

**Victorian Certificate of Education  
2014**

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER           Letter

# VCE VET ENGINEERING STUDIES

## Written examination

**Wednesday 19 November 2014**

**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	20	20	20
B	16	16	80
			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 27 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 – Multiple-choice questions****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.

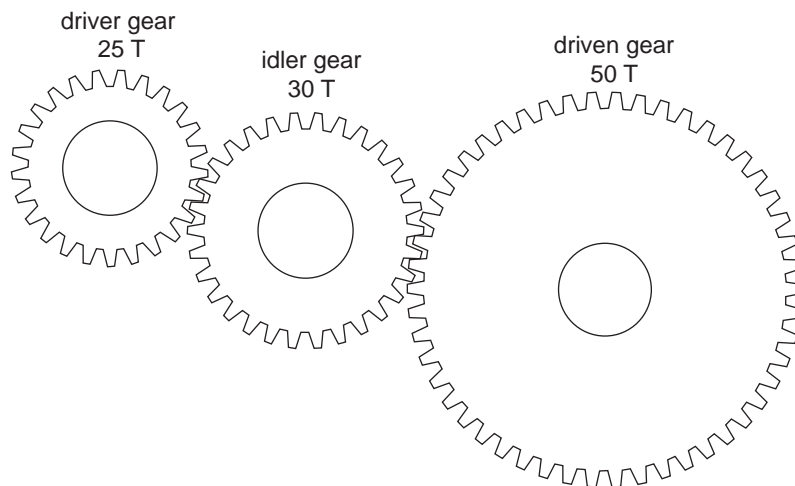
No marks will be given if more than one answer is completed for any question.

**Question 1**

Under the 5S system, which one of the following steps follows Shine?

- A. Sort
- B. Sustain
- C. Set in order
- D. Standardise

*Use the following information to answer Questions 2 and 3.*

**Question 2**

What effect does the idler gear have on the ratio in the gear train?

- A. It changes the ratio.
- B. It decreases the ratio.
- C. It increases the ratio.
- D. It has no effect on the ratio.

**Question 3**

Referring to the arrangement of gears in the diagram, what effect would there be on the speed of the driven gear in relation to the speed of the driver gear?

- A. The speed of the driven gear would be higher than the speed of the driver gear.
- B. The speed of the driven gear would be half the speed of the driver gear.
- C. The speed of the driven gear would be the same as the speed of the driver gear.
- D. The speed of the driven gear would be twice the speed of the driver gear.

**Question 4**

In engineering, the term 'tolerance' refers to

- A. the clearance between two workpieces.
- B. the dimensions of the workpiece measured.
- C. the maximum deviation from the specified dimension.
- D. an error that is averaged over a series of measurements.

**Question 5**

A 20 L drum of water-soluble cutting oil is knocked over and splits open, spilling its contents onto a concrete floor.

What should you do first?

- A. Contain the spill with rags and report the incident to the workshop manager.
- B. Place an empty cardboard box in the middle of the oil spill, to remind yourself to clean it up later.
- C. Complete a safety incident report to ensure the cleaner pays particular attention to this area.
- D. Immediately use the fire hose or other high-pressure water source to disperse the oil and wash it down the drain.

**Question 6**

A specific fabrication job requires aluminium sheet with a thickness of 0.91 mm.

The most accurate measurement tool that could be used to check the thickness of the sheet would be a

- A. micrometer.
- B. laser pointer.
- C. vernier caliper.
- D. 150 mm steel rule.

**Question 7**

What is the purpose of deburring?

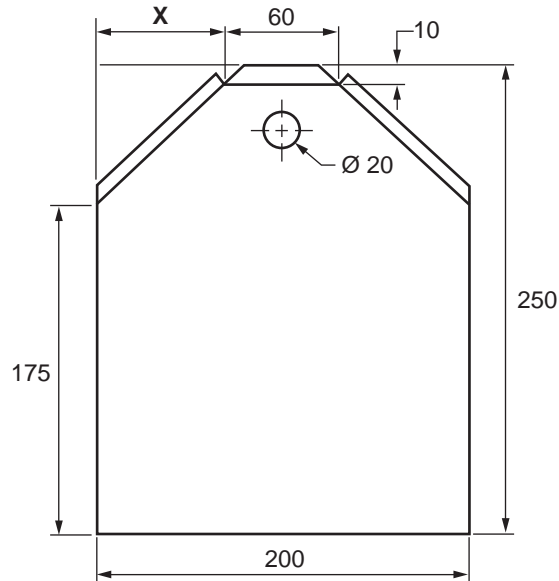
- A. to shape the part
- B. to create a chamfer
- C. to remove sharp edges
- D. to give the job a shiny finish

**Question 8**

The main purpose of the Standardise step when applying 5S procedures is to ensure that

- A. all employees avoid bad habits.
- B. all jobs are finished the same way.
- C. all employees work the same hours, to reduce overtime costs.
- D. the workplace is set up so you can easily see if anything is out of place.

Use the following information to answer Questions 9–11.



The design of one end section of an open-folded sheet metal toolbox is shown above. All dimensions are in millimetres (mm).

### Question 9

The diagram shows where three 10 mm metal folds would be made.

The purpose of folding the sheet metal for this job is to

- A. allow for screws to be placed there.
- B. provide a flange for the lid to be attached.
- C. remove the sharp edges and strengthen the edge.
- D. add pop rivets at a later stage of the manufacturing process.

### Question 10

The measurement of the length X in the diagram is

- A. 60
- B. 70
- C. 90
- D. 140

### Question 11

Refer to the measurement 175 that is shown on the diagram.

What percentage is 175 of the total height of the end section?

- A. 17.5%
- B. 70%
- C. 75%
- D. 80%

**Question 12**

While operating a lathe, the coolant stops running.

What should be used to top up the coolant?

- A. water from a drum
- B. oil directly from a drum
- C. mixed coolant from a drum
- D. water from a hose connected directly to the tap

**Question 13**

After completing a job, the milling machine is usually cleaned by removing the swarf and offcuts, which then need to be disposed of.

Which one of the following is the best option for disposing of the swarf and offcuts?

- A. Leave them for the cleaner.
- B. Put them in the scrap-metal bin.
- C. Leave them in a neat pile on the end of the milling machine.
- D. Put them in the rubbish bin beside the milling machine.

**Question 14**

A first-year apprentice is paid \$399.00 for working a 38-hour week, from Monday to Friday.

If the apprentice works an extra four hours on a Saturday at a double-time rate, what will the apprentice's total weekly pay be?

- A. \$441.00
- B. \$439.00
- C. \$483.00
- D. \$525.00

**Question 15**

The benefit of introducing 5S procedures in the workplace is

- A. an increase in profits.
- B. an improvement in workplace safety.
- C. attracting overseas investment.
- D. encouraging teamwork among the workers.

**Question 16**

Portable power tools should be regularly tested and tagged.

The purpose of testing and tagging is to

- A. ensure that the power tool is electrically safe.
- B. show the suitability of the power tool for the job.
- C. indicate who is qualified to operate the power tool.
- D. ensure that the power tool is powerful enough to do the job.

**Question 17**

In an engineering drawing, the function of the datum is to show a

- A. point that serves as a reference for most measurements.
- B. point that is always on the very edge of the drawing.
- C. line drawn in the lower left corner where the date is always entered.
- D. point on the drawing that identifies where drilling will take place.

**Question 18**

You discover a rubbish bin on fire in the storeroom.

Your first action should be to

- A. quickly leave the building.
- B. look for an extinguisher to fight the fire.
- C. activate the fire alarm to alert the fire and rescue service.
- D. go further into the storeroom to have a closer look at the burning materials.

**Question 19**

An example of an environmentally sustainable work practice is

- A. using only off-peak electricity to run machinery.
- B. careful measurement, with consideration given to the use of materials, as well as minimising offcuts and waste.
- C. allowing employees to have a monthly lunchtime barbecue outside in the sunshine and open air.
- D. ensuring that manufactured products are well packed with polystyrene, to avoid damaging them when they are transported.

**Question 20**

A renewable resource is best described as a resource that

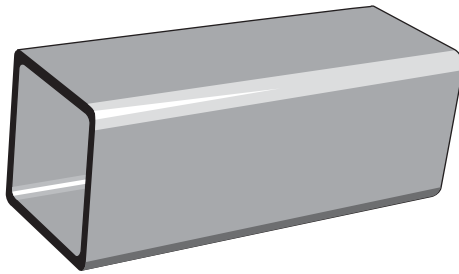
- A. is available in plentiful quantities.
- B. has an endless and immediate supply.
- C. can be replenished within the average person's lifetime or less.
- D. is usually a fossil fuel, such as natural gas, that, when consumed, has a reduced environmental impact.

**SECTION B****Instructions for Section B**

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

**Question 1** (1 mark)

Figure 1 shows a piece of rectangular cross-section steel pipe.

**Figure 1**

Name **one** measuring tool that could be used to accurately measure within 0.1 mm both the inside and outside of the rectangular cross-section steel pipe.

**Question 2** (4 marks)

The Sustain step of the 5S procedures states that ‘good work practices are maintained as a habit’.

Descriptions of each of the 5S steps are provided in the table below.

Identify the four missing 5S steps in the spaces provided. The descriptions of the steps are not given in any particular order.

<b>5S step</b>	<b>Description of 5S step</b>
<i>Sustain</i>	Good work practices are maintained as a habit.
	You can immediately see what you have or what is missing.
	All necessary items are arranged so they can be easily picked for use.
	Cleaning time is used to inspect the machinery and undertake maintenance.
	All unnecessary items are removed and placed elsewhere for disposal.

**Question 3** (3 marks)

- a. Before starting a job, what documentation is required to ensure that the work can be completed safely? 1 mark

---

- b. Who is required to complete this documentation? 1 mark

---

- c. What safety considerations should be included in the documentation? 1 mark

---

**Question 4** (3 marks)

**Figure 2**

Source: WorkSafe Victoria, *A Guide to Safety in the Metal Fabrication Industry*, March 2007, p. 25

The worker shown in Figure 2 is cutting steel tubing with an angle grinder.

Identify three safety issues shown in Figure 2.

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

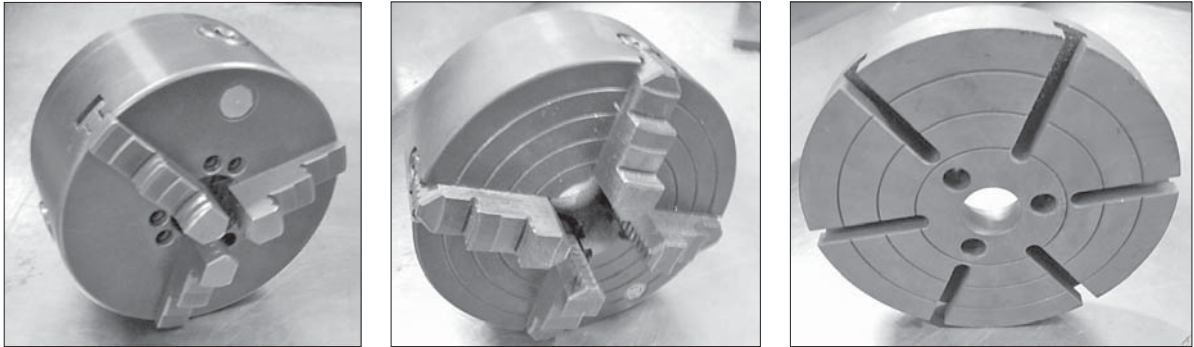
2. \_\_\_\_\_

3. \_\_\_\_\_



**Question 5** (3 marks)

Figure 3 shows three material mounting devices. These have been labelled **A.**, **B.** and **C.**

**A.****B.****C.****Figure 3**

Identify the most suitable material mounting device to hold a piece of hexagon bar in place, and write the corresponding letter and name of the device in the spaces provided below. Give a reason for your choice of mounting device.

Letter \_\_\_\_\_

Name of device \_\_\_\_\_

Reason \_\_\_\_\_

Use Figure 4 to answer Questions 6 and 7.

Figure 4 shows a man welding in a production workshop.



**Figure 4**

Source: WorkSafe Victoria, *A Guide to Safety in the Metal Fabrication Industry*, March 2007, p. 14

**Question 6** (3 marks)

Identify three hazards the man welding and others in the immediate workshop area may be exposed to.

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

**Question 7** (6 marks)

Management decides to implement 5S procedures in the workplace shown in Figure 4.

Select any three 5S steps and, for each of the steps selected, give two examples of how the step could be applied in the welding production workshop shown in Figure 4.

Explain in detail how each example is implemented.

<b>5S step (not required in order)</b>	<b>Example of application in welding production workshop</b>
	1.  2.
	1.  2.
	1.  2.

**Question 8** (4 marks)

Figure 5 shows two people lifting metal beams that are 5 m long and weigh 65 kg.



**Figure 5**

Source: WorkSafe Victoria, *A Guide to Safety in the Metal Fabrication Industry*, March 2007, p. 10

- a.** Referring to the manual lifting method shown in Figure 5, list three possible injuries that could occur to the people doing the lifting. 3 marks

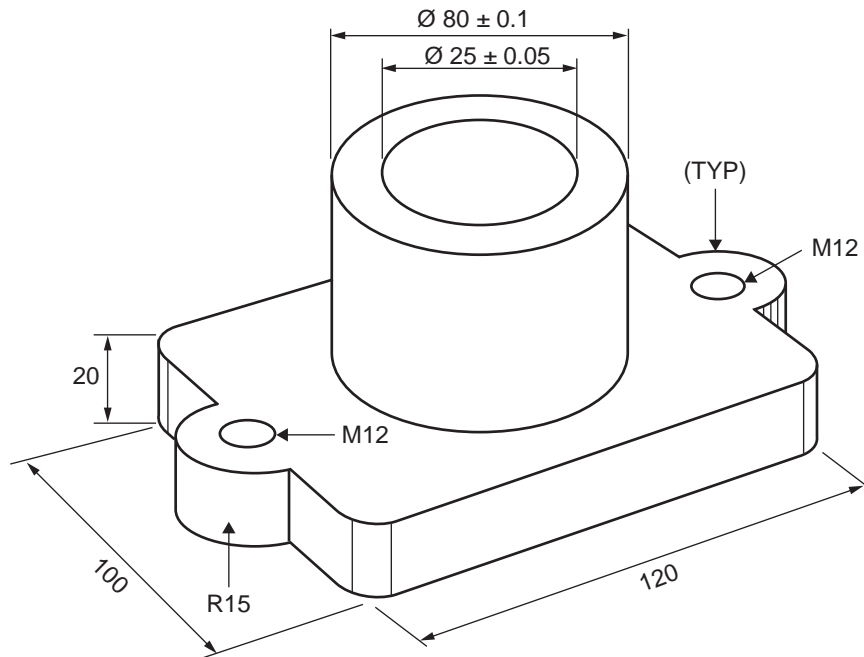
- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_

- b.** Describe a safer method for lifting the metal beams. 1 mark

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

**Question 9** (6 marks)

Figure 6 shows a drawing of a mounting plate.



**Figure 6**

- a. What work-holding method would be the most suitable for turning the  $\varnothing 80$  on a lathe? 1 mark
- 
- b. Name the tool that should be used to accurately machine the  $\varnothing 25$  hole. 1 mark
- 
- c. What does the label 'TYP' refer to? 1 mark
-

Figure 7 shows a metric thread chart.

I.S.O. METRIC COARSE THREADS							
NOTE:—All dimensions in mm							
O.Dia.	Core	Pitch	Depth	Flat	Effec.	Tapp'g Drill	Cl'ance Drill
1.6	1.1706	0.35	0.2147	0.04375	1.373	1.25	1.65
1.8	1.3706	0.35	0.2147	0.04375	1.573	1.45	1.85
2.0	1.5092	0.40	0.2454	0.05000	1.740	1.60	2.05
2.2	1.6480	0.45	0.2760	0.05625	1.908	1.75	2.25
2.5	1.9480	0.45	0.2760	0.05625	2.208	2.05	2.60
3.0	2.3866	0.50	0.3067	0.06250	2.675	2.50	3.10
3.5	2.7638	0.60	0.3681	0.07500	3.110	2.90	3.60
4.0	3.1412	0.70	0.4294	0.08750	3.545	3.30	4.10
4.5	3.5798	0.75	0.4601	0.09375	4.013	3.80	4.60
5.0	4.0184	0.80	0.4908	0.10000	4.480	4.20	5.10
6.0	4.7732	1.00	0.6134	0.12500	5.350	5.00	6.10
7.0	5.7732	1.00	0.6134	0.12500	6.350	6.00	7.20
8.0	6.4664	1.25	0.7668	0.15625	7.188	6.80	8.20
10.0	8.1596	1.50	0.9202	0.18750	9.026	8.50	10.20
12.0	9.8530	1.75	1.0735	0.21875	10.863	10.20	12.20
14.0	11.5462	2.00	1.2269	0.25000	12.701	12.00	14.25
16.0	13.5462	2.00	1.2269	0.25000	14.701	14.00	16.25
18.0	14.9328	2.50	1.5336	0.31250	16.376	15.50	18.25
20.0	16.9328	2.50	1.5336	0.31250	18.376	17.50	20.25
22.0	18.9328	2.50	1.5336	0.31250	20.376	19.50	22.25
24.0	20.3194	3.00	1.8403	0.37500	22.051	21.00	24.25

**Figure 7**

- d. Use the metric thread chart shown in Figure 7 to determine the pitch of the M12 threads to be tapped as shown in Figure 6.

1 mark

---

- e. Describe a suitable work-holding method for drilling and tapping the M12 holes shown in Figure 6.

2 marks

---



---

**Question 10** (4 marks)

An engineering workplace wishes to improve its sustainable work practices and so it introduces paperless job cards. The workers initially found the system difficult to use because they were used to finding the associated job card and paperwork located together with every job in production. With the new system, the workers have only a bar-coded tag with each job in production. This tag is scanned on arrival and departure for each stage of production.

- a. Identify two possible sustainability benefits to the workplace that could result from the introduction of the new paperless job card system. 2 marks

Sustainability benefit 1 \_\_\_\_\_

\_\_\_\_\_

Sustainability benefit 2 \_\_\_\_\_

\_\_\_\_\_

- b. Identify two possible difficulties in introducing the new paperless job card system to this production environment. 2 marks

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

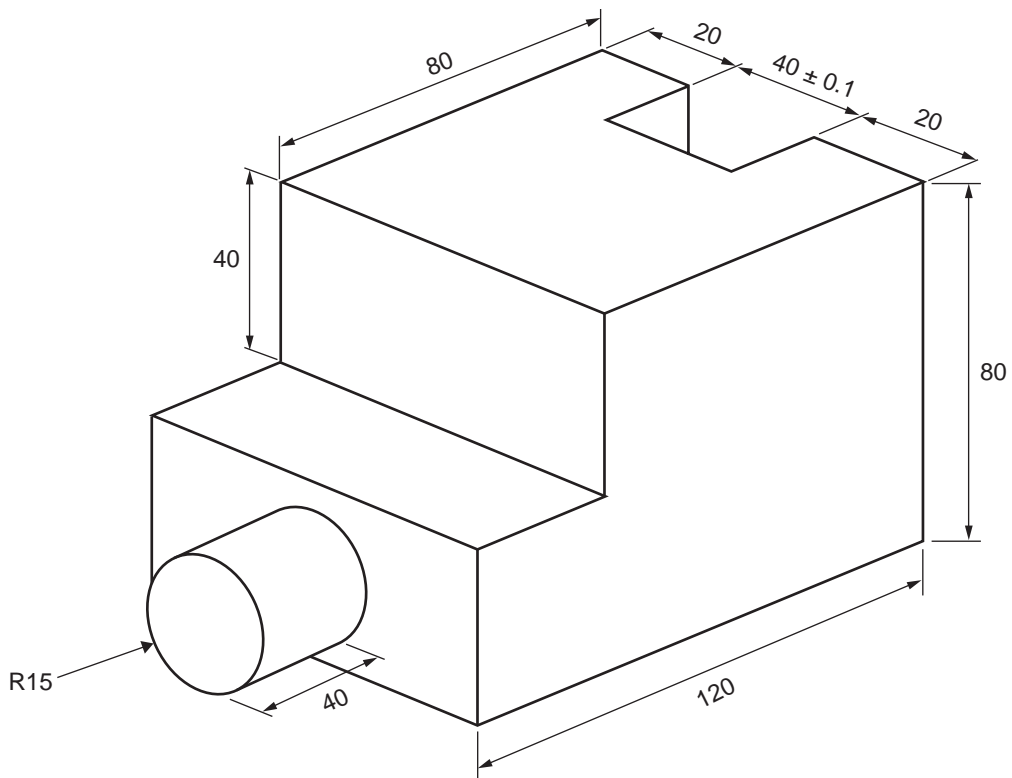
\_\_\_\_\_

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

\_\_\_\_\_

**Question 11** (8 marks)

Figure 8 shows an isometric view of a steel guide block.



**Figure 8**



a. On the sketch below, complete the top, side and front views of the steel guide block shown in Figure 8.

- Use conventional drawing systems.
- Show views in third-angle projection.
- Show all hidden detail and centre lines.
- Label the views drawn.

4 marks

Name: Guide Block		
Material: Mild Steel	Scale: 1:2	

- b.** What is the minimum and maximum size that the 40 mm slot is allowed to be? 1 mark

Minimum \_\_\_\_\_

Maximum \_\_\_\_\_

- c.** What tool should be used to measure the 40 mm slot to ensure it has been machined accurately? 1 mark

\_\_\_\_\_

- d.** The guide block shown in Figure 8 is to be machined from one solid piece of mild steel.

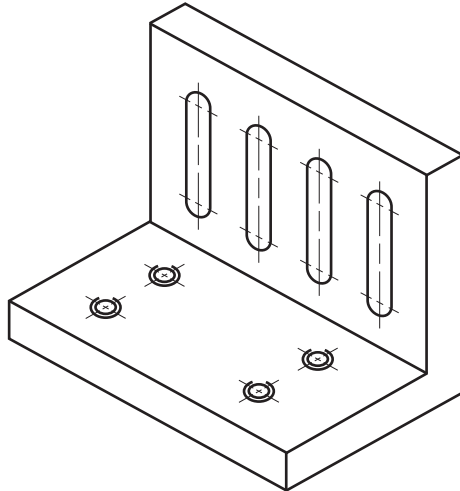
- i.** What is the minimum size of the block of mild steel that could be used to machine down to the required dimensions? 1 mark

\_\_\_\_\_

- ii.** What machines would be used to machine the guide block from the block of mild steel? 1 mark

\_\_\_\_\_

**Question 12** (9 marks)



**Figure 9**

- a. Figure 9 shows an angle plate with holes on the horizontal section and elongated slots in the vertical section that cut completely through the angle plate.

On the sketch below, complete the top, side and end views of the angle plate.

- Show views in third-angle projection.
- Show hidden detail and centre lines for the **four holes**. Hidden detail for the slots is not required.

4 marks

Name: Angle Plate	Material: Mild Steel

b. What types of holes are shown on the angle plate in Figure 10 below?

1 mark

c. Complete the drawing in Figure 10, showing:

- an overall length of 180 mm
- two holes, 40 mm from the datum
- a length of 100 mm between the holes
- a width of 50 mm between the holes.

4 marks

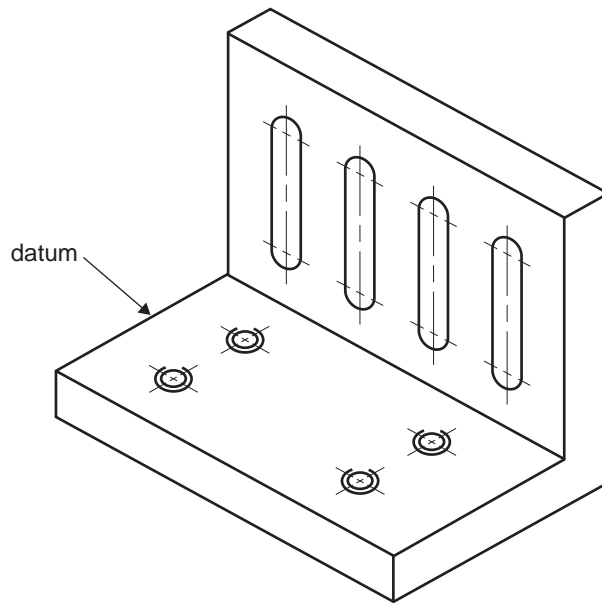
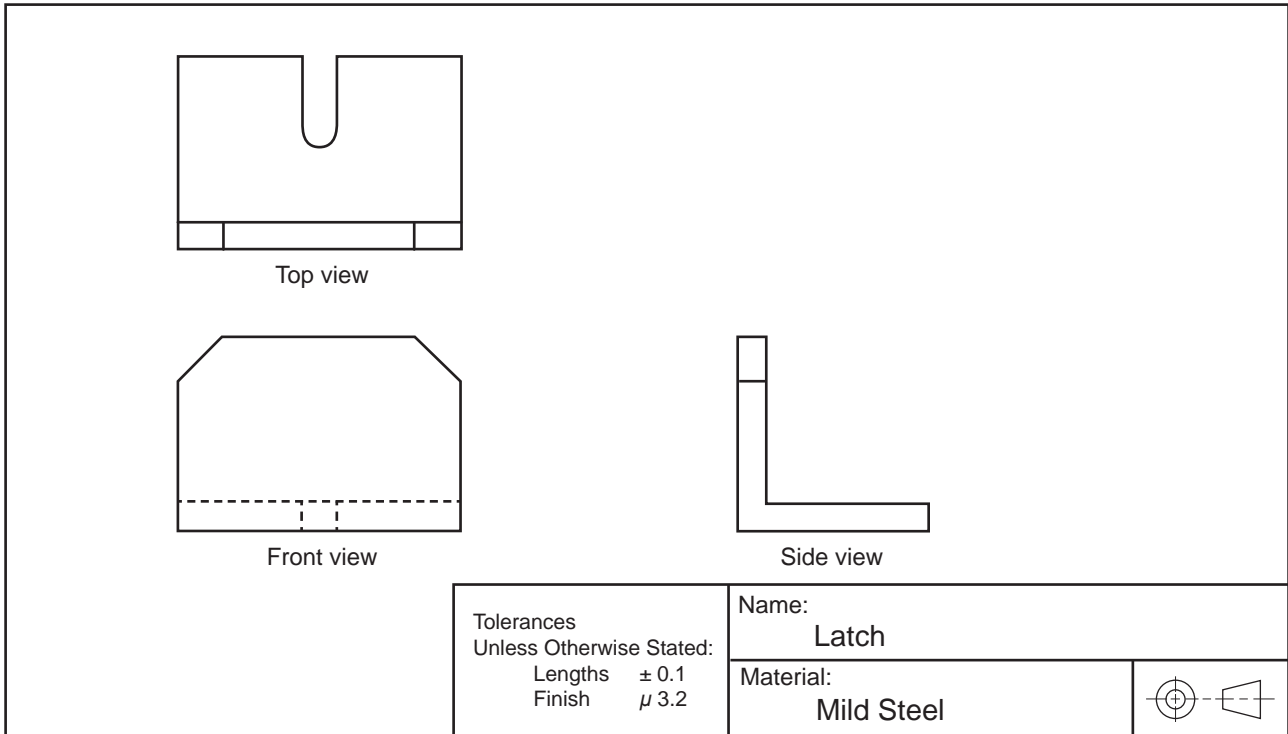


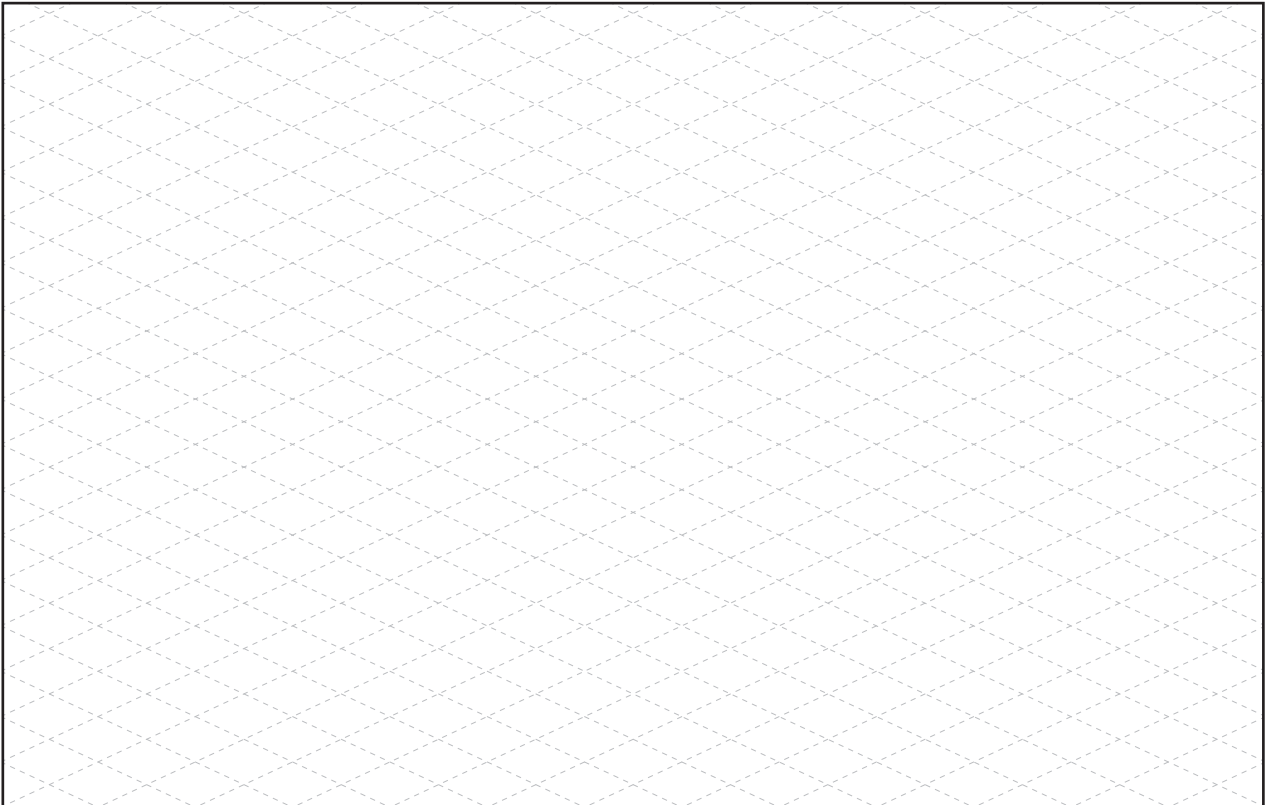
Figure 10

**Question 13** (4 marks)

Figure 11 shows the top, front and side views of a steel latch.

**Figure 11**

In the space provided below, sketch an isometric view of the steel latch shown in Figure 11.



**Question 14** (7 marks)

The material safety data sheet (MSDS) for isopropyl alcohol states that it is classified as 'Dangerous Goods Class 3'.

Hazard identification:

- R12 – Extremely flammable
- R36 – Irritating to eyes
- R67 – Vapours may cause drowsiness and dizziness

- a. Apart from safety boots and overalls, what are three other types of personal protective equipment (PPE) that are required when handling isopropyl alcohol? 3 marks

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

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

3. \_\_\_\_\_

- b. Other than using PPE, what are **two** safety precautions that should be taken before handling isopropyl alcohol? 2 marks

\_\_\_\_\_

\_\_\_\_\_

- c. Where should isopropyl alcohol be stored and why? 2 marks

\_\_\_\_\_

\_\_\_\_\_

**CONTINUES OVER PAGE**

Use Figure 12 to answer Questions 15 and 16.

Figure 12 shows a sample water bill.

<b>WELL CITY WATER SUPPLIER</b>	
Telephone: 1800 3453 3453 Address: 1043 Main Street, Well City, 9999	
Customer name: HG Engineering Works Billing address: PO Box 32, Well City, 9999 Account number: 004123965	<b>Amount due: \$321.45</b> <b>Pay by: 06/01/2015</b>
Service charge period: 01/10/2014 to 31/12/2014 Water usage charge (at \$1.786 per kilolitre) Water supply charge Wastewater disposal charge (at \$0.98 per kilolitre)	\$169.65 \$58.70 \$93.10
Total amount owing this service charge period	\$321.45

**Figure 12**



**Question 15** (9 marks)

HG Engineering Works consumes the majority of its water in the wash-up room and in the toilets. The manager is concerned that the business's average water bill is around \$320.00 even though the amount of water consumed is relatively small.

- a. Analyse the water bill shown in Figure 12 and provide a short description of the purpose of the two charges listed in the table below. 2 marks

Charge	Purpose of charge
water usage charge	
wastewater disposal charge	

- b. Which item on the bill is a fixed charge, regardless of the level of consumption or disposal? 1 mark

---

- c. How much water did the company use on average **per month** during the service charge period? Show your working. 2 marks

---



---



---

- d. Give three recommendations for how the bill could be reduced without compromising the comfort and occupational health and safety (OH&S) of the workers. 3 marks

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

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

3. \_\_\_\_\_

- e. Tap water costs \$1.786 per kilolitre.  
Determine the cost of 1 L of water. 1 mark

---

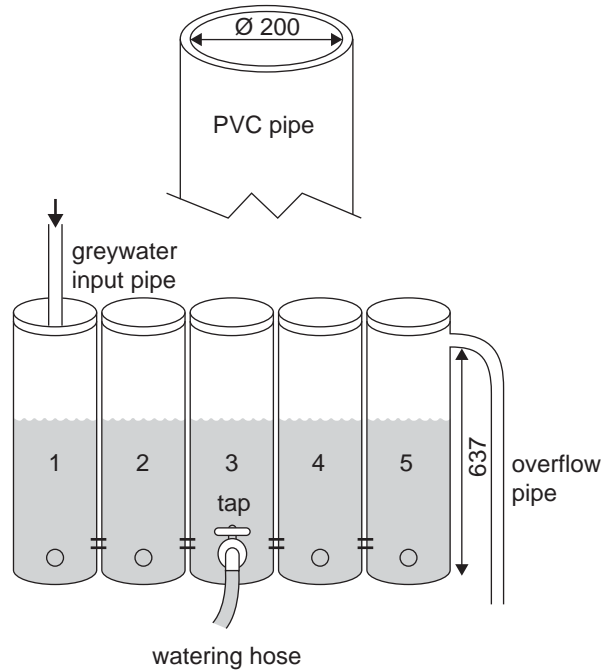


---

**Question 16** (6 marks)

The manager of HG Engineering Works wants to trial the collection of greywater from the wash-up room, including the wash basins and showers, to provide water for a herb garden located outside their building. The plan is to construct a small greywater storage unit for the trial.

Surplus Ø 200 mm PVC pipe is used for this trial. Five lengths of Ø 200 mm × L 650 mm capped PVC interconnected pipes are used to create a small, slender, wastewater storage tank. The overflow outlet is 637 mm from the base, as shown in Figure 13 below.



**Figure 13**

- a. What does the term ‘greywater’ mean? 1 mark

---

- b. Calculate the greywater storage capacity of **one** cylinder using the formula provided below. Show your working and give your answer in litres.

Formula for volume of a cylinder =  $\pi r^2 h$

Note:  $1000 \text{ mm}^3 = 1 \text{ cm}^3 = 1 \text{ mL}$

2 marks

---



---



---

- c. What is the approximate total capacity, in litres, of the five cylinders combined? 1 mark

---

- d.** Would this greywater have any potential OH&S issues? Explain your answer. 2 marks

---

---

---

---