Victorian Certificate of Education 2010

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

Letter

Figures									
Words									

VCE VET ENGINEERING STUDIES CERTIFICATE III

Written examination

Wednesday 17 November 2010

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	2	2	15
C	11	11	30
D	6	6	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 28 pages with a formula sheet on page 28.
- 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

How many kilowatts is equal to 4000 watts?

A. 4
B. 40
C. 400
D. 40 000

Question 2

Which one of the following materials is a good insulator of current?

A. PVC
B. carbon
C. bronze
D. nichrome

Use Figure 1 to answer Questions 3 and 4.

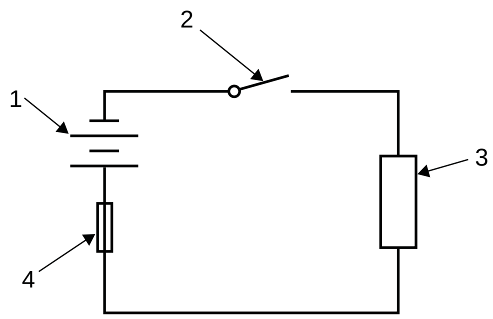


Figure 1

Question 3

In Figure 1, the symbol labelled ‘2’ represents a

A. load.
B. switch.
C. power source.
D. circuit protection device.

Question 4

Which number in Figure 1 shows the load?

A. 1
B. 2
C. 3
D. 4

Question 5

In a simple circuit, one of the main purposes of the circuit protection device is to

A. disconnect the load when it is not operating.
B. provide a safe voltage for the circuit.
C. prevent over-loading of the circuit.
D. consume electricity efficiently.

Question 6

A 240-volt circuit has 8 amps flowing through it.

The resistance of the circuit is

A. 24 ohms.
B. 30 ohms.
C. 36 ohms.
D. 42 ohms.

Question 7

A parallel circuit is different to a series circuit in that it has

A. fewer current paths.
B. a single current path.
C. more than one current path.
D. no current path.

Question 8

Which of the following is a device that uses the magnetic effect of an electric current?

A. LED
B. light globe
C. electric motor
D. electric strip heater

Question 9

Fuses operate by using the ___________ effect of an electric current.

A. heating
B. chemical
C. magnetic
D. antimagnetic

Question 10

In Figure 2, the ammeter shown is used to measure the circuit current.

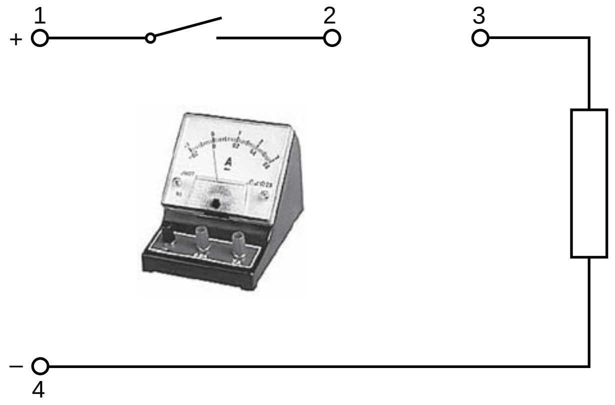


Figure 2

For the ammeter to read correctly, the positive and negative leads of the ammeter should be connected across

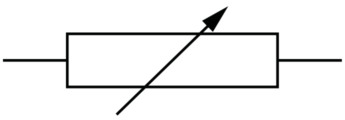
A. 1 and 4 and leave the switch open.
B. 2 and 3 and leave the switch open.
C. 1 and 4 and close the switch.
D. 2 and 3 and close the switch.

Question 11

Resistance is the property of a material that ___________ current flow.

A. assists
B. opposes
C. increases
D. doubles

Question 12



Which electrical component is represented by the symbol shown above?

A. fixed resistor
B. power resistor
C. carbon resistor
D. variable resistor

Question 13

What are the upper and lower values of a 15 ohm resistor with a 10% tolerance?

A. 10 to 20 ohms
B. 13.5 to 16.5 ohms
C. 14 to 16 ohms
D. 14.5 to 15.5 ohms

Question 14

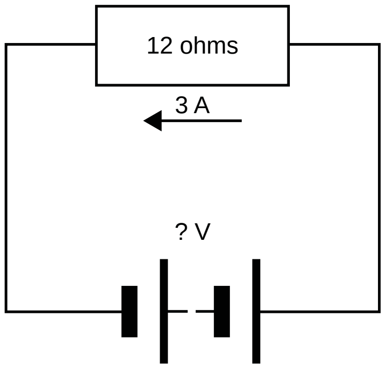


Figure 3

What is the supply voltage of the circuit shown in Figure 3?

A. 12 V

B. 24 V

C. 36 V

D. 48 V

Question 15

When measuring the value of an unknown low voltage supply, always start with the voltmeter set to the __________ range.

A. lowest

B. continuity

C. resistance

D. highest

END OF SECTION A
TURN OVER

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 an isometric view of a clamp.

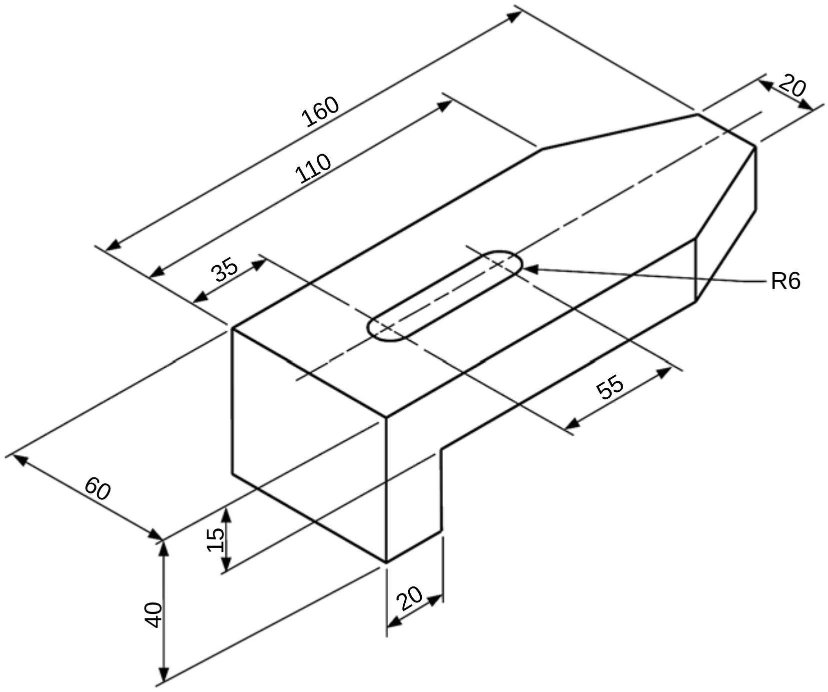
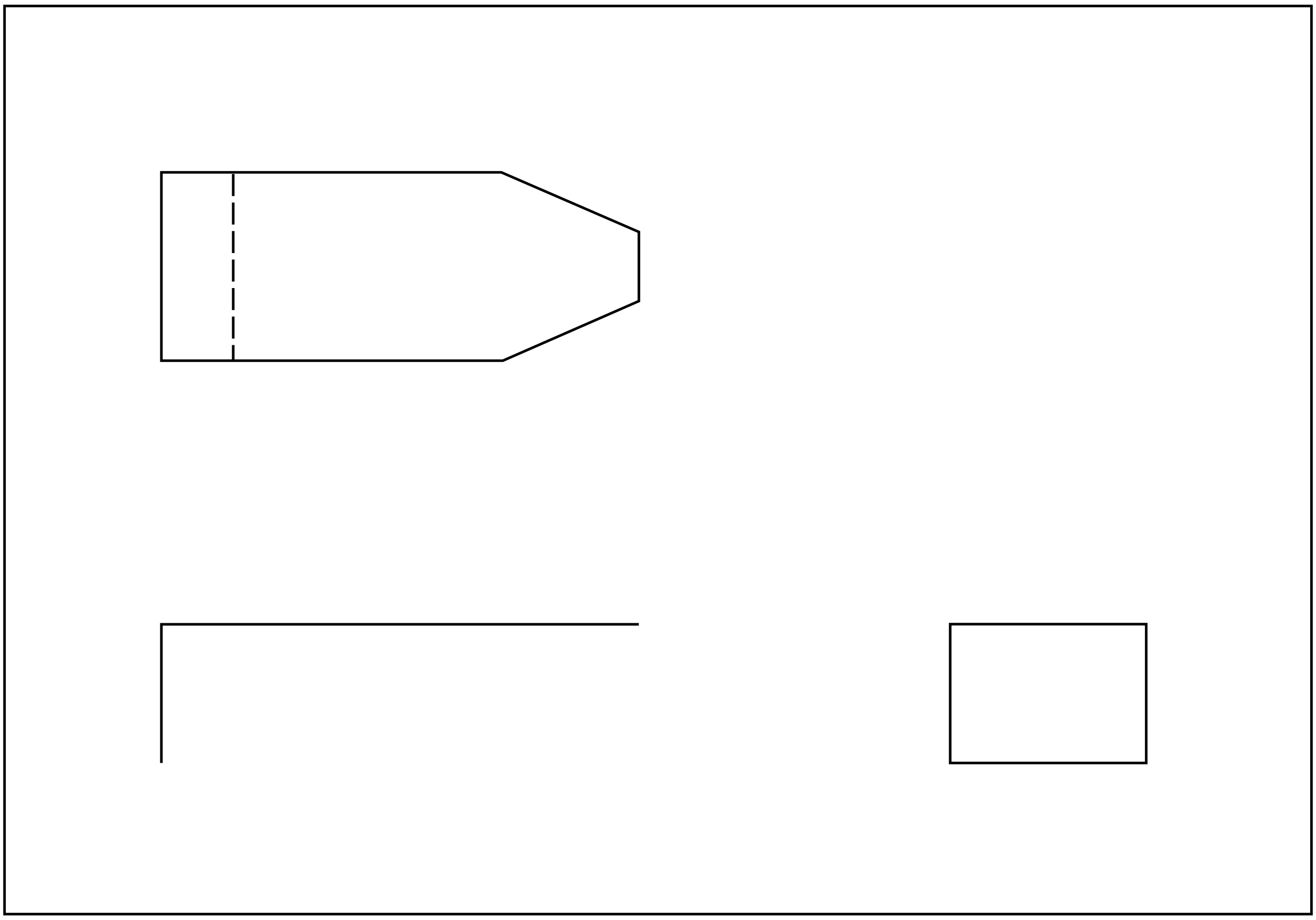


Figure 1

On the sketch below complete the top, side and end views of the clamp shown in Figure 1.

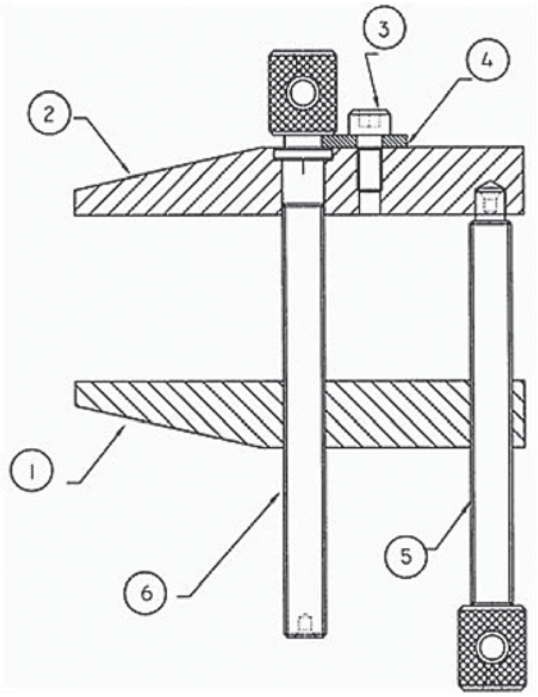
- Use conventional drawing systems.
- Show views in third-angle projection.
- Show all hidden detail.
- Dimension the **position** and **size** of the **slot only**. (Do not dimension the clamp itself.)



4 marks

Question 2

Figure 2 shows an assembly drawing of a parallel clamp.



No.	Description	Q'ty	Mat'l.
1	Movable Jaw	1	MS
2	Fixed Jaw	1	MS
3	M 6 Socket Head Cap Screw	1	-
4	Retainer Plate	1	MS
5	Clamp Screw	1	MS
6	Adjusting Screw	1	MS

Tolerances Unless Otherwise Stated: Diameters ± 0.05 Lengths ± 0.25 Finish μ 3.2	Name: Parallel Clamp	
	Material: Mild Steel	

Figure 2

Figure 3 shows a detailed drawing of the fixed jaw from the parallel clamp.

Question 2 relates to the drawing shown in Figure 3.

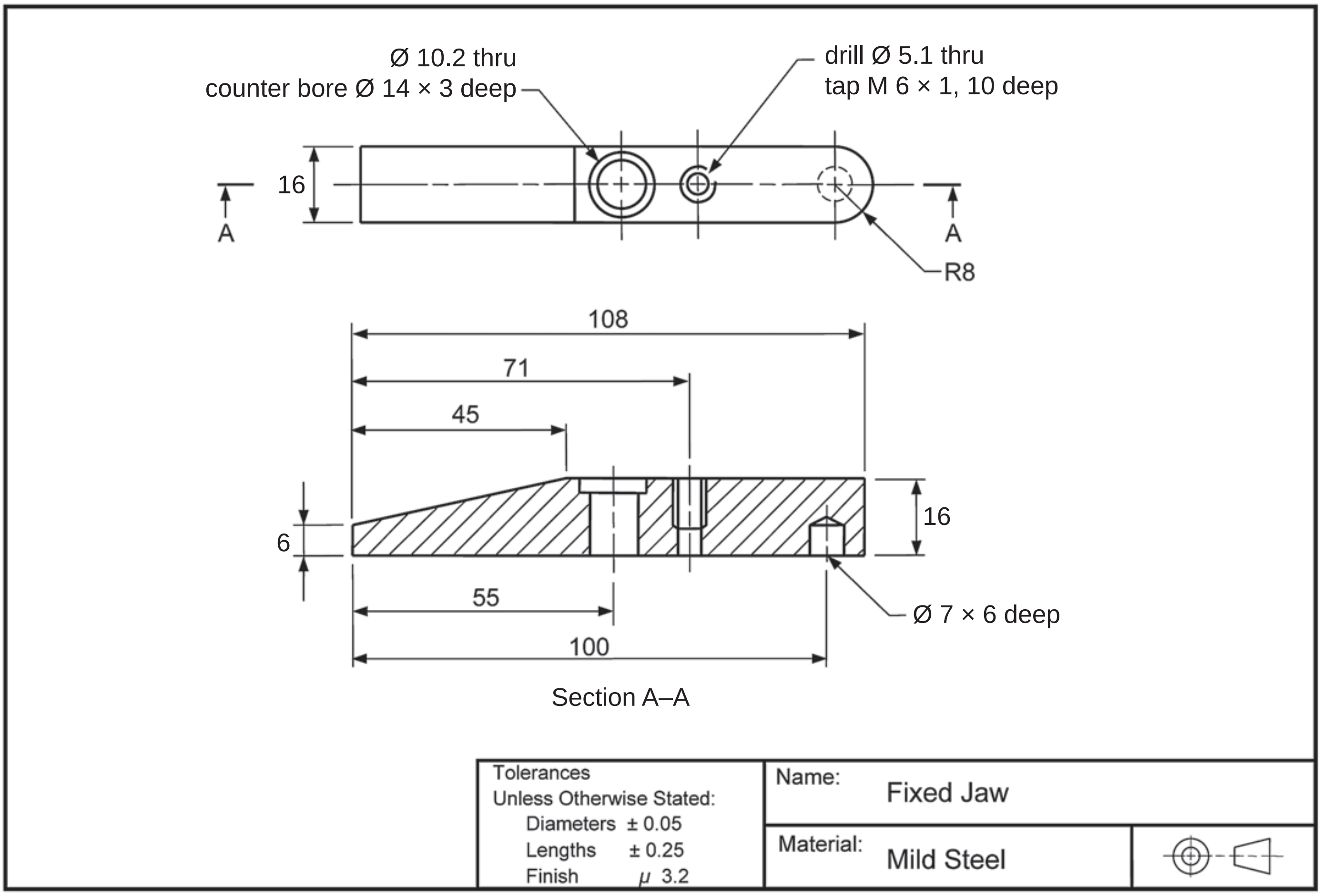


Figure 3

a. What does R8 mean?

1 mark

The side view of the jaw in Figure 3 shows it drawn with 45° lines.

b. What do these lines indicate?

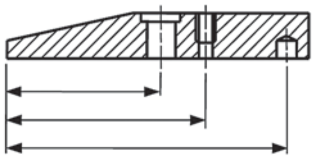
1 mark

c. How deep is the counter-bored hole?

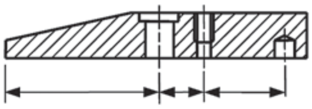
1 mark

The positions of the holes in the fixed jaw have been dimensioned from one end as shown in sketch A. Sketch B shows incorrect dimensioning.

A.



B.

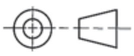


d. Explain why using dimensioning as shown in sketch B could lead to inaccuracies in the positioning of the holes.

2 marks

e. What is the tolerance of the diameters in Figure 3?

1 mark



f. What does this symbol mean?

1 mark

g. In the space provided below, sketch an isometric view of the fixed jaw shown in Figure 3.
(Do not dimension the drawing.)

4 marks

Total 15 marks

END OF SECTION B
TURN OVER

SECTION C – VBN 787 Apply mathematical principles to engineering designs

Instructions for Section C

Answer **all** questions in the spaces provided.
Where a question is worth more than one mark, you **must** show your working out.
Where applicable, answers must be given to two decimal places.
Unless otherwise indicated all measurements are in mm (millimetres).

Question 1

Figure 1 shows a gate frame that is made from 25 mm square tubing.

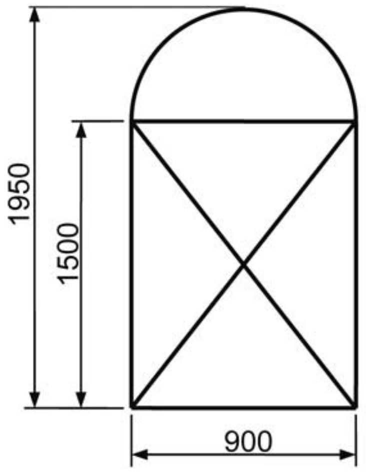


Figure 1

Calculate the total length of tubing that is required for the gate.

3 marks

Question 2

The gate shown in Figure 1 will be covered with sheet metal that weighs 11.2 kg per m^2.
Calculate the weight of the sheet metal that is required to cover one side of the gate.

2 marks

Question 3

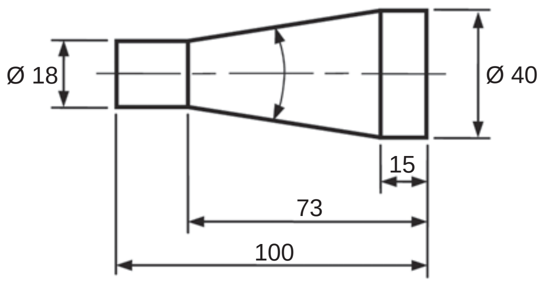


Figure 2

Calculate the included angle for the part shown in Figure 2.

3 marks

Question 4

Figure 3 shows the finished length of a pin.

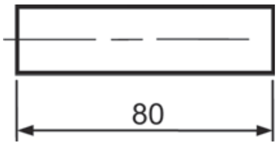


Figure 3

How many pins can be obtained from a 6.0 metre length bar? Allow 2 mm per cut for the saw, and 1 mm for each pin to clean up the length.

1 mark

Question 5

During an 8-hour work shift, 40 minutes is lost due to a machine breakdown.

What percentage of the shift time is lost due to the machine breakdown?

1 mark

Question 6

The shape shown in Figure 4 is dimensioned in inches ("). The inch is an imperial measurement.

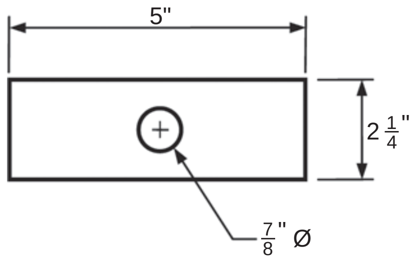


Figure 4

Convert the three dimensions to metric (mm) measurements.
(1" = 25.4 mm)

$\frac{7}{8}$" Ø = ____________ mm

$2\frac{1}{4}$" = ____________ mm

5" = ____________ mm

3 marks

Question 7

A solder is composed of copper, zinc and tin in the ratio of 8:6:2.
If a batch of solder weighs 112 kg, calculate the weight of each metal in this batch.

weight of copper	kg
weight of zinc	kg
weight of tin	kg

3 marks

Question 8

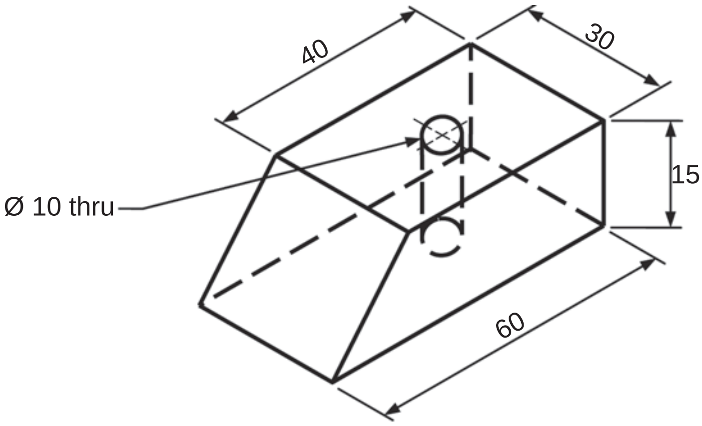


Figure 5

Calculate the volume, in cm^3, of the wedge shown in Figure 5 above.

5 marks

Question 9

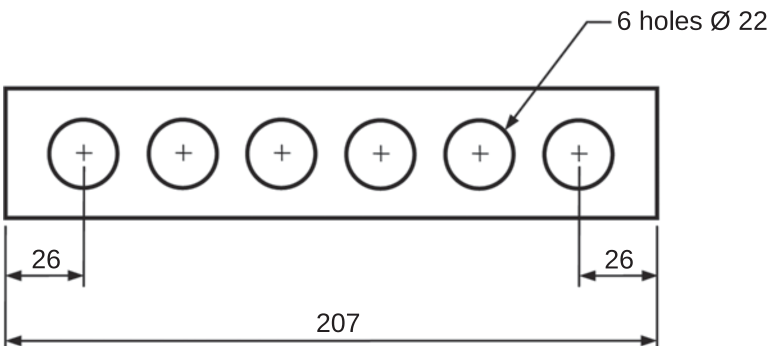


Figure 6

What is the distance between the centres of the equally spaced holes on the parallel strip in Figure 6 above?

2 marks

Question 10

A steel can Ø 88 needs a label. The label will wrap around the can and overlap by 3 mm.
How long will the label need to be?

2 marks

Question 11

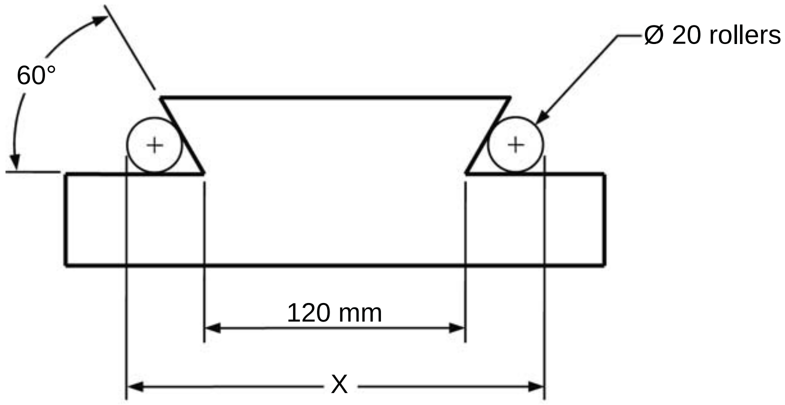


Figure 7

Calculate distance 'X' on Figure 7 above.

5 marks

Total 30 marks

END OF SECTION C

SECTION D – VBN 788 Design and prototype components and/or small structures using engineering design principles

Instructions for Section D

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

The trailer shown in Figure 1 is going to be fitted with a tilt locking mechanism. This mechanism will be mounted on the ‘A’ frame.

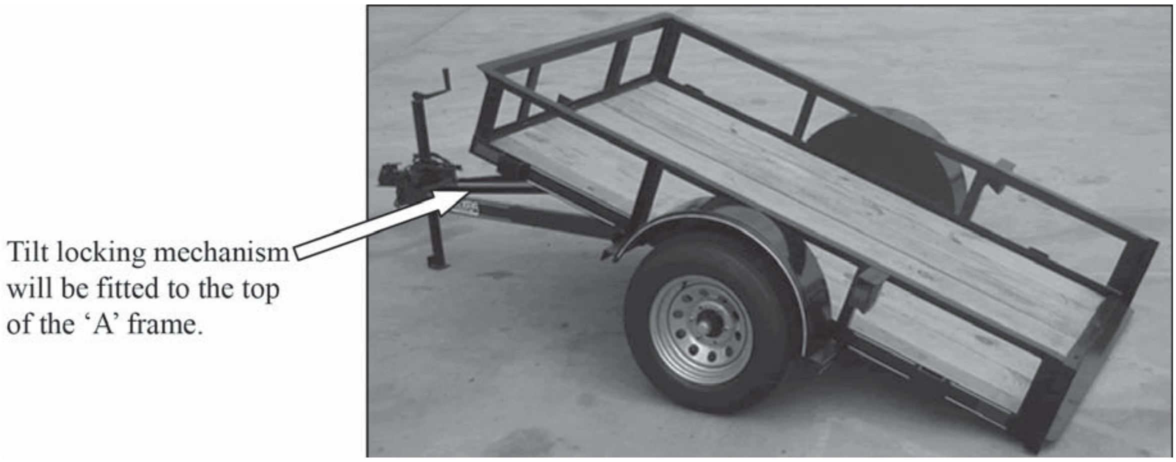


Figure 1

Figure 2 shows an assembly drawing of the tilt locking mechanism. The unlocking system is **not** shown.

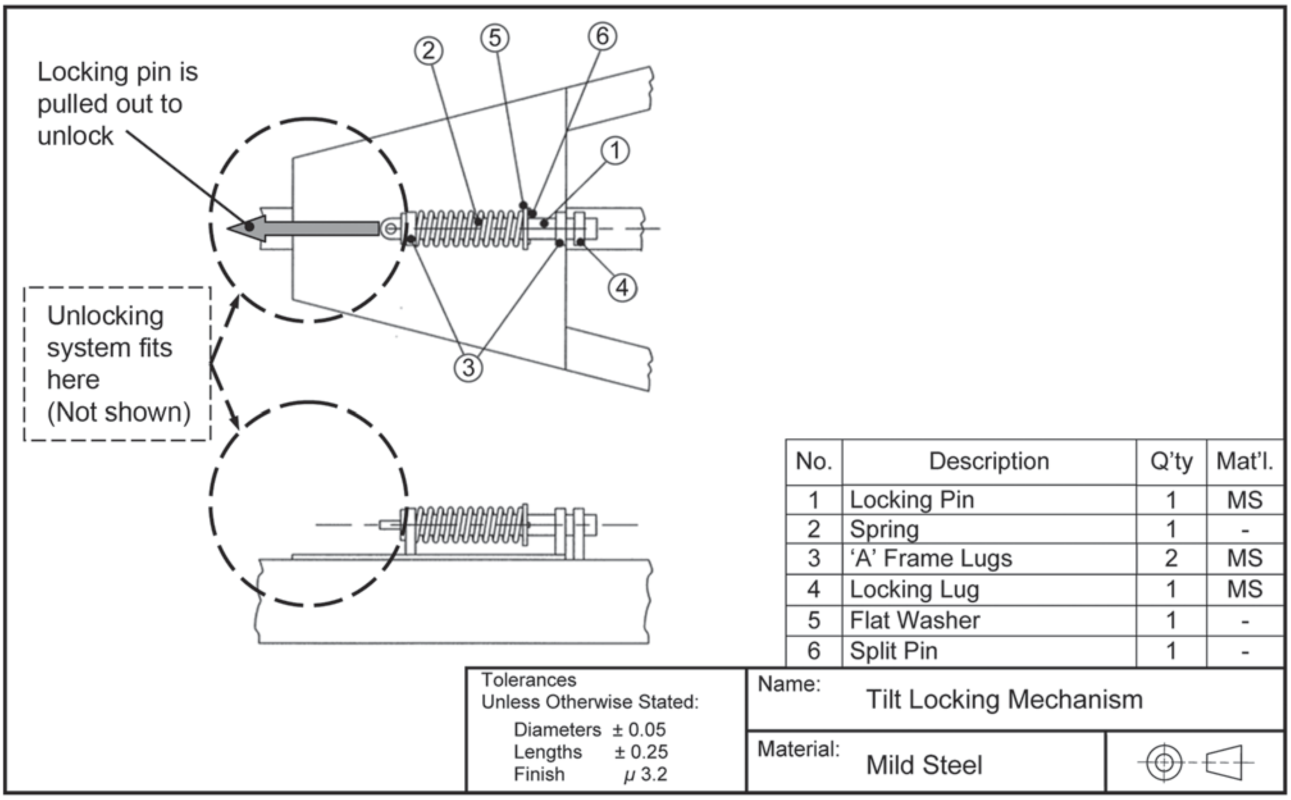


Figure 2

Figure 3 shows a detailed drawing of the locking pin and the locking lug.

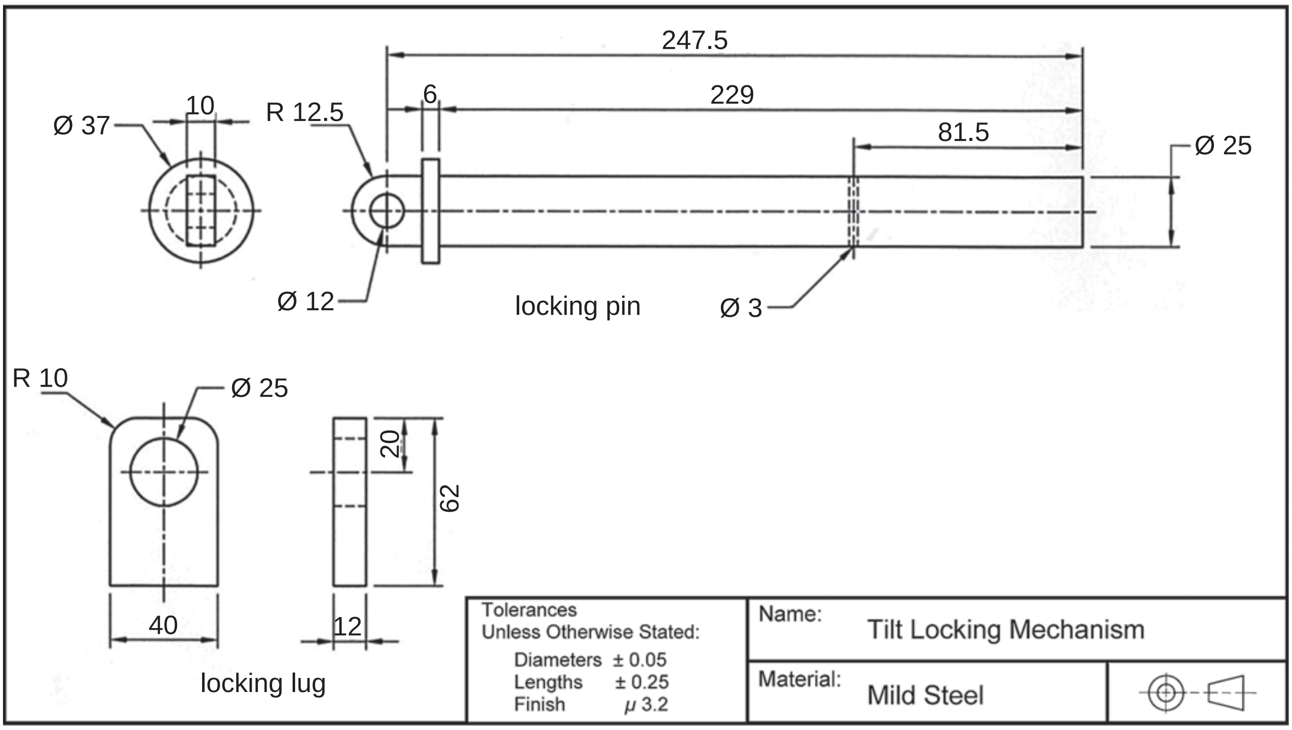


Figure 3

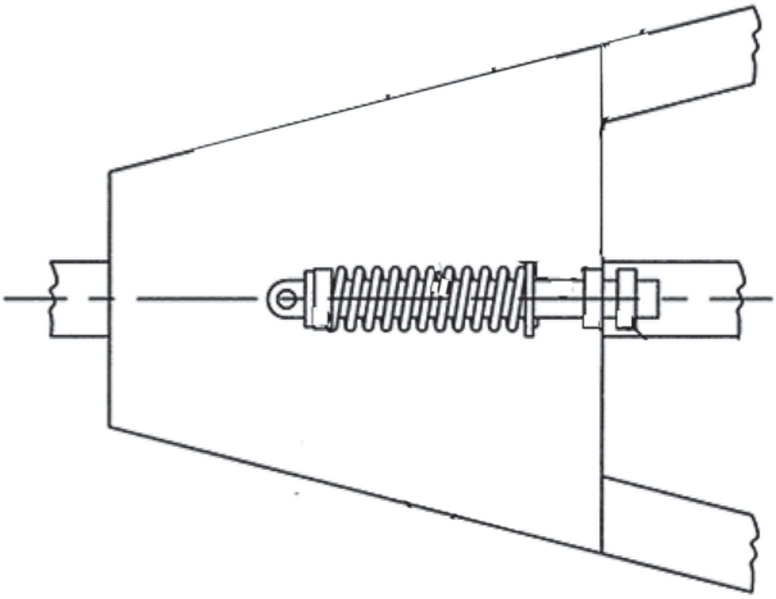
CONTINUES OVER PAGE

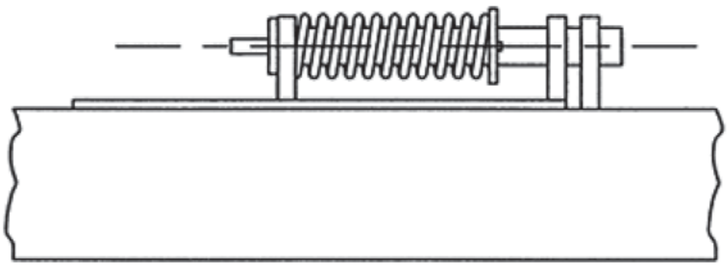
Question 1

You are required to design a mechanical unlocking system that disengages the locking pin from the locking lug.

Sketch your design below.

- Label all parts.
- Show how the unlocking system is attached to the 'A' frame.
- Show basic dimensions and materials used.
- Include notes on how your design works.





10 marks

Question 2

The detailed drawing (Figure 3) shows that the locking pin and the hole in the locking lug are both Ø25. If the **general** tolerance is applied to these two diameters they may not fit together.

i. Explain why they may not fit together.

ii. On Figure 4, show the tolerance that should be applied so that the locking pin and lug fit together correctly.

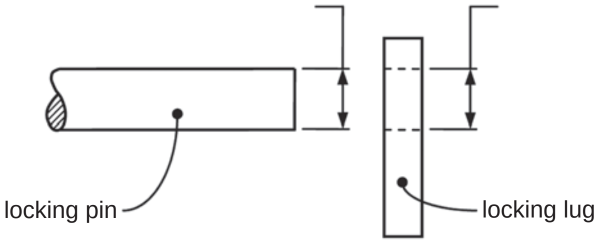


Figure 4

2 + 2 = 4 marks

Question 3

The locking pin was found to be difficult to engage with the locking lug when the trailer was returned to its normal carrying position.

Sketch **two** modifications to the locking pin and the locking lug that will make it easier to engage.

4 marks

Question 4

The mild steel used for the tilt locking mechanism often rusts.

Other than painting, what can be done to the material to stop it rusting?

1 mark

Question 5

This question relates to the manufacture of the locking pin shown in Figure 3 (page 20).

a. Which of the following material diameters would be the most suitable to manufacture the locking pin?

A. Ø 12

B. Ø 24

C. Ø 25

D. Ø 38

E. Ø 62

1 mark

b. What length should the material be cut to make the locking pin?

____

1 mark

c. List four **cutting** tools that would be required to manufacture the locking pin.

1. ____
2. ____
3. ____
4. ____

2 marks

d. List two **measuring** tools that are required to manufacture the locking pin.

1. ____
2. ____

1 mark

e. List two **machines** that are required to manufacture the locking pin.

1. ____
2. ____

2 marks

f. A 64 mm long piece of material has been cut off from a 40 × 12 mild steel bar to make the locking lug shown in Figure 5.

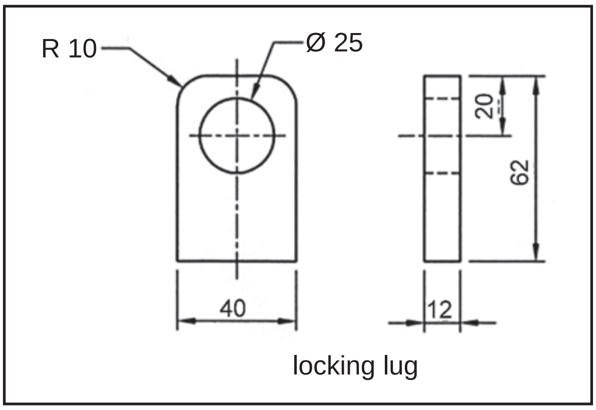


Figure 5

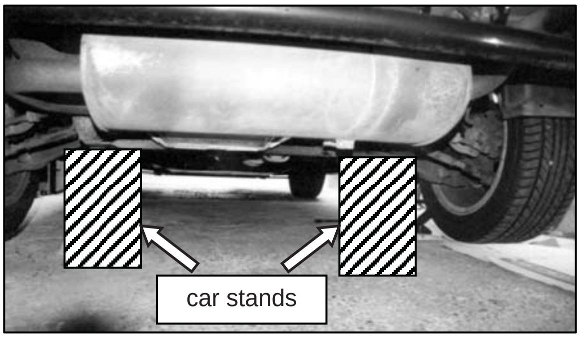
Describe how the locking lug will be manufactured by filling in the operational plan below.

Operation No.	Operation description	Tools/Cutters

6 marks

Question 6

You are required to design a set of car stands to support a car which has been jacked up.



The following materials are available for you to use.

– square tube – 25 square × 3 mm wall thickness
– square tube – 40 mm square × 5 mm wall thickness
– angle iron – 20 × 20 × 3
– angle iron – 50 × 50 × 5
– flat bar – 50 × 5
– 10 mm thick plate
– 25 mm thick plate
– round bar – Ø 12

- You do **not** need to use all of the materials shown above.
- Your design needs to have at least 4 adjustable height positions between 300 mm and 450 mm.
- Show dimensions and materials used.

8 marks

Total 40 marks

END OF SECTION D
TURN OVER

Data/formula sheet

Circumference of a circle = πD

Area of a circle = πr^2

Area of a triangle = $\frac{1}{2}$ × base × height

Volume of a sphere = $\dfrac{4\pi r^3}{3}$

Area of a rectangle = L × W

Volume of a square prism = L × W × H

Area of a circular ring = $\dfrac{\pi (D^2 - d^2)}{4}$

Volume of a cylinder = $\pi r^2 \times L$

Sin = $\dfrac{\text{opposite}}{\text{hypotenuse}}$

Cos = $\dfrac{\text{adjacent}}{\text{hypotenuse}}$

Tan = $\dfrac{\text{opposite}}{\text{adjacent}}$

Surface area of a sphere = $4\pi r^2$

Area of a cylinder = circumference × length

END OF QUESTION AND ANSWER BOOK