



**Victorian Certificate of Education  
2008**

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

**STUDENT NUMBER**

Figures

Words


Letter

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**VCE VET ENGINEERING STUDIES  
CERTIFICATE II  
Written examination**

**Wednesday 19 November 2008**

**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**

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
A	15	15	15
B	4	4	15
C	3	3	15
D	10	10	15
E	3	3	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 30 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**

A device that uses a chemical effect to produce electrical energy is the

- A. electric motor.
- B. light bulb.
- C. battery.
- D. transformer.

**Question 2**

The meter used to measure electrical pressure in a circuit is the

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

**Question 3**

The ampere is the unit for electrical

- A. conductance.
- B. current.
- C. voltage.
- D. resistance.

**Question 4**

A power resistor has R47 stamped on its body.

This indicates a resistance of

- A.  $0.47 \Omega$
- B.  $4.7 \Omega$
- C.  $47 \Omega$
- D.  $470 \Omega$

**Question 5**

A device which converts mechanical energy into electrical energy is the

- A. solar cell.
- B. battery.
- C. motor.
- D. generator.

**Question 6**

Power in a DC circuit can be calculated by using the formula

- A.  $P = V \times R$
- B.  $P = V \times I$
- C.  $P = V \times W$
- D.  $P = I \times R$

**Question 7**

To measure current with an ammeter, the ammeter must be placed

- A. in series.
- B. across the supply.
- C. in parallel.
- D. across the component drawing current.

**Question 8**

The most suitable application for a thermocouple is a

- A. camera flash unit.
- B. heating element in an electric jug.
- C. voltage amplifier.
- D. device for measuring high temperatures.

**Question 9**

If you are about to use an analog multimeter to measure resistance in a circuit, which of the following should you do first?

- A. switch on the supply to the circuit to be tested
- B. disconnect all supplies from the circuit to be tested
- C. connect a probe to the low voltage end of the circuit
- D. connect a probe to the high voltage end of the circuit

**Question 10**

A transformer is a device which

- A. steps up or steps down AC voltages.
- B. steps up or steps down DC voltages.
- C. converts AC voltages to DC voltages.
- D. converts DC voltages to AC voltages.

**Question 11**

Which one of the following groups are **all** good electrical conductors?

- A. silver, glass and lead
- B. copper, mica and gold
- C. silver, copper and gold
- D. copper, mica and plastic

**Question 12**

A  $5.6 \text{ k}\Omega$  resistor has tolerance of  $\pm 5\%$ .

Its acceptable resistance range is from

- A. 5040 to 6160  $\Omega$
- B. 5320 to 5880  $\Omega$
- C. 4380 to 6720  $\Omega$
- D. 5000 to 6200  $\Omega$

**Question 13**

A low current will **always** occur in a

- A. series circuit.
- B. parallel circuit.
- C. high resistance circuit.
- D. low resistance circuit.

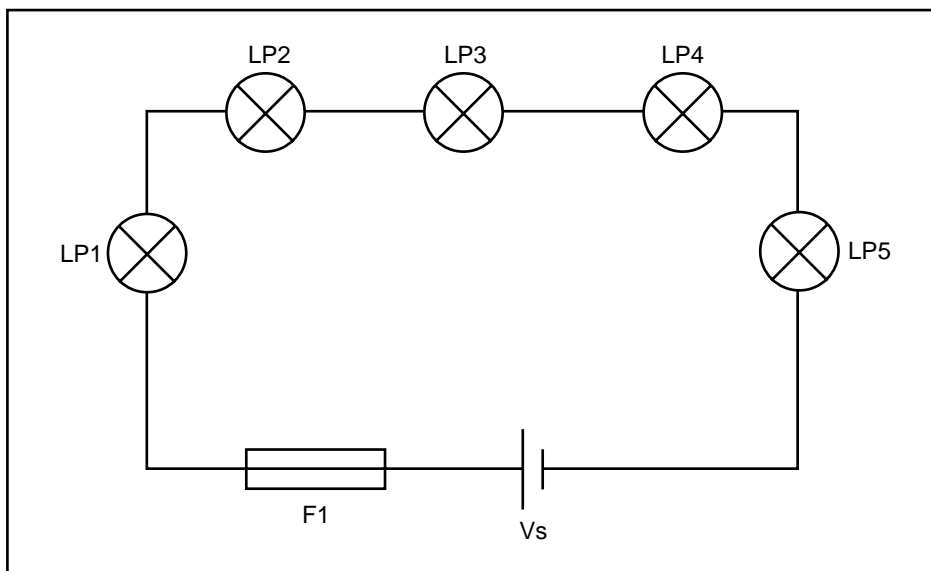
**Question 14**

If the voltage applied to a circuit is halved, the circuit current will

- A. remain constant.
- B. decrease to zero.
- C. be double the original current.
- D. be half the original current.

**Question 15**

The five lamps shown in the circuit below are connected in series.



If the third lamp (LP3) becomes open circuit, then

- A. lamps LP1 and LP2 will go out and lamps LP4 and LP5 will remain on.
- B. all lamps except LP3 will remain on.
- C. all lamps will go out.
- D. the fuse F1 protecting the circuit will blow.

## 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 a drawing of a mandrel. A mandrel is a work-holding device.

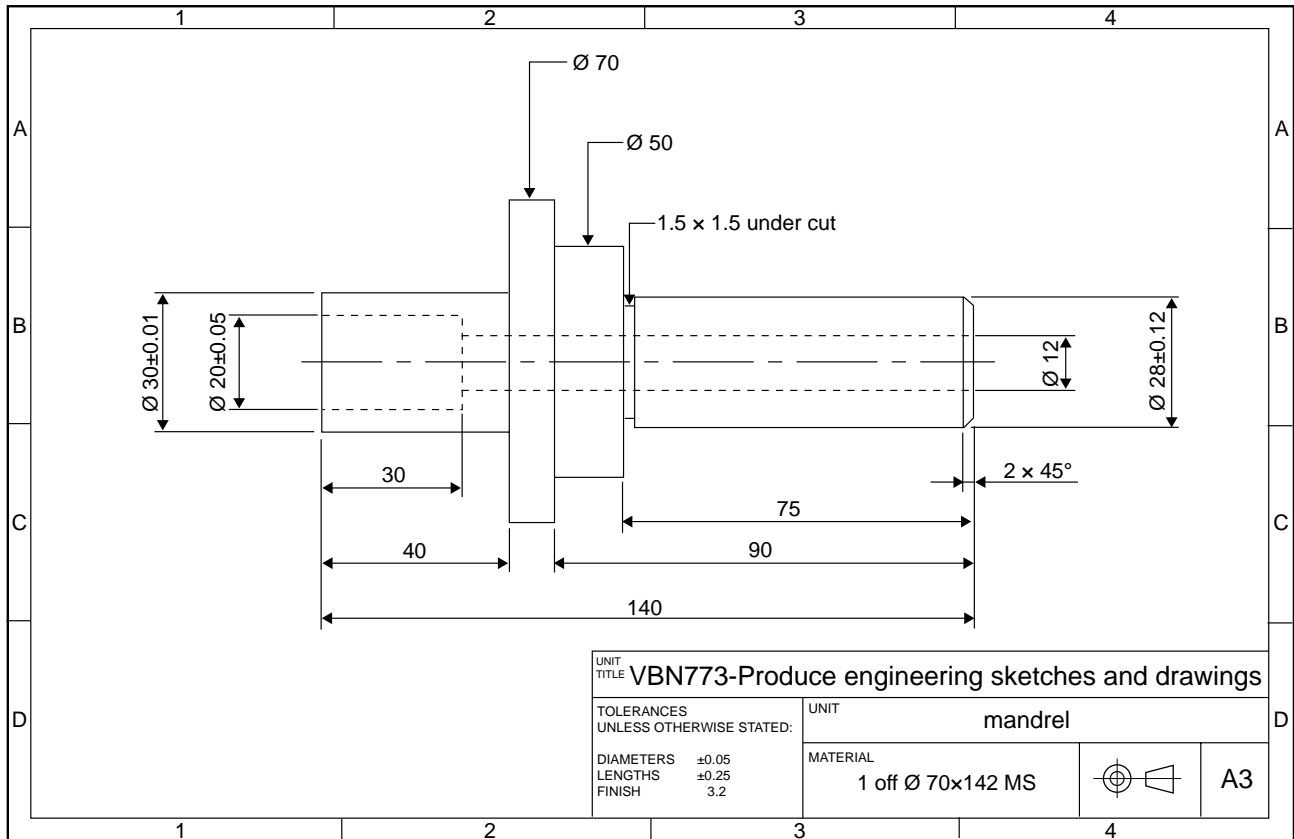


Figure 1

- a. What is the cross-sectional shape of the mandrel?

\_\_\_\_\_

1 mark

- b. What is the diameter of the counterbore?

\_\_\_\_\_

1 mark

- c. What is the thickness of the  $\varnothing 70$  flange?

\_\_\_\_\_

1 mark

- d. What is the tolerance of the 140 length?

\_\_\_\_\_

1 mark

e. What are the maximum and minimum sizes that the  $\text{Ø} 28$  can be machined to?

maximum \_\_\_\_\_

minimum \_\_\_\_\_

2 marks

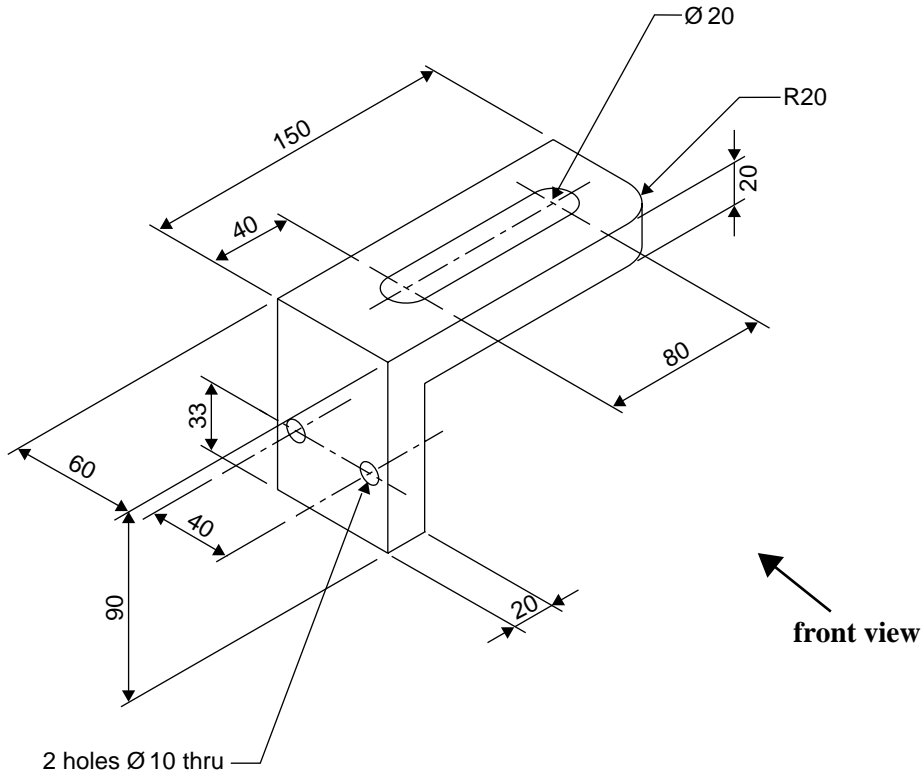
f. What do you call the feature  $2 \times 45^\circ$ ?

\_\_\_\_\_

1 mark

**Question 2**

Figure 2 shows an isometric drawing of a bracket.

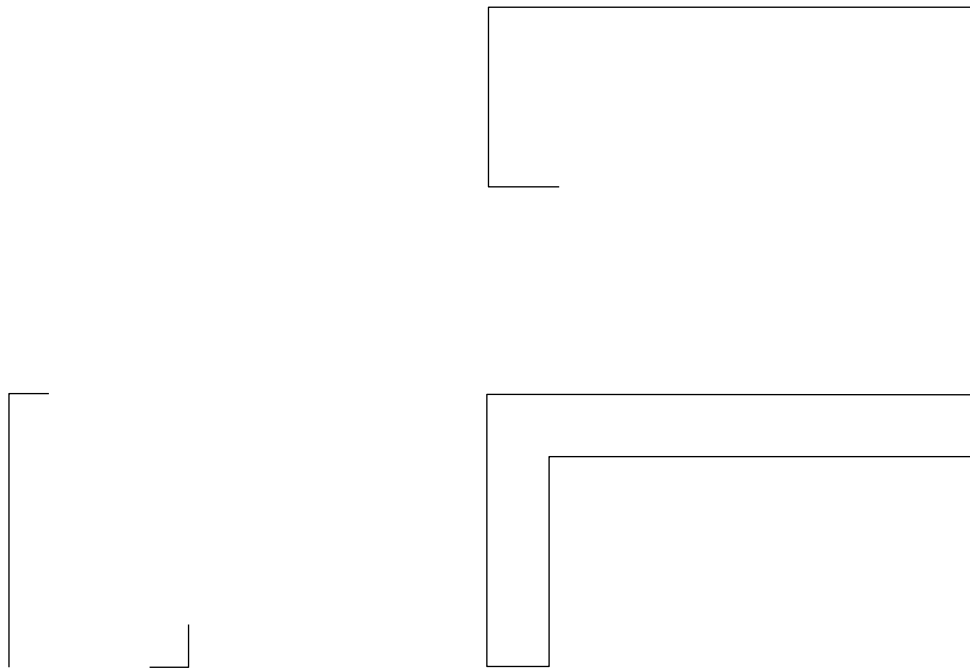


**Figure 2**

Below is the beginning of an orthogonal drawing of the bracket shown in Figure 2.

Complete the orthogonal drawing showing **top**, **front** and **side** views in third-angle projection.

- The drawing is not to scale.
- Use conventional drawing systems.
- Show all hidden detail.
- Do **not** dimension.

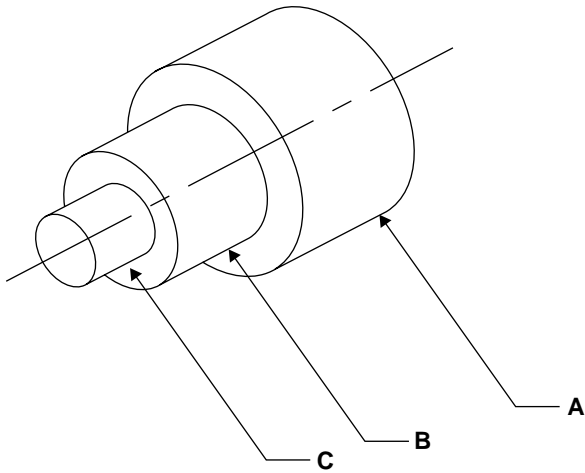


4 marks

**SECTION B – continued**  
**TURN OVER**

**Question 3**

Figure 3 shows an isometric drawing of a spindle. The sizes for each feature are shown in the table.

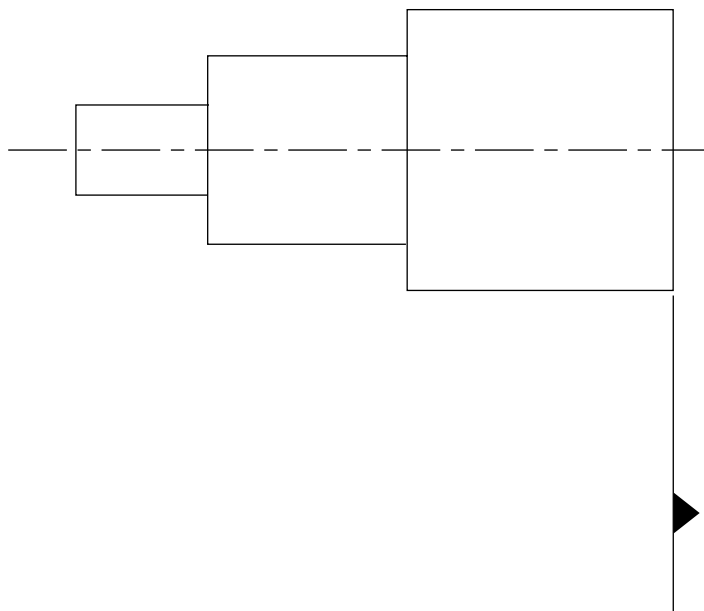


	Length (mm)	Ø (mm)
<b>A</b>	40	30
<b>B</b>	30	20
<b>C</b>	20	10

**Figure 3**

Correctly dimension the orthogonal drawing of the spindle shown below using the information from Figure 3.

- Show all dimensions.
- Where applicable, dimension from the datum surface.
- Use conventional dimensioning systems.

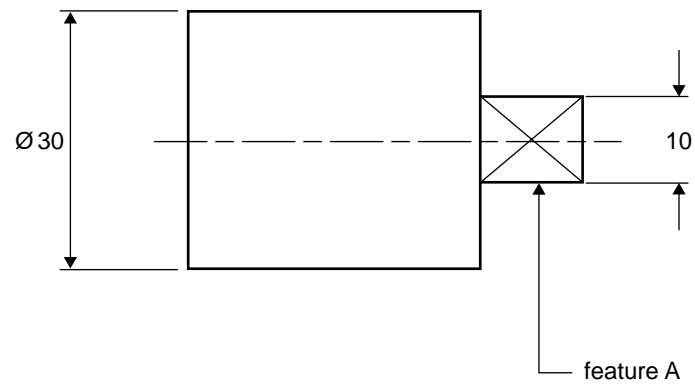


3 marks



**Question 4**

Figure 4 shows a shaft.



**Figure 4**

What do the crossed lines at feature A indicate?

\_\_\_\_\_

1 mark

Total 15 marks

**END OF SECTION B  
TURN OVER**

**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 about to manufacture a ratchet and pawl.  
 Figure 1 shows an assembly drawing of a ratchet and pawl.  
 Figure 2 shows a detailed drawing of the pawl pivot screw.  
 Figure 3 shows a detailed drawing of the pawl.

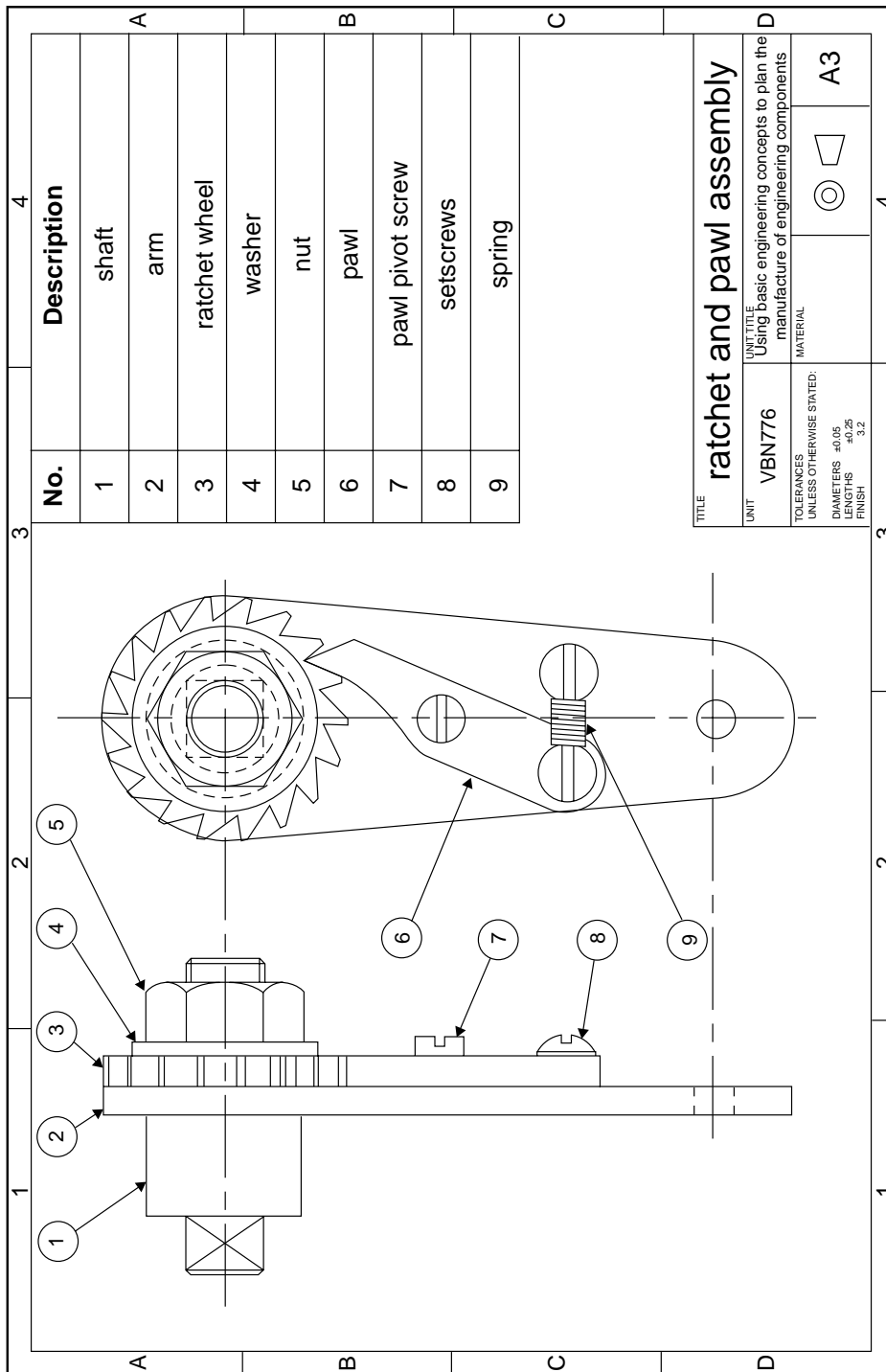
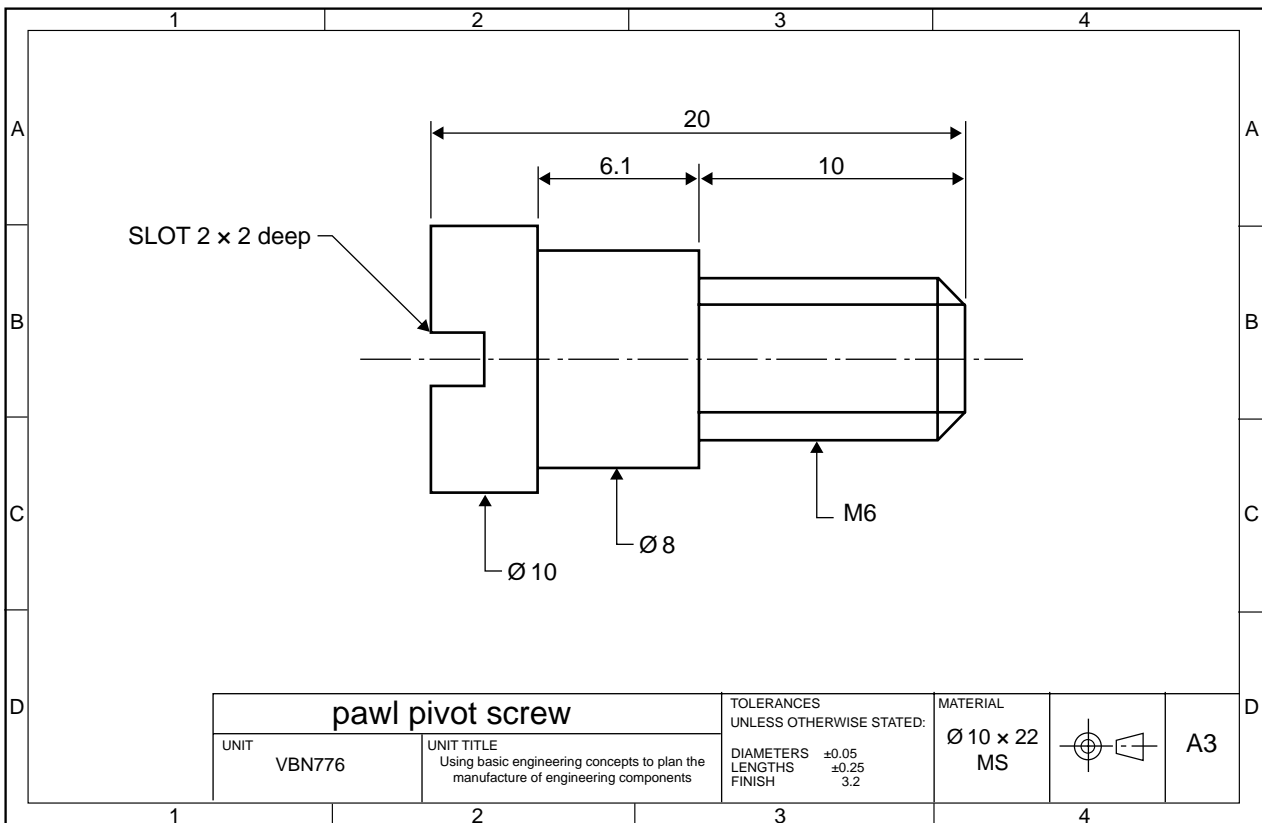


Figure 1

**Question 1**

Figure 2 shows a detailed drawing of the pawl pivot screw.



**Figure 2**

a. What material is specified on the drawing to make the pawl pivot screw?

Material type	
Material dimensions	

2 marks

The material for the pawl pivot screw is to be set up in the lathe for turning.

b. Name the work-holding method that would be the most suitable to hold the pawl pivot screw material.

\_\_\_\_\_

1 mark

Before making the pawl pivot screw you need to plan the sequence of operations and list the tools that you will need.

c. Why is it important to plan a job?

\_\_\_\_\_  
\_\_\_\_\_

2 marks

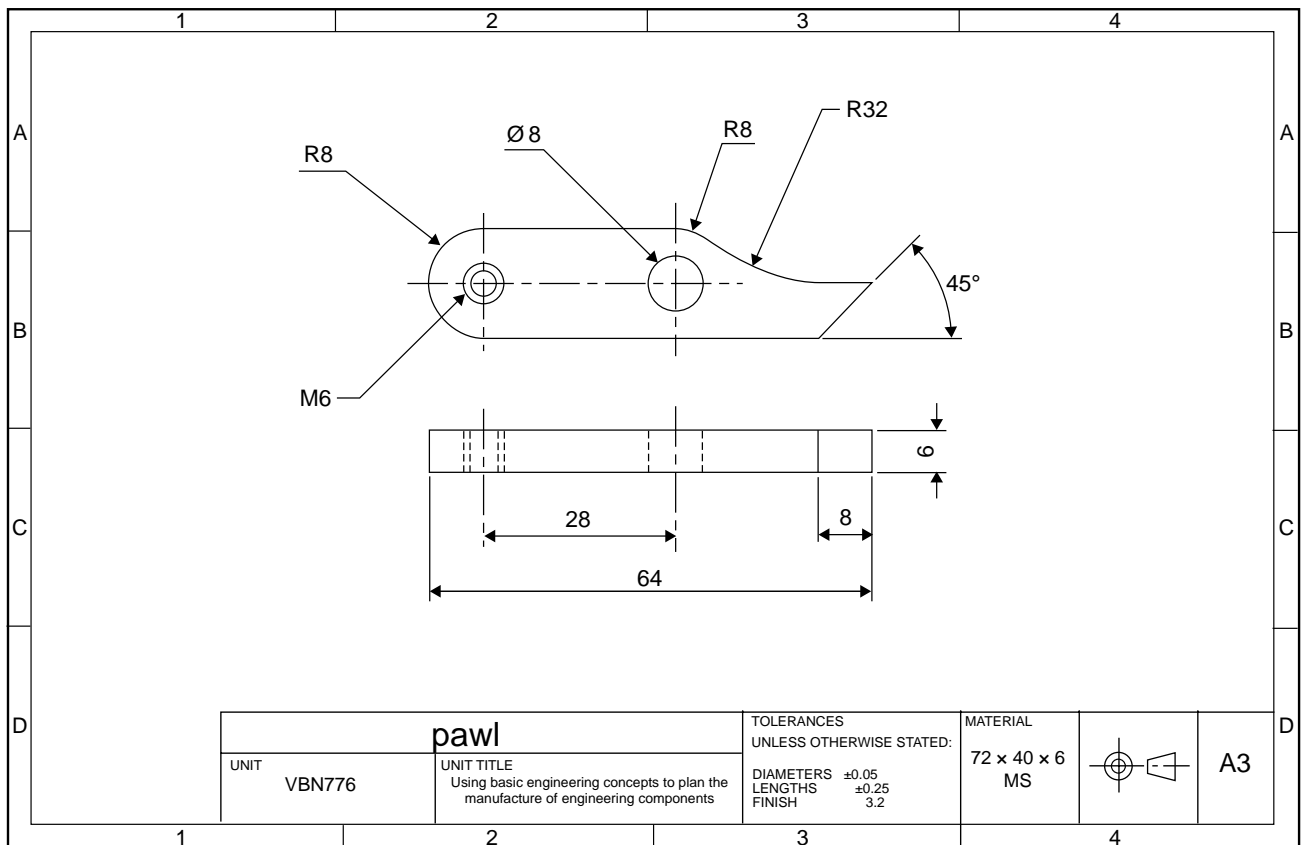
d. Complete the table below by listing the tools required to manufacture the pawl pivot screw.

Task	Tools required
Turn the diameters and make the thread	
Measure the diameters and lengths	

2 marks

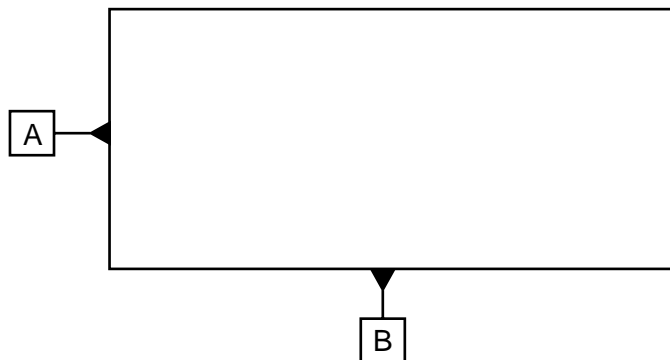
**Question 2**

Figure 3 shows a detailed drawing of the pawl.



**Figure 3**

The pawl will be made from the mild steel plate shown below. The two edges labelled A and B have been filed flat and square to each other so they can be used to take measurements when marking out.



a. What is the name given to edges A and B?

\_\_\_\_\_

1 mark

Before marking out, the surface of the material will be coated with marking-out blue.

b. Why is marking-out blue used?

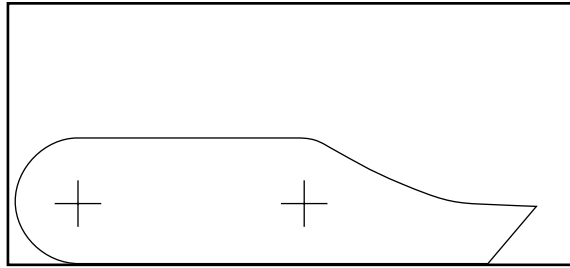
\_\_\_\_\_

1 mark

The pawl has been marked out as shown in Figure 4. The next step is to centre punch and witness mark.

c. On Figure 4

- i. draw a small circle (○) on each position that should be centre punched
- ii. draw small crosses (×) to show where witness marks should be placed.



**Figure 4**

3 marks

The following list shows the operations required to manufacture the pawl. The sequence of operations is **not** in order.

- tap M6 thread
- hacksaw
- mark out
- drill holes
- file shape

d. Complete the table below showing the correct sequence of operations.

Sequence	Operation
1	
2	
3	tap M6 thread
4	
5	

2 marks

**Question 3**

When all the parts have been manufactured, the ratchet and pawl will need to be assembled.  
From the list below, select **two** tools that will be required to assemble the ratchet and pawl.

- A. Phillips head screwdriver
- B. hammer
- C. chisel
- D. flat blade screwdriver
- E. Allen keys
- F. spanners
- G. circlip pliers

	and	
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1 mark

Total 15 marks

**SECTION D – VBN 777 Handle engineering materials in a safe and proper manner****Instructions for Section D**

Answer **all** questions in the spaces provided.

**Question 1**

It is common practice for workplaces to carry out a risk assessment before starting manufacture. Why is a risk assessment important?

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2 marks

**Question 2**

‘Moving materials around from one location to another adds value to the product.’

- A. true  
B. false

1 mark

**Question 3**

A chain sling is rated at 1200 kg SWL. What do the initials SWL stand for?

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1 mark

**Question 4**

You are using a chemical and have a minor spill. What is the name of the information sheet which tells you how to treat the spill safely?

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1 mark

**Question 5**

‘The operator of a ride-on forklift must be licensed.’

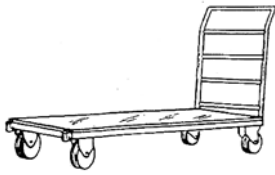
- A. true  
B. false

1 mark

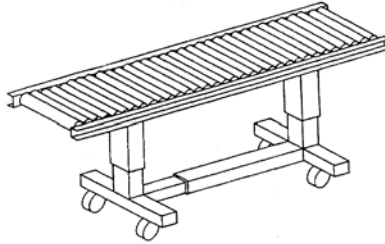
**Question 6**

The diagrams below show six pieces of load shifting equipment.

**A.**



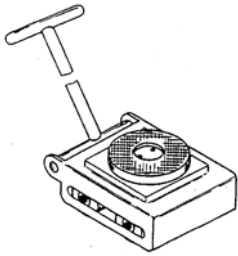
**B.**



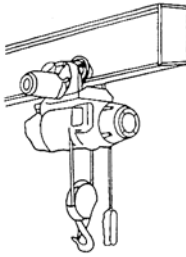
**C.**



**D.**



**E.**



**F.**

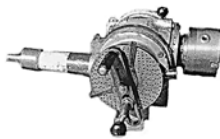


From the load shifting equipment shown above, choose the most appropriate (A.–F.) to shift each of the following.

**a.** tool box weighing 50 kg – shifted 100 metres




**b.** dividing head weighing 35 kg – shifted from a bench and placed on a milling machine table




**c.** 10 mm thick plate – lifted from a vertical rack




3 marks



**Question 7**

Which one of the signs below (A.–F.) should be displayed outside an area used for storing acetylene bottles?

A.



B.



C.



D.



E.



F.




1 mark

**Question 8**

A heavy load is being moved using an overhead crane inside a workshop. List two safety hazards involved.

1. \_\_\_\_\_

2. \_\_\_\_\_

2 marks

**Question 9**

You are entering an area where the signs shown below are displayed. What PPE must be worn in this area?



1. \_\_\_\_\_

2. \_\_\_\_\_

2 marks

**Question 10**

A piece of 6 mm thick steel plate has been guillotined to 400 mm × 400 mm and is being carried manually to a workbench. State one possible safety hazard when carrying this material.

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1 mark

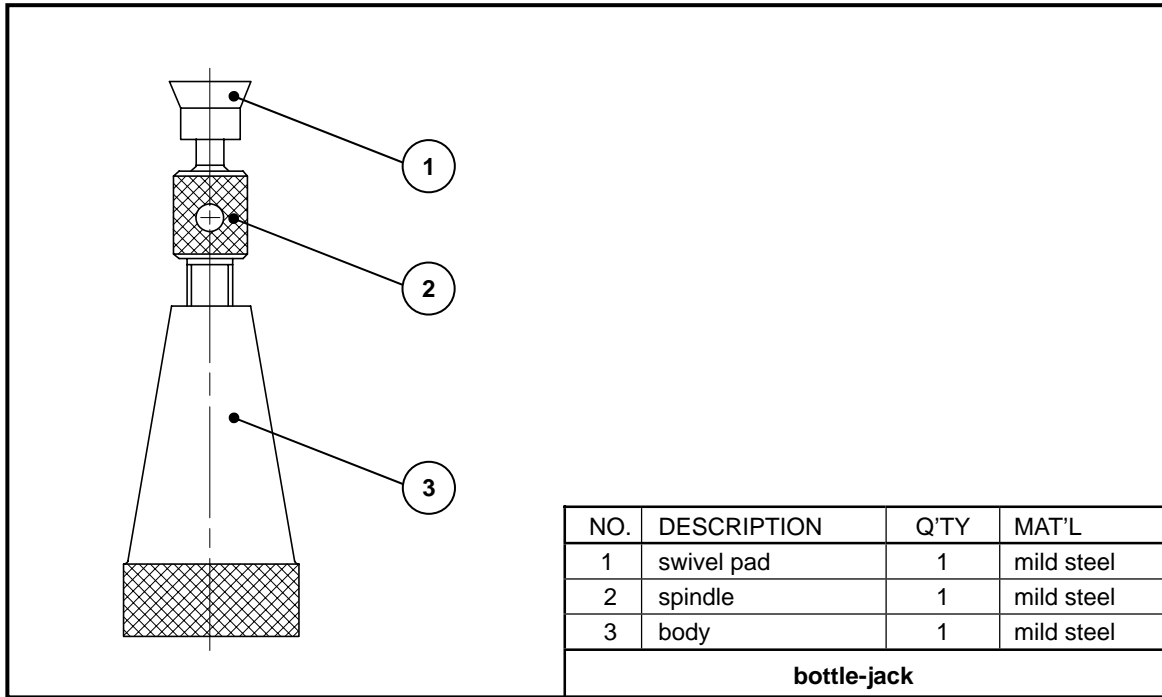
Total 15 marks

**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).

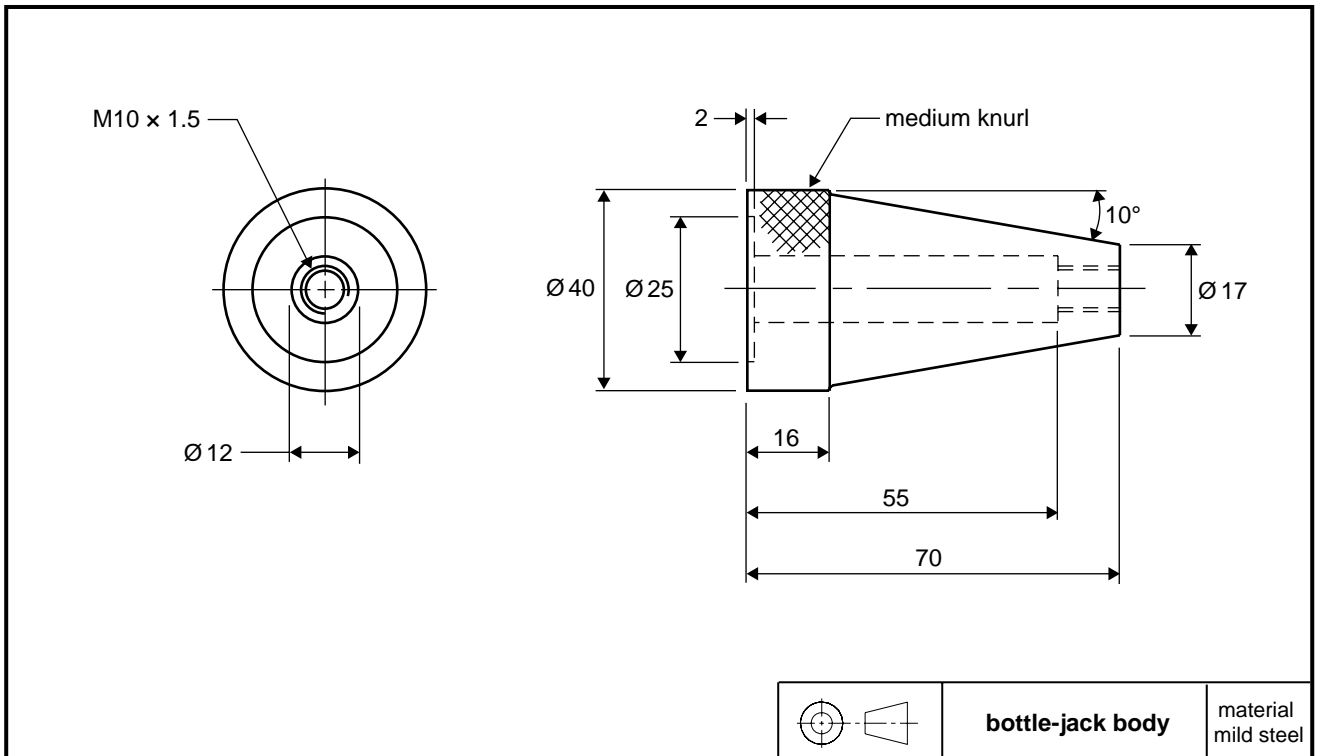
Figure 1 shows an assembled view of a bottle-jack. A bottle-jack is used to lift or support large workpieces. Questions 1 and 2 relate to the manufacture of the bottle-jack.



**Figure 1**

**Question 1**

The following questions relate to the manufacture of the bottle-jack body shown in Figure 2.



**Figure 2**

The bottle-jack body will be turned on the lathe shown in Figure 3.

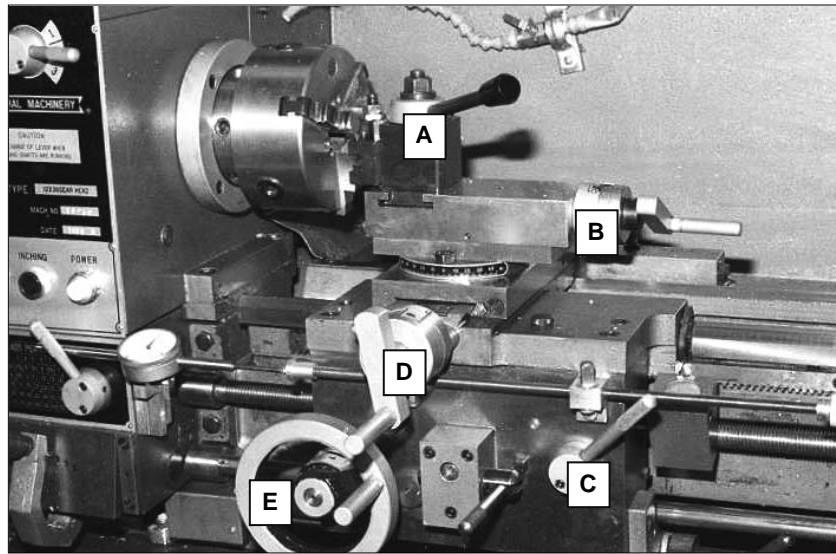


Figure 3

a. Which letter in Figure 3 indicates the hand-wheel that will be used to perform each of the following operations?

i. facing off

ii. parallel turning

iii. taper turning

3 marks

Before drilling the 12 mm diameter hole, the tool shown below is used.



b. What is the correct name of the tool shown?

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1 mark

c. Why is this tool used before drilling in the lathe?

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1 mark

You are using a cemented carbide tool to rough turn the Ø40 section of the body.

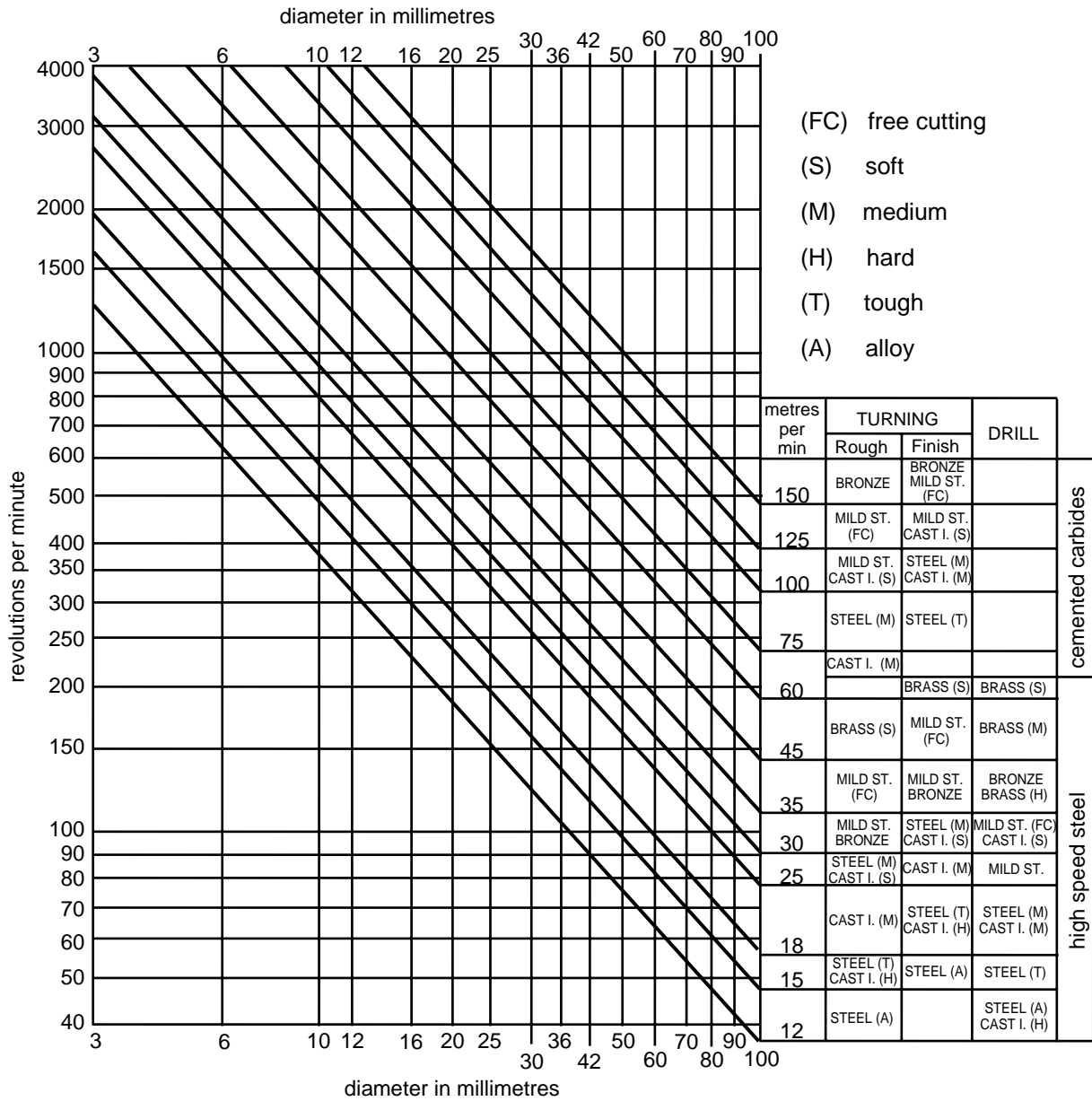


Figure 4

d. Use the nomogram shown in Figure 4 to determine the approximate rpm at which to set the lathe.

rpm

2 marks

Figure 5 shows a tapping chart.

<b>M (ISO) METRIC COARSE</b>							
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 × 0.25	1.00	1.00	0.838	0.693	0.729	0.75	1.05
M 1.1 × 0.25	1.10	1.10	0.938	0.793	0.829	0.85	1.15
M 1.2 × 0.25	1.20	1.20	1.038	0.893	0.929	0.95	1.25
M 1.4 × 0.30	1.40	1.40	1.205	1.032	1.076	1.10	1.45
M 1.6 × 0.35	1.60	1.60	1.373	1.170	1.221	1.25	1.65
M 1.8 × 0.35	1.80	1.80	1.573	1.370	1.421	1.45	1.85
M 2.0 × 0.40	2.00	2.00	1.740	1.509	1.567	1.60	2.05
M 2.2 × 0.45	2.20	2.20	1.908	1.648	1.713	1.75	2.25
M 2.5 × 0.45	2.50	2.50	2.208	1.948	2.013	2.05	2.60
M 3.0 × 0.50	3.00	3.00	2.675	2.387	2.459	2.50	3.10
M 3.5 × 0.60	3.50	3.50	3.110	2.764	2.850	2.90	3.60
M 4.0 × 0.70	4.00	4.00	3.545	3.141	3.242	3.30	4.10
M 4.5 × 0.75	4.50	4.50	4.013	3.580	3.688	3.70	4.60
M 5.0 × 0.80	5.00	5.00	4.480	4.019	4.134	4.20	5.10
M 6.0 × 1.00	6.00	6.00	5.350	4.773	4.917	5.00	6.10
M 7.0 × 1.00	7.00	7.00	6.350	5.773	5.917	6.00	7.20
M 8.0 × 1.25	8.00	8.00	7.188	6.466	6.647	6.80	8.20
M 9.0 × 1.25	9.00	9.00	8.188	7.466	7.647	7.80	9.20
M 10.0 × 1.50	10.00	10.00	9.020	8.160	8.376	8.50	10.20
M 11.0 × 1.50	11.00	11.00	10.026	9.160	9.376	9.50	11.20
M 12.0 × 1.75	12.00	12.00	10.863	9.853	10.106	10.20	12.20
M 14.0 × 2.00	14.00	14.00	12.701	11.546	11.835	12.00	13.25
M 16.0 × 2.00	16.00	16.00	14.701	13.546	13.835	14.00	16.25
M 18.0 × 2.00	18.00	18.00	16.376	14.933	15.294	15.50	18.25

Figure 5

- e. Use the tapping chart to work out the size of the hole that needs to be drilled for the thread in the body.

\_\_\_\_\_

1 mark

Figure 6 shows the graduations on the compound rest of the lathe being used to turn the body.

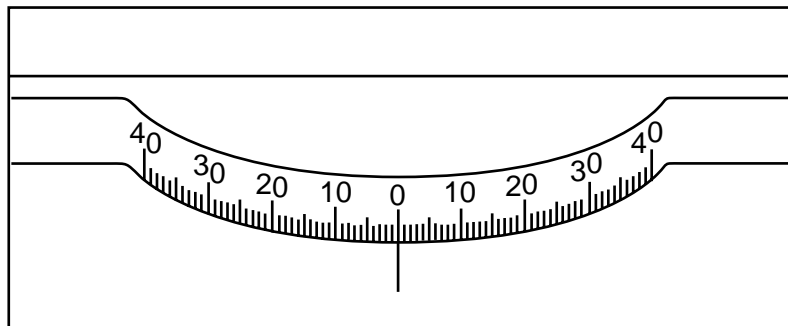


Figure 6

- f. On Figure 6, use an arrow to show the angle the compound rest should be set to turn the taper on the body.

1 mark

The body will be made from a 1 metre bar and parted off when finished. The parting-off tool needs to be set up on centre height before it is used.

g. Describe how to set up the parting-off tool so that it is accurately on centre height.

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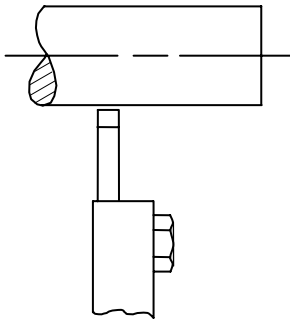
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2 marks

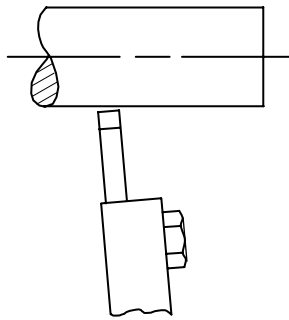
After setting the parting-off tool on centre height, it then needs to be set up so that it is fed in correctly.

h. Which of the diagrams below (A.–C.) shows the parting-off tool correctly set up in relation to the work?

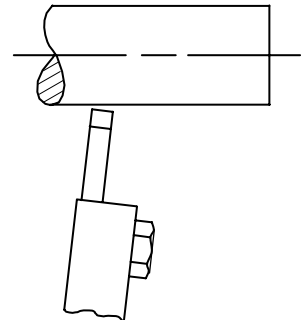
A.



B.



C.



1 mark

The body will be held on the lathe in a 3 jaw self-centring chuck.

The body should be set up so that as many operations as possible can be performed in the one set-up.

i. Give two reasons for this.

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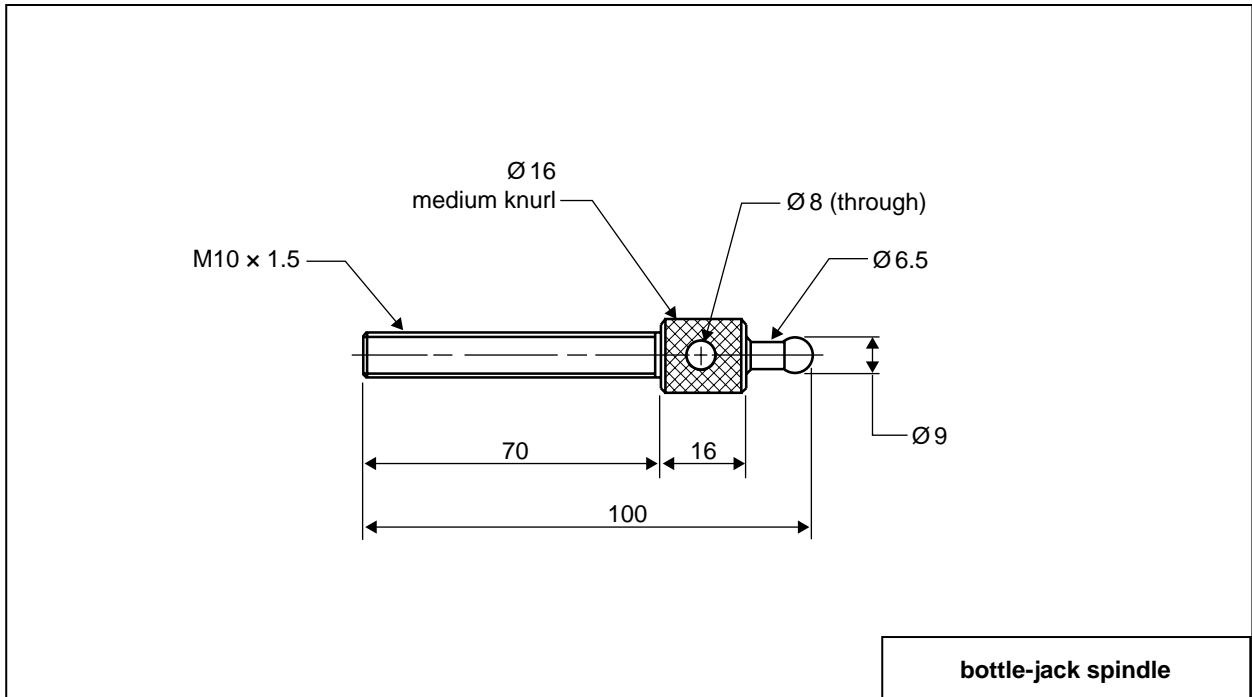
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2 marks

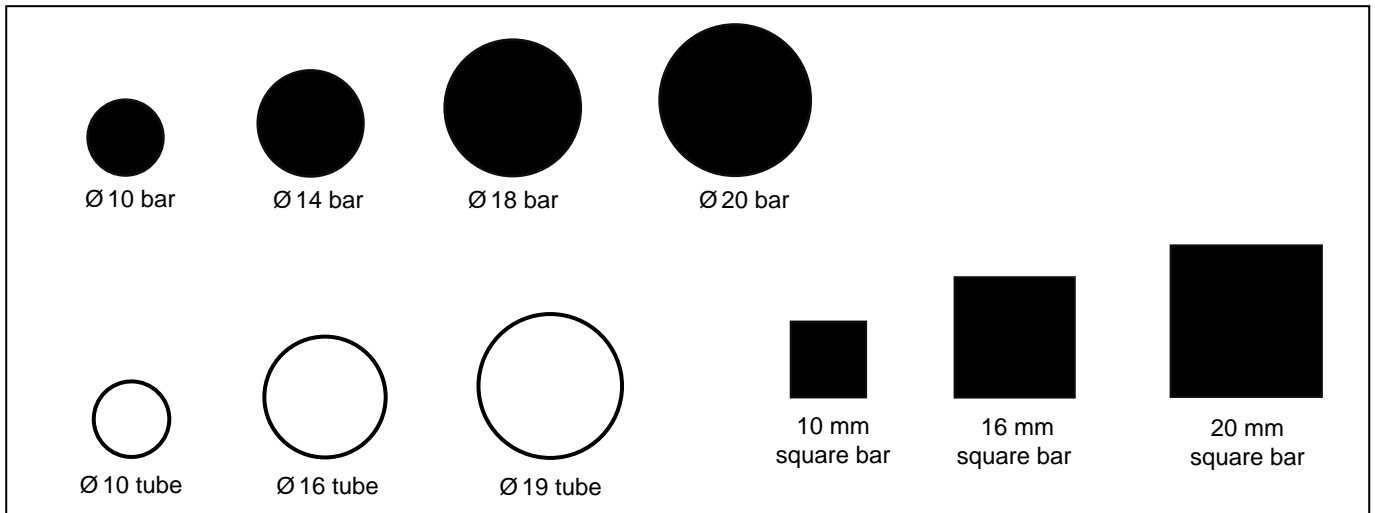
**Question 2**

The following questions relate to the manufacture of the bottle-jack spindle shown in Figure 7.



**Figure 7**

When looking for material for the spindle the following stock is available in the store.



- a. From the selection of material shown above, name the most suitable material to use when manufacturing the bottle-jack spindle.

\_\_\_\_\_

1 mark



The spindle will need to be supported by a centre when being turned. Two centres that could be used are shown below.

b. Name the two types of centres shown.

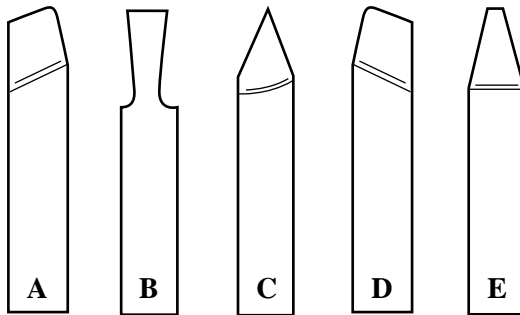


\_\_\_\_\_

\_\_\_\_\_

2 marks

c. Which of the lathe tools shown below (A–E) would be the most suitable to turn the Ø 10 in preparation for the thread? (Note: The tool will be fed towards the headstock of the lathe.)



1 mark

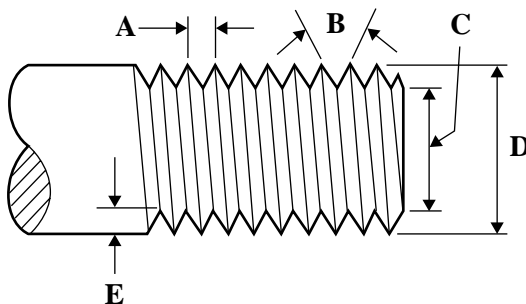
d. What is the name of the tool chosen in the question above?

\_\_\_\_\_

1 mark

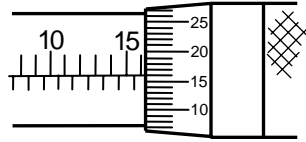
The spindle has an ‘M10 × 1.5’ thread. The ‘1.5’ is the pitch of the thread.

e. On the thread shown below, which letter indicates the pitch of the thread?



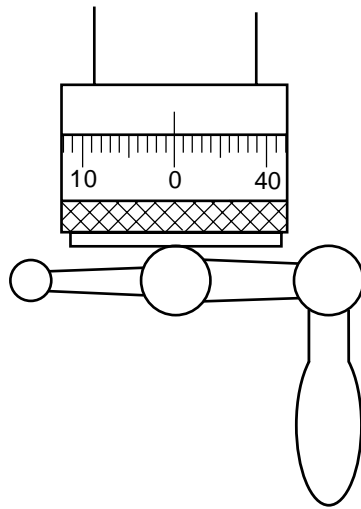
1 mark

The  $\varnothing 16$  is being turned down to size. The current size is shown on the 0–25 mm micrometer shown below.



f. i. What is the reading on the micrometer?

- ii. On the diagram below, use an arrow to show how much the cross-slide should be wound in to turn the diameter from the size shown on the micrometer down to  $\varnothing 16$ .  
 (1 division = 0.02 mm movement of the cross-slide)



1 + 2 = 3 marks

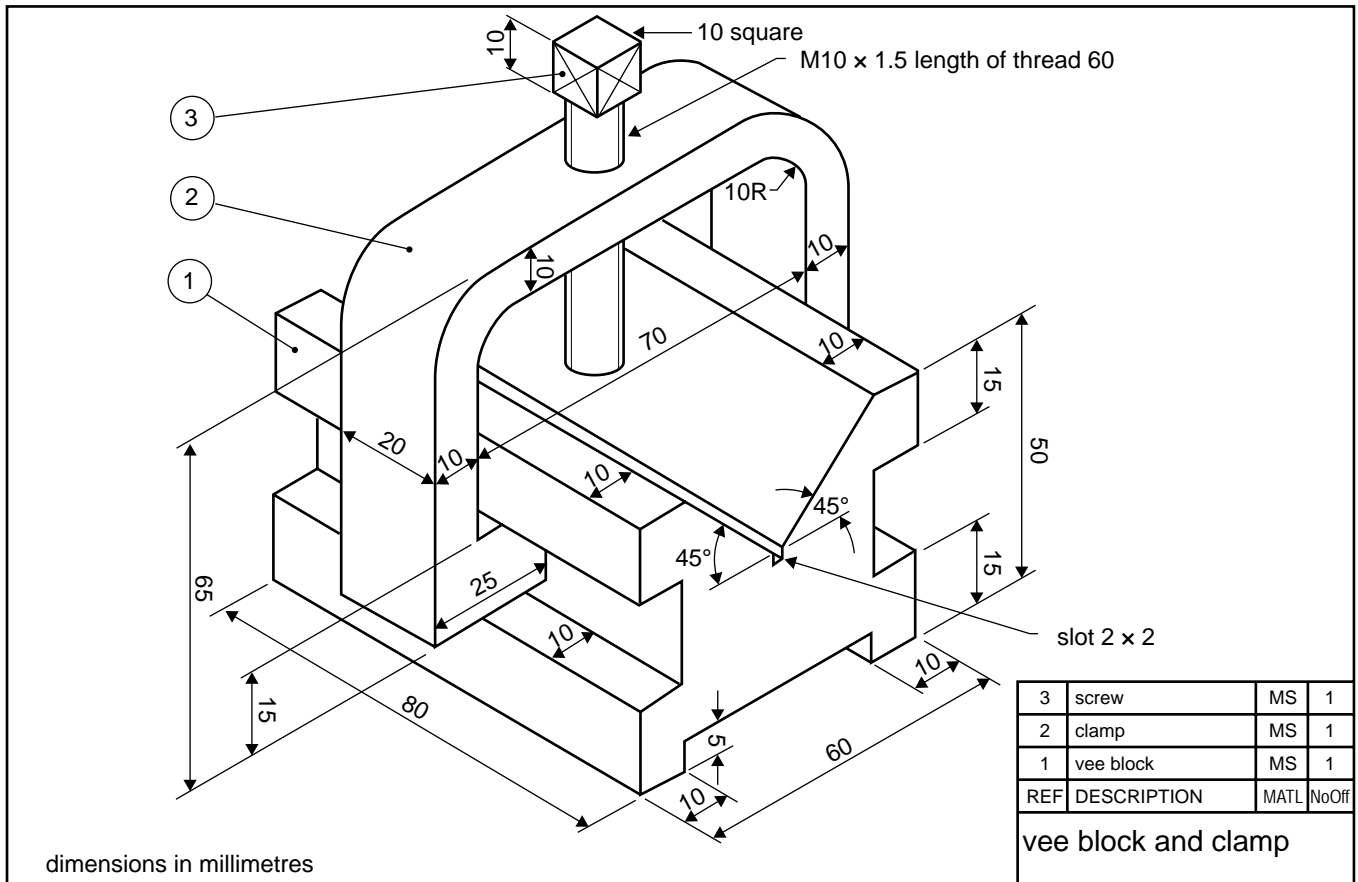
g. What is the purpose of the knurl on the bottle-jack spindle?

1 mark

**Question 3**

Figure 8 shows a vee block and clamp.

The questions which follow relate to the manufacture of the vee block and clamp.



**Figure 8**

a. Briefly explain what a vee block is used for.

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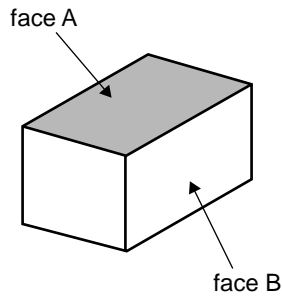
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1 mark

The material being used to make the vee block is 70 mm square, and needs to be milled down to the 60 × 50 size.

Face A has already been machined flat as shown in Figure 9.

Face B is the next face to be machined.



**Figure 9**

The material needs to be clamped in the vice shown in Figure 10 to machine face B.



**Figure 10**

- b. Indicate with an arrow on Figure 10 which vice jaw face A should be clamped against.

1 mark

The material for the vee block needs to be lifted off the base of the vice so that it sits above the vice jaws when being machined.

- c. What should be used to lift the material accurately off the base of the vice?

1 mark

The cutter shown in Figure 11 is 16 mm in diameter and will be used to mill the 20 mm wide slots in the side of the vee block.



**Figure 11**

- d. What is the name of the milling cutter shown in Figure 11?

1 mark

- e. Calculate the rpm for the cutter shown in Figure 11, using a cutting speed of 38 m/min.  
Show all working out.

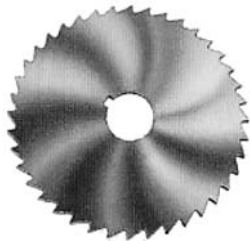
$$\text{rpm} = \frac{320 S}{D}$$

2 marks

- f. What measuring tool can be used to check the squareness of the vee block?  
\_\_\_\_\_

1 mark

The milling cutter shown in Figure 12 is a slitting saw. It will be used to mill the 2 mm wide slot in the bottom of the vee.

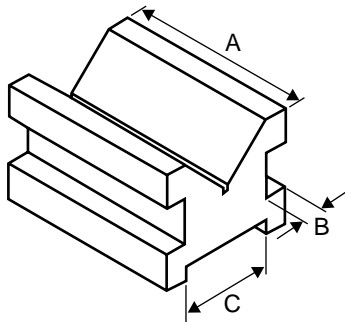


**Figure 12**

- g. On Figure 12, use an arrow to show the correct direction of rotation of the slitting saw.

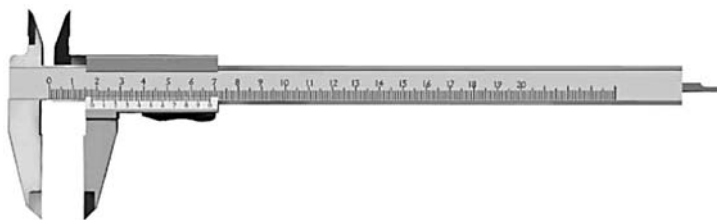
1 mark

Figure 13 shows the finished vee block. The three features (A, B and C) need to be measured using the vernier caliper shown in Figure 14.



**Figure 13**

- h. Place the corresponding letter on the part of the vernier caliper that can be used to measure each of the three features (A, B and C).



**Figure 14**

3 marks

**i.** List three marking-out tools that you would need to mark out the vee block **clamp** shown in Figure 8.

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_

3 marks

The M10 thread in the vee block clamp will be tapped by hand using the set of taps shown below.

**j.** Which one of the three taps should be used first?

**A.**



**B.**



**C.**



1 mark

When tapping by hand, the tap needs to be turned back occasionally before continuing.

**k.** Explain why this is necessary.

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1 mark

Total 40 marks