 marks

END OF SECTION B
TURN OVER

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SECTION C – VBN 776 Using basic engineering concepts to plan the manufacture of engineering components

Instructions for Section C

Answer **all** questions in the spaces provided. All dimensions are in mm (millimetres).

Your class is required to manufacture a brass-faced hammer.
Figure 1 shows an assembly drawing of the hammer.
Figure 2 shows a detailed drawing of the handle.
Figure 3 shows a detailed drawing of the hammer head.
Use these drawings to answer the questions which follow.

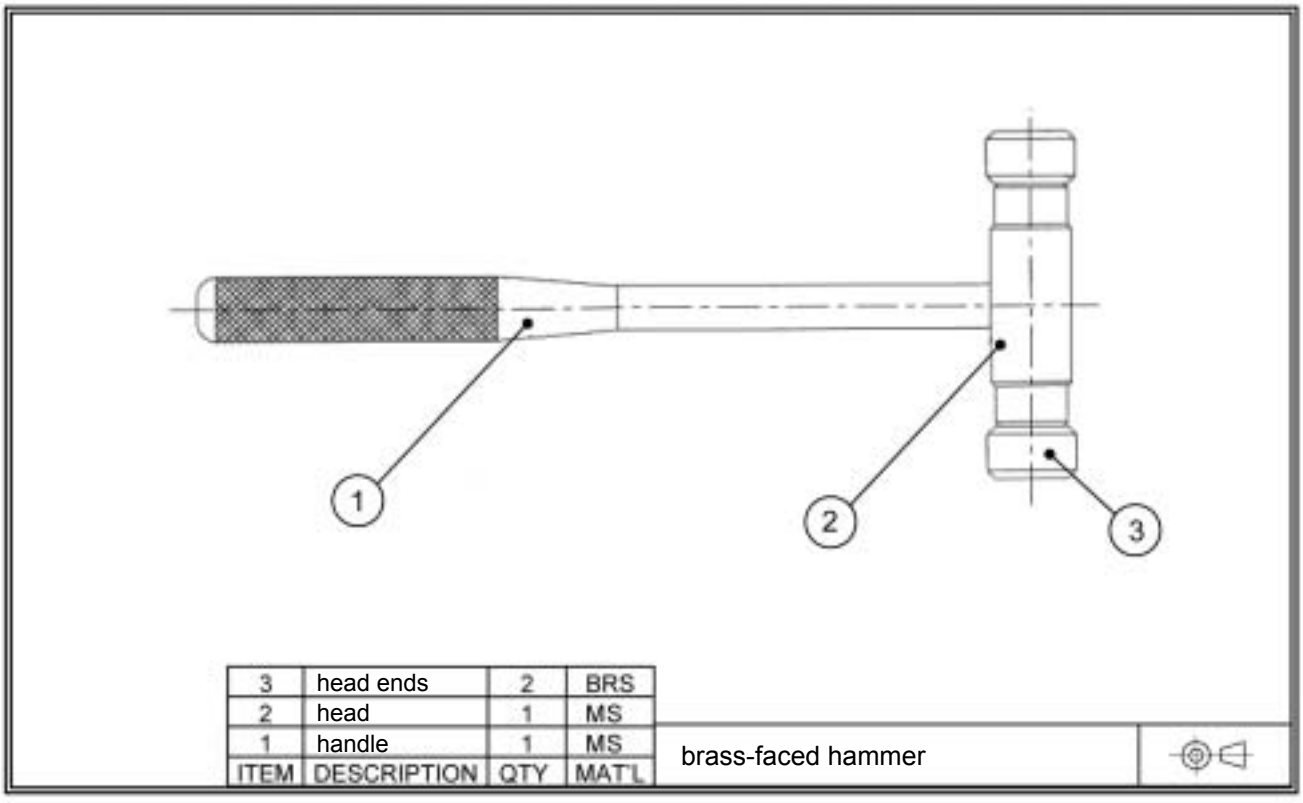


Figure 1

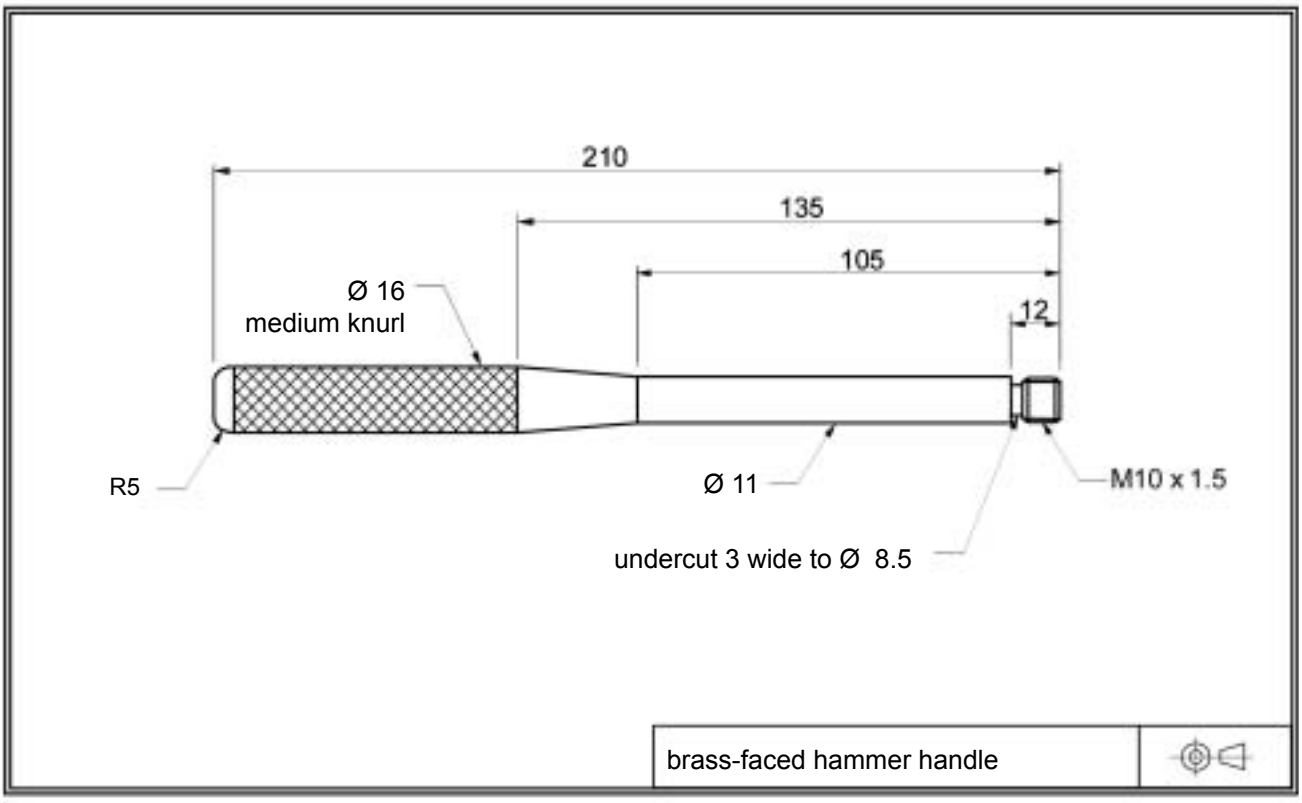


Figure 2

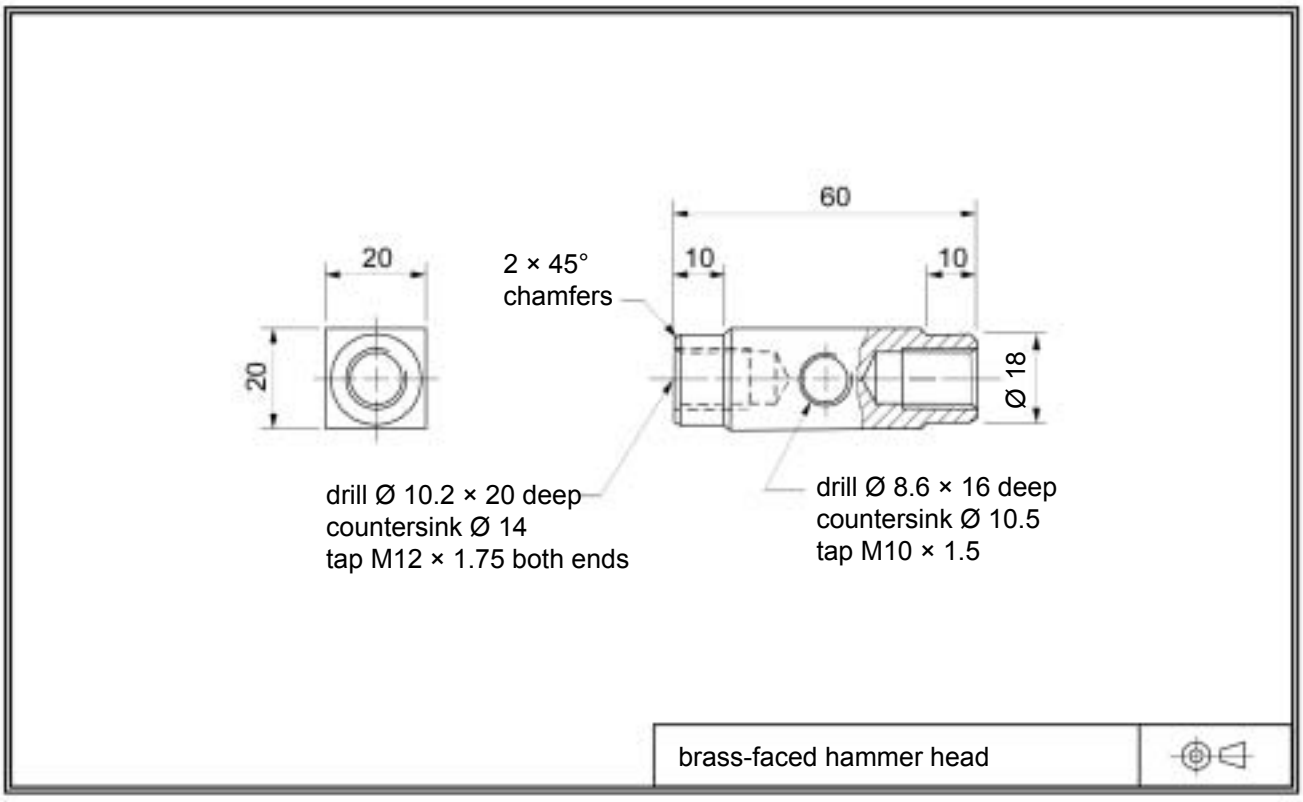


Figure 3

Question 1

Before you begin to manufacture the brass-faced hammer (Figure 1), you will need to develop an operational plan.

a. Give two reasons why developing an operational plan is important.

i. _____

_____

1 mark

ii. _____

_____

1 mark

b. The material for the handle (Figure 2) is being cut from a 3 metre long bar.

i. What length should it be cut to?

_____

1 mark

The M10 × 1.5 thread on the handle has an undercut.

ii. What is the purpose of the undercut?

_____

_____

1 mark

iii. What tool is used to produce the undercut for the thread?

_____

1 mark

c. What material is used for the hammer head in Figure 3?

_____

1 mark

The M12 threads in the hammer head in Figure 3 must be tapped square to the faces.

d. State how this can be achieved when using a centre lathe.

_____

_____

_____

1 mark

e. In Figure 1 the head ends are made of brass.

i. Why is brass used?

_____

1 mark

ii. What other material would be suitable for the head ends?

_____

1 mark

Question 2

Complete the operational planning sheet for the hammer head (Figure 3) of the brass-faced hammer.

Op. No.	Operation description	Type of machine	Work holding method	Equipment/cutters
1	Check size	NA*	Hand	Steel rule
2	Clean and debur	NA*	Vice	File
3	Face off one end Turn ∅ 18 and chamfer one end			
4	Drill and countersink hole for M12 thread			
5	Tap M12 thread			
6	Repeat steps 3–5 for other end	NA*	NA*	NA*
7	Mark out hole for M10 in preparation for drilling	NA*		
8	Drill and countersink hole for M10			
9	Tap M10 × 1.5 thread	NA*		
10	Finish	NA*	Hand or Vice	Emery cloth Smooth file

* NA = not applicable

6 marks

Total 15 marks

END OF SECTION C

SECTION D – VBN 777 Handle engineering materials in a safe and proper manner

Instructions for Section D

Answer **all** questions in the spaces provided. All dimensions are in mm (millimetres).

Question 1

Prior to handling, lifting, shifting or setting down of material, you should first consider **safety**.

Whose safety should you be considering?

_____

1 mark

Question 2

What piece of equipment, used in conjunction with a crane, would be used to shift steel sheets from one location to another?

_____

1 mark

Question 3

State one of the three main types of slings used for lifting.

_____

1 mark

Question 4

A ∅ 50 mild steel bar is being cut to length using a power hacksaw.

State one type of injury which could be sustained when handling the sawn lengths.

_____

1 mark

Question 5

Wire or rope slings must have a tag attached at one end.

State two pieces of information that can be obtained from the tag.

1. _____

2. _____

2 marks

Question 6

Complete the following table to show the best place to store the materials listed.

Material	Storage location
Drums of solvent	
Steel sheet, steel plate or bar stock	

2 marks

Question 7

Who is responsible for producing Material Safety Data Sheets (MSDS)?

_____

1 mark

Question 8

State two pieces of information conveyed by a MSDS.

1. _____

2. _____

2 marks

Question 9

Why is it important to know the location and types of fire extinguishers available for use in an engineering workshop?

_____

_____

1 mark

Question 10

List a safety precaution to be followed when working in an area where the sign shown below is displayed.

_____

_____

1 mark

Question 11

List two items of Personal Protective Equipment (PPE) you must wear if working with a substance labelled with the sign shown below.

1. _____

2. _____

1 mark

Question 12

Incorrect lifting is a common cause of back injury.

List two points to observe for safe lifting.

1. _____

2. _____

1 mark

Total 15 marks

END OF SECTION D
TURN OVER

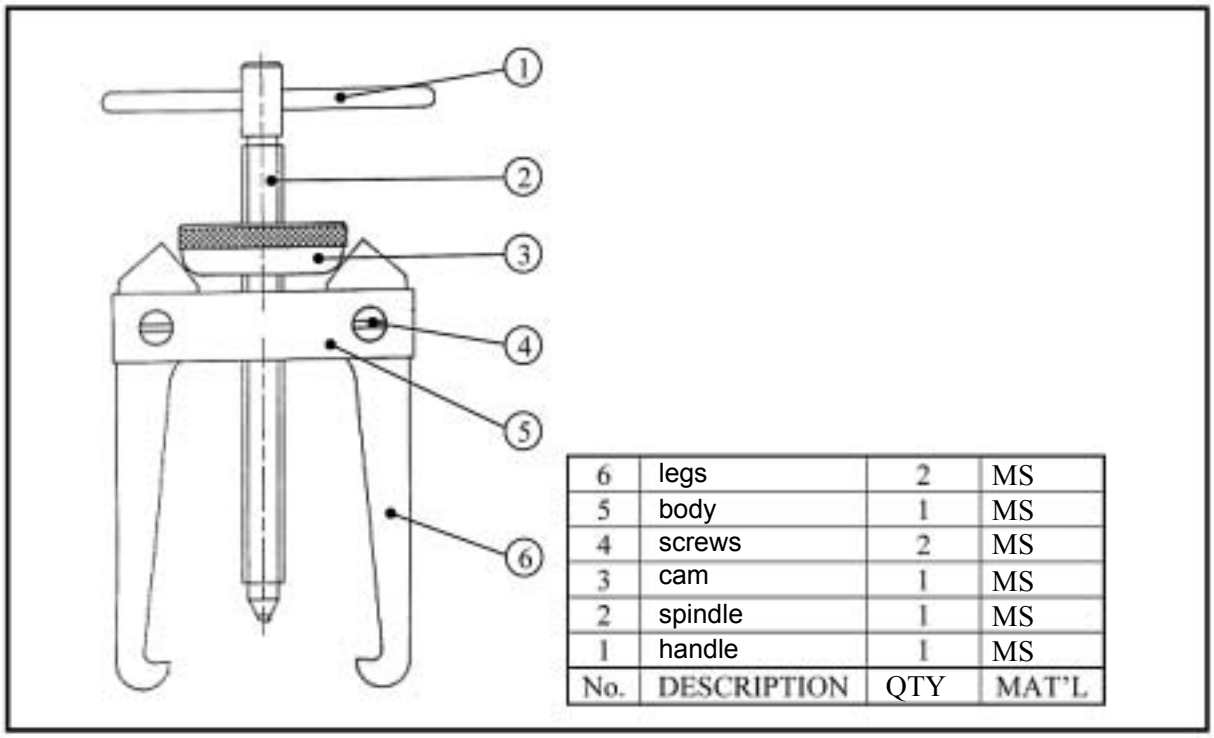
SECTION E – VBN 778 Produce basic engineering components using fabrication and machining techniques

Instructions for Section E

Answer **all** questions in the spaces provided. All dimensions are in mm (millimetres).

Figure 1 shows an assembled view of a wheel-puller. A wheel-puller is used for removing bearings and pulleys off shafts.

A wheel-puller consists of six parts as detailed in Figure 1. Questions 1 and 2 relate to the manufacture of the wheel-puller body (Figure 2) and wheel-puller spindle (Figure 4).



No.	DESCRIPTION	QTY	MAT'L
6	legs	2	MS
5	body	1	MS
4	screws	2	MS
3	cam	1	MS
2	spindle	1	MS
1	handle	1	MS

Figure 1

Figure 2 below shows a detailed drawing of the wheel-puller body.

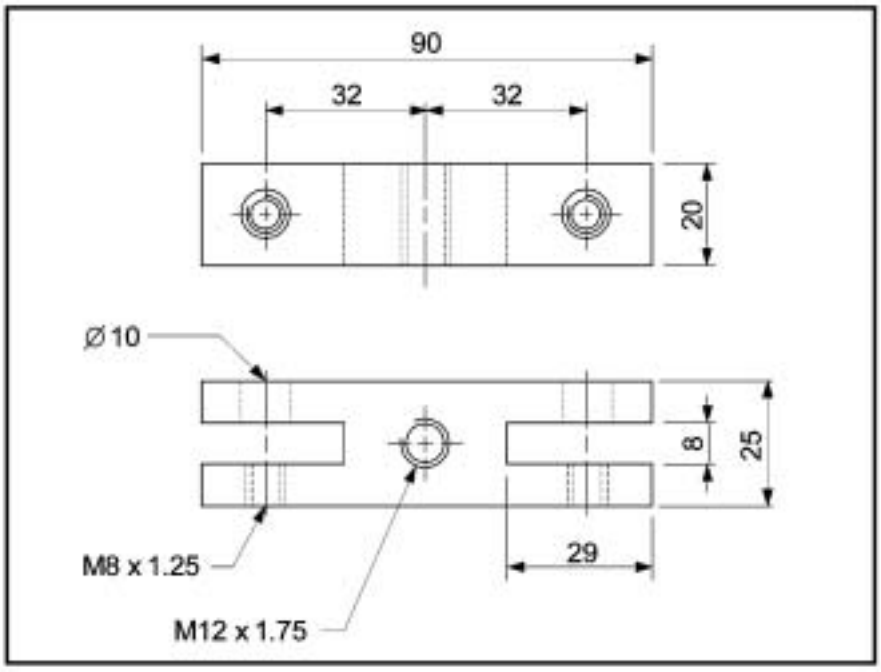
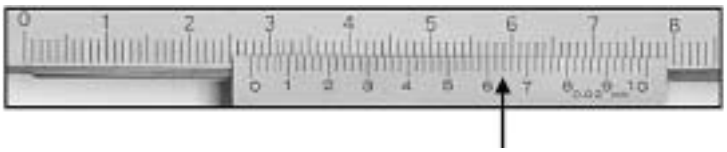


Figure 2

Question 1

This question relates to the manufacture of the wheel-puller body shown in Figure 2. The 25 mm width of the wheel-puller body (Figure 2) is being milled to size. The current width has been measured by a vernier calliper and the size is shown on the scale below.



a. **i.** What is the reading on the vernier calliper?

_____

ii. How much needs to be milled off to get the width down to 25 mm?

_____

2 marks

b. The 8 mm slots in the body will be milled on a plain (horizontal) milling machine.

i. What type of cutter would be suitable to mill the slots?

_____

1 mark

ii. How would you centralise the cutter so that the slot is in the middle of the 25 mm wide wheel puller body?

_____

_____

_____

_____

2 marks

iii. What measuring tool could be used to measure the width of the 8 mm slots accurately to within 0.02 mm?

_____

1 mark

c. What check should be done during the setting up of the vice to ensure the slots are machined parallel to the sides?

_____

_____

_____

_____

1 mark

d. Towards which vice jaw should the pressure of the cutter be directed when milling the slots?

_____

1 mark

e. What check would you do when setting and tightening the wheel-puller body in the vice?

_____

_____

1 mark

Figure 3 shows a tapping chart.

M

(ISO) METRIC COARSE

Nom Dia. M (mm)	Pitch (mm)	Basic Major Diameter (mm)	Basic Effective Diameter (mm)	Basic Minor Dia. of Int. Thd (mm)	Basic Minor Dia. of Ext. Thd (mm)	Tapping Drill Size (mm)	Clearance Drill Size (mm)
M 1.0	x 0.25	1.00	0.838	0.693	0.729	0.75	1.05
M 1.1	x 0.25	1.10	0.938	0.793	0.829	0.85	1.15
M 1.2	x 0.25	1.20	1.038	0.893	0.929	0.95	1.25
M 1.4	x 0.30	1.40	1.205	1.032	1.075	1.10	1.45
M 1.6	x 0.35	1.60	1.373	1.170	1.221	1.25	1.65
M 1.8	x 0.35	1.80	1.573	1.370	1.421	1.45	1.85
M 2.0	x 0.40	2.00	1.740	1.509	1.567	1.60	2.05
M 2.2	x 0.45	2.20	1.908	1.648	1.713	1.75	2.25
M 2.5	x 0.45	2.50	2.208	1.948	2.013	2.05	2.60
M 3.0	x 0.50	3.00	2.675	2.387	2.459	2.50	3.10
M 3.5	x 0.60	3.50	3.110	2.764	2.850	2.90	3.60
M 4.0	x 0.70	4.00	3.545	3.141	3.242	3.30	4.10
M 4.5	x 0.75	4.50	4.013	3.580	3.688	3.70	4.60
M 5.0	x 0.80	5.00	4.480	4.019	4.134	4.20	5.10
M 6.0	x 1.00	6.00	5.350	4.773	4.917	5.00	6.10
M 7.0	x 1.00	7.00	6.350	5.773	5.917	6.00	7.20
M 8.0	x 1.25	8.00	7.188	6.466	6.647	6.80	8.20
M 9.0	x 1.25	9.00	8.188	7.466	7.647	7.80	9.20
M 10.0	x 1.50	10.00	9.026	8.160	8.376	8.50	10.20
M 11.0	x 1.50	11.00	10.026	9.160	9.376	9.50	11.20
M 12.0	x 1.75	12.00	10.863	9.853	10.106	10.20	12.26
M 14.0	x 2.00	14.00	12.701	11.546	11.835	12.00	14.25
M 16.0	x 2.00	16.00	14.701	13.546	13.835	14.00	16.25
M 18.0	x 2.50	18.00	16.376	14.933	15.294	15.50	18.25
M 20.0	x 2.50	20.00	18.376	16.933	17.294	17.50	20.25
M 22.0	x 2.50	22.00	20.376	18.933	19.294	19.50	22.25
M 24.0	x 3.00	24.00	22.051	20.319	20.752	21.00	24.25

Figure 3

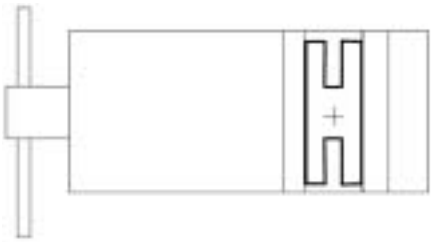
f. Using the tapping chart, what size hole needs to be drilled for the M8 threads?

_____

1 mark

The body is held in a vice on a drilling machine ready to drill the M12 thread hole. You need to prevent the vice from spinning around when being drilled.

g. Show on the drawing below the best position to clamp a stop to the drilling machine table.



1 mark

The vice has a solid base.

h. What should be done to prevent the drill from drilling into the bottom of the vice?

_____

_____

_____

1 mark

The twist drill being used for the M12 hole is blunt and needs to be sharpened. The grinder, however, has a glazed wheel.

i. How would you rectify this problem?

1 mark

The 10 mm holes and the M8 threaded holes need to line up accurately, so that the screws fit.

j. Describe how the holes would be set up and drilled to achieve this.

2 marks

Figure 4 shows a detailed drawing of the wheel-puller spindle.

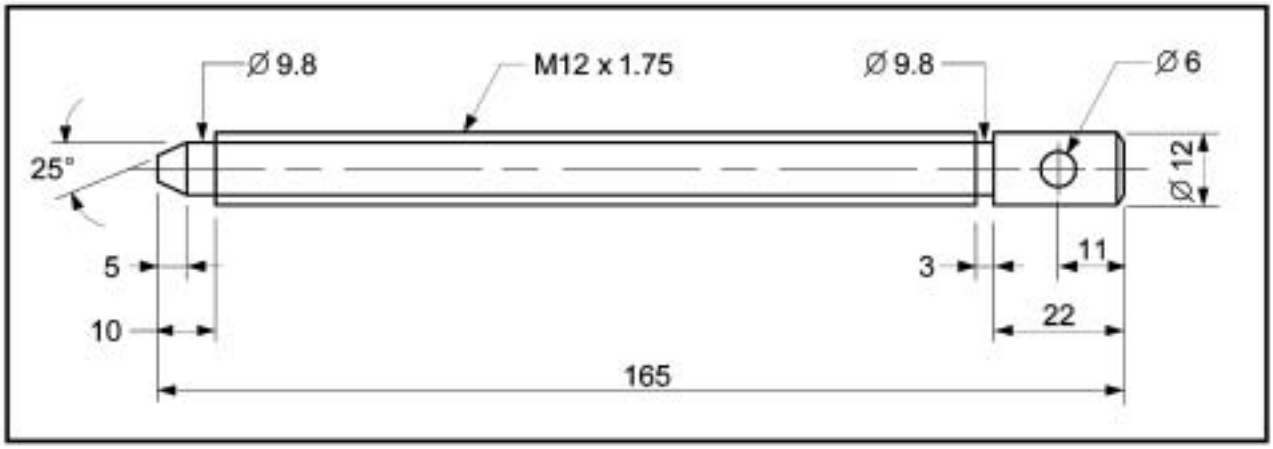


Figure 4

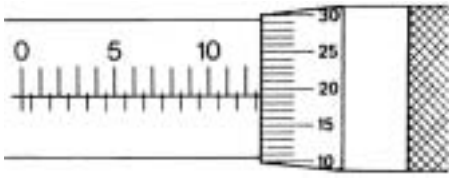
Question 2

This question relates to the manufacture of the wheel-puller spindle shown in Figure 4.

a. Calculate the rpm to turn the 12 mm diameter using a cutting speed of 35 m/min (rpm = 320 v/d where v = cutting speed). Show all working out.

2 marks

The 12 mm diameter is being turned down to size. The current diameter is shown on the 0–25 mm micrometer scale below.



b. **i.** What is the reading on the micrometer?

_____

ii. What depth of cut is required to achieve the 12 mm diameter?

_____

iii. Which part of the lathe will be adjusted to increase the depth of the cut?

_____

1 + 1 + 1 = 3 marks

Before using the 0–25 mm micrometer, it should be checked for accuracy.

c. Describe how this can be done.

2 marks

d. What part of the lathe is adjusted to machine the 25° taper on the spindle?

1 mark

When turning the spindle, the surface finish produced is too rough.

e. From the list **(A–D)** below, which is the **most likely** way to improve the surface finish?

A. increase rpm
B. reduce rpm
C. increase feed rate
D. reduce feed rate

1 mark

f. When turning the diameters of the shaft, which part of the lathe is automatically fed?

A. cross-slide
B. top-slide
C. carriage
D. tool post

1 mark

g. List two safety hazards that exist when using lathes.

1.

2.

2 marks

h. How can the spindle be securely held on the drilling machine to drill the Ø 6 hole for the handle?

1 mark

Figure 5 below shows a detailed drawing of a sheet-metal bracket.

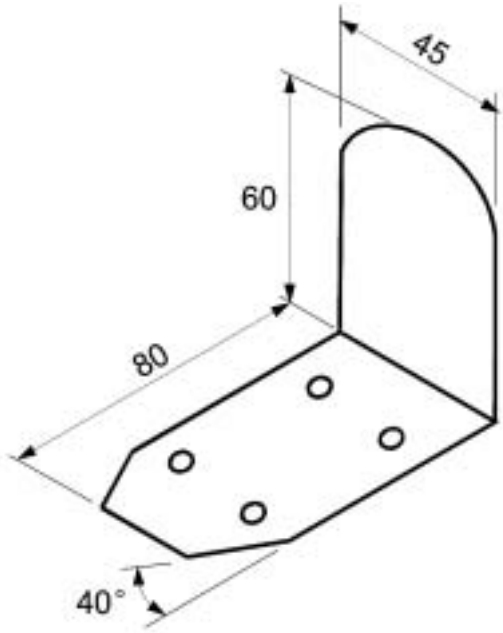


Figure 5

Question 3

This question relates to the manufacture of the sheet-metal bracket shown in Figure 5.

When marking out the bracket on sheet-metal, it is sometimes difficult to see the marked-out lines.

a. What can be done to make the lines easier to see?

_____

_____

1 mark

b. What piece of equipment, together with a scriber, is required to mark off the 40° angle on the bracket?

_____

1 mark

c. What marking-out tool is best suited to mark out the radius at the top of the bracket?

_____

1 mark

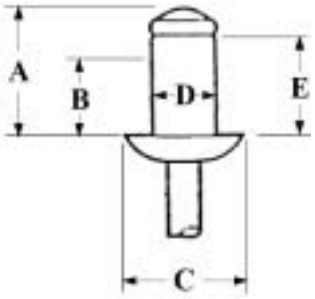
d. What piece of equipment would be suitable to produce the 90° bend in the bracket?

_____

1 mark

e. The bracket will be attached to a sheet-metal box using 4 pop rivets through the holes shown.

i. Which letter, **A–E**, on the sketch of the pop rivet below shows the drill size for the holes in the sheet metal?



☐

1 mark

ii. For the pop rivet shown above, which letter, **A–E**, indicates the maximum thickness of sheet metal that can be riveted together?

☐

1 mark

One reason pop rivets are used is because the box is sealed and **cannot be accessed** from the inside.

f. What other type of mechanical fastener can be used in this situation?

_____

1 mark

g. Complete the sentence below.

After marking out, the position of the holes should be _____ to prevent the drill from moving out of position when drilling.

1 mark

A similar bracket is going to be fitted to a boat and will come in contact with sea water.

h. What material would be suitable for this application?

_____

1 mark

Question 4

a. Four M10 bolts are being used to hold a small electric motor in place.

i. What does the 'M' stand for?

_____

1 mark

ii. What does the '10' stand for?

_____

1 mark

The motor vibrates when operating, causing the plain washers and nuts to come loose.

b. What other type of mechanical fastener can be used to prevent this from happening?

_____

1 mark

Total 40 marks

END OF QUESTION AND ANSWER BOOK