

Practice Attitude Quiz

Mechanical Engineering

Part 1: About this Mechanical Engineering Resource

QUIZ

Guidance

This Practice Aptitude Quiz is intended to be a general illustration of some of the key learning standards required of people attempting an Australian Apprenticeships entry-level qualification in the Mechanical Engineering sector.

This Practice Aptitude Quiz is neither a formal tool nor a direct pre-requisite for any job application.

The quiz focuses on literacy, numeracy, comprehension, mechanical and problem solving questions contextualised to the Printing industry.

The mathematical skills required to complete the questions contained within this document are equivalent to mathematics at the Year 10 level.

Different organisations and people such as careers practitioners can use the quiz with young people, Group Training Organisations and Job Services Australia providers with job seekers.

The Practice Aptitude Quiz can be:

- > Used by careers practitioners with individuals or in a class setting to provide general guidance on the level of study involved in undertaking an entry level qualification in this industry;
- > Provided to people to enable them to practice their skills before sitting an actual aptitude test;
- > Used by Mathematics teachers as a guide to industry maths requirements at the entry point of this particular Australian Apprenticeship;
- > Used by teachers as classroom based activities for students in Year 11 and year 12.

Please note that rates quoted in this assessment for various items, including pay rates, are not meant to reflect today's values, but are used purely for mathematical purposes.

The quiz should be able to be completed in approximately 90 minutes.

Calculators may be used to complete this practice exercise.

Answers are located at the end of the quiz.

Mechanical Engineering Career, Occupational Information and Job Hunting Resources

Information and links on the Mechanical Engineering sector, careers, job prospects as well as career websites and job hunting resources can be found at www.aapathways.com.au/Career-Resources.

After the Quiz

There are a range of support services available to help you find out about courses that may help you improve your literacy and numeracy skills and also your readiness for work.

If you are still at school you should discuss any concerns you may have with your career practitioner. Further information may also be provided by a Job Services Australia provider, an Australian Apprenticeships Centre, a Group Training Organisation or a training provider.

Useful Contacts

Here are some links to job seeker support services:

- > Search for your local Australian Apprenticeships Centre - www.aapathways.com.au/aac
- > Find a local Group Training Organisation - www.grouptraining.com.au/Find/find_gto.html
- > Job Services Australia providers work with eligible job seekers to develop an individually tailored Employment Pathway Plan. The plan maps out the training, work experience and additional assistance needed to find job seekers sustainable employment - www.jobsearch.gov.au/provider/default.aspx

Part 2: The Quiz

Section 1 - Literacy, Reading and Comprehension

1. Complete the following questions related to safety and quality.

a. Complete the numbers to indicate the alphabetical order of the twelve words listed. The first two are shown:

| | |
|---|-------------|
| | measurement |
| | standard |
| 2 | caliper |
| | gauge |
| | tolerance |
| 1 | accuracy |

| | |
|--|-----------|
| | finish |
| | roughness |
| | diameter |
| | width |
| | length |
| | hardness |

b. The following text has 11 spelling errors. As you find each word, list them in the space below using the correct spelling.

Occupational Helth and Safely is an important part of your everyday working life within the Mechanical Engineering sector. The use of Personal Protective Equitment (PPE) is madtory in the workplace. Equitment can include googles, stell capped boots, hard hats and heat and fire resitent gloves. You muk read safety signs and be careful with haevy lifting.

c. Selecting the correct tool for each task is very important. It also prevents damage to the tool and ensures that work is carried out safely. Draw a line to match the correct tool to each mechanical component in the list below.

| |
|-------------|
| Screwdriver |
| Rivet Gun |
| Spanner |
| Hammer |

| |
|--------|
| Nut |
| Chisel |
| Screw |
| Rivet |

2. Read the following article and answer the questions that follow.

Working as a Fitter (also known as a Mechanical Engineering Tradesperson)

If you enjoy a physical challenge and doing practical, hands on work, this type of occupation may just fit your style. Fitting work requires the use of hand skills for the assembly and maintenance of equipment found throughout a wide range of industries. These include manufacturing industries such as metal products, plastics, food and beverage and paper products to name a few. Other industries such as mining and forestry, involving the maintenance of mobile equipment, also provide job opportunities. Fitting work is performed in a wide range of environments such as production facilities, mechanical workshops, onsite and outdoors or underground in a mine.

Mobile cranes, elevated work platforms, forklifts and mining equipment are just some of the machines that a fitter may repair or service. Other equipment includes power transmission gearboxes, conveyors, lifts, rolling mills, food production and packaging machinery. Machinery may be highly automated and include hydraulic and pneumatic systems. Some fitting work requires the ability to work accurately when assembling precision components such as gearboxes and turbines. Replacing bearings, aligning couplings, rebuilding pumps and other components are other tasks carried out every day by a fitter.

A wide range of hand tools such as sockets, spanners, torque wrenches, hammers, chisels, scrapers, screwdrivers and many others are utilised to assemble and repair parts. Other power tools such as angle grinders, power drills, cold cut saws, friction saws and bench drills form part of the range of tools that a fitter is trained to use. Specialised equipment including welders, oxyacetylene and plasma cutters are also used.

Maintenance work often involves break down repair of equipment, however preventative maintenance strategies continue to become more common. Condition monitoring is utilised to track and in some cases predict the operating condition of machines. This includes measuring energy usage, vibration, temperature and the amount of wear particles in lubricating fluids. Other technology such as lasers enables shorter setup times when aligning shafts and other equipment. The ultimate aim of preventative maintenance is to ensure that the machine is reliable and available for maximum production output.

Working safely is vitally important as workplaces often contain large heavy equipment that may cause serious injury.

Questions - Working as a Fitter

- a. What are the two main types of fitting work that requires the use of hand skills?

- b. List four industries in which fitting work is carried out.

- c. Name two different work environments in which a fitter may perform work.

- d. List four machines that a fitter may repair or service.

- e. List four types of hand tools that a fitter may use.

- f. Name four types of measurements carried out as part of condition monitoring.

3. Read the following article and answer the questions that follow.

Working as a Machinist (also known as a Mechanical Engineering Tradesperson)

Work carried out by a Machinist involves the use of machines to make parts from plastic, steel, aluminium, brass and other engineering materials. Machinists can also use a lathe to resize existing parts after resurfacing by metal spraying. The required accuracy of machining may be high, especially when producing precision parts that operate with small gaps between them. Technical drawing interpretation skills are important to enable the machinist to manufacture parts to the correct size and surface finish required.



Manual Lathe

Manual machines such as lathes, drills, borers and mills are regularly utilised for production of large sized or small quantities of general parts. Automated machinery such as Computer Numerical Control (CNC)

QUIZ

machining centres and lathes are suitable for high volume production work. They are also popular for machining of small quantity precision parts due to their high accuracy and fine surface finish. Machinists program and operate CNC machines.

Computer controlled machines are becoming more sophisticated with turning and milling functions now combined into one machine. In some cases, these machines can move simultaneously in up to five axis and produce parts with very complex shapes. The ultimate objective of machining is to make a part using minimal amount of material within the shortest amount of time.

The correct selection of materials, machine and tooling is critical to achieve the required accuracy and speed. Modern materials now include titanium and other tough or hard metals. When machining hard materials, cutters made from specialised materials to prevent wear and tool damage are utilised. This ensures that the size and finish of the part is within specification and the cutting tool lasts as long as possible.

Micrometers and gauges are utilised to check that sizes of small diameter parts are correct. For larger or complex parts, coordinate measuring machines are used to measure in several dimensions with the part mounted stationary while the measuring probe moves around the part.



CNC Machining Centre



Coordinate Measuring Machine Probe

Questions – Working as a Machinist

- a. What are four common types of materials machined?

- b. List the two reasons that technical drawing interpretation skills are important.

- c. What types of machines are utilised to make large sized or small quantities of parts?

- d. What types of machines are popular for manufacturing small parts due to their high level of accuracy and fine surface finish?

- e. How many axis can some Computer Numerical Control machines operate simultaneously?

- f. What are two main components in the objective of machining?

- g. What are the two main requirements achieved by selecting the correct combination of materials, machine and tooling?

- h. What are two types of measuring instruments used to measure small diameter parts?

Section 2 - Workplace Health and Safety

1. Read the following information about Personal Protective Equipment (PPE) and answer the questions on the next page.

Personal protective clothing, hand protection and foot protection are often necessary at a work site and respiratory protective equipment may be required when dangerous gases and dusts are present. Personal Protective Equipment (PPE) includes clothing, equipment and substances designed to be worn or used by a person to protect them from risks of injury or disease.

PPE is only to be used in the workplace where it is not reasonably practicable to control hazards by other means.

The following information describes some PPE used to guard workers against specific hazards.

Gloves



Photo A

Breathing Mask



Photo B

Goggles



Photo C



Sign A



Sign B



Sign C



Sign D

| Part of Body | Some Potential Hazards |
|--------------|---|
| Head: | Falling objects |
| Face & Eyes: | Sparks, ultraviolet light, metal shards, chemical splashes, fumes |
| Hearing: | Excessive noise |
| Respiratory: | Dust, fumes, vapours |
| Hands: | Abrasion, sparks, irritant substances, vibration , electric shock |
| Feet: | Crushing, slipping, abrasion, irritant substances, wetness, electric shock, static electricity, puncture, cold/heat |

QUIZ

Questions

- a. Using an angle grinder can produce sparks that have the potential to damage eyes. What PPE could be used to guard against this hazard? (Note: there may be more than one PPE that can be used in this case).

- b. If you are lifting heavy objects there is a risk of dropping the load on your feet. What PPE can be used to protect you in this situation?

- c. Some machinery operates at high noise levels. What PPE can help to protect worker's hearing in these types of situations?

Section 3 - Problem Solving and Numeracy

Problem Solving

1. After fixing seven parts on the machine, the Fitter is only half way through completing the task. What is the total number of parts requiring repair?

2. A Fitter has obtained twenty parts and needs fifteen more to complete an assembly. Unfortunately, the store only has seven more parts available. How many parts will the Fitter need to order to enable the task to be finally completed?

3. A Fitter is driving to a site where a mobile crusher needs repairs and must drive another twenty kilometres to reach the work site. The speed limit is eighty kilometres per hour. What is the minimum time it will take, in minutes, to reach the destination safely without breaking the speed limit?

4. A Fitter working in a cement manufacturing plant is connecting a large motor to a gearbox and needs ten bolts to assemble a coupling. The bolts available are longer than required and need cutting shorter to make them fit. As each one will take nine minutes to cut, how many hours will it take to cut all of the bolts to the correct length?

5. A Machinist has used a computer controlled lathe to turn ten parts from a length of metal and has used up one third of the total material available. How many more pieces can the Machinist make before running out of metal?

6. After making parts on a lathe, the Machinist needs to drill six holes in the end of each shaft at equal distance to each other around a circular pattern. How many degrees will the Machinist rotate the part before drilling the next hole?

Numeracy (Basic Mathematics)

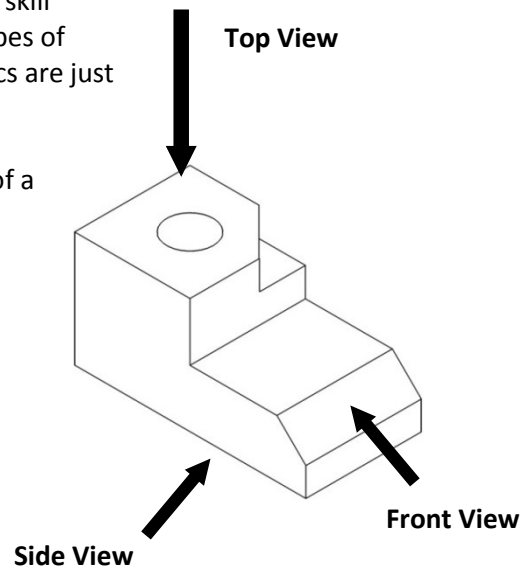
7. Attempt all calculations below without using a calculator. Show all working out.

| | QUESTIONS | ANSWERS |
|----|--|---------|
| a. | $56 + 78 =$ | |
| b. | $87 + 1032 =$ | |
| c. | $2432 + 567 =$ | |
| d. | $324 - 45 =$ | |
| e. | $897 - 26 =$ | |
| f. | $1024 - 48 =$ | |
| g. | $\frac{1}{2} \times 27 =$ | |
| h. | $\frac{2}{3} \times 75 =$ | |
| i. | $\frac{3}{4} \times 60 =$ | |
| j. | $10\% \times 35 =$ | |
| k. | $60\% \times 200 =$ | |
| l. | $75\% \times 400 =$ | |
| m. | $72 \div 12 =$ | |
| n. | $39 \div 13 =$ | |
| o. | $560 \div 7 =$ | |
| p. | $\frac{300 \times 30}{60} \times 60 =$ | |

Section 4 - Visual Perception

The ability to read and interpret drawings is an important skill required to work in the mechanical engineering trade. Types of technical drawings such as detail, assembly and schematics are just some of the drawing types used.

The drawing on the right hand side is a pictorial drawing of a clamp block. The hole goes all the way through the block.



1. What would the clamp block look like if viewed from the top view? Circle the correct response.



A



B

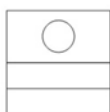


C

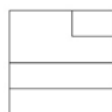


D

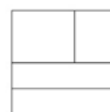
2. What would the clamp block look like when viewed from the front view? Circle the correct response.



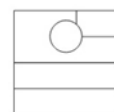
A



B



C



D

3. What would the clamp block look like from the side view? Circle the correct response.



A



B



C



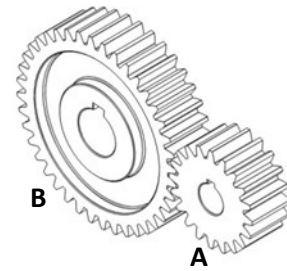
D

Section 5 – Mechanical Aptitude

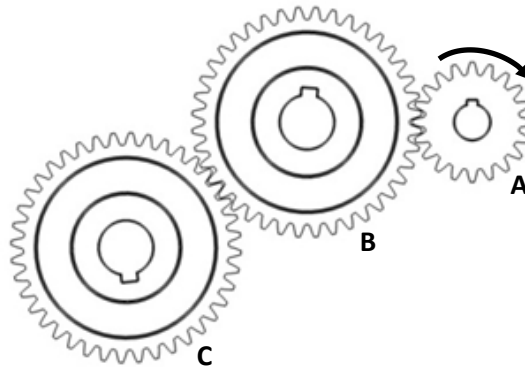
Ratio and Proportion

1. In the gears shown, the small gear (A) has half the number of teeth than the large gear.

If the small gear (A) turns around one hundred times, how many times will the large gear rotate?



2. This gear train uses three gears. The large gears (B) & (C) have the same number of teeth. The small gear (A) rotates in a clockwise direction and only has half the number of teeth of the large gears.



- a. What direction will the second large gear (C) rotate?

- b. How many times will gear (A) need to rotate to make gear (C) rotate three complete times?

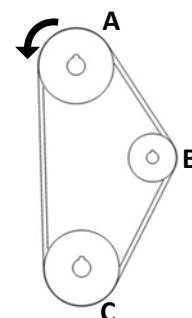
_____ rotations

- c. How many times will gear (A) need to rotate to make gear (B) rotate three complete times

_____ rotations

3. A belt drive transmits power between pulleys using a vee shaped belt. The top pulley (A) is rotating anti-clockwise.

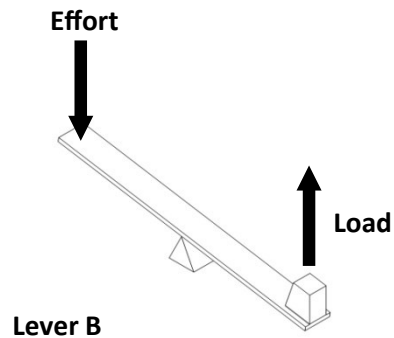
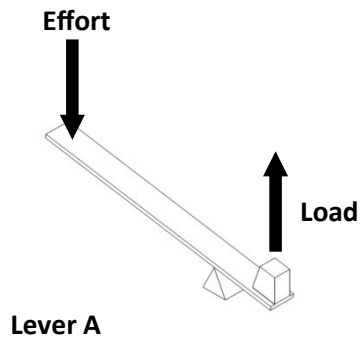
- a. What direction will the bottom pulley (C) rotate?



- b. The tensioning pulley (B) is smaller than the other pulleys. Will it rotate faster or slower than the bottom pulley (C)?

Levers and Forces

4. A lever is a mechanical device used to multiply force such as those shown below.



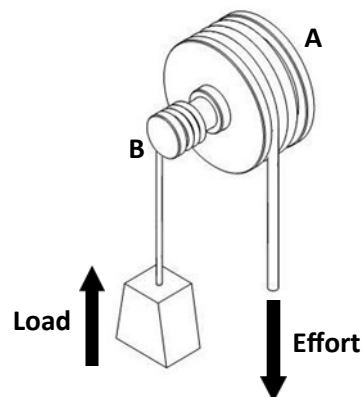
- a. Which lever will lift the load with the least amount of effort?

- b. If the effort downwards is at the same speed on both levers what lever will move the load upwards the fastest?

5. A winch uses two different size pulleys to multiply force. The large pulley (A) is three times larger than the small pulley (B).

- a. If 100 kg of effort is used to pull the rope around the large pulley (A) downward, how much load can be lifted by the rope around the small pulley (B)?

- b. Would the load move up faster or slower than the rope being pulled down on the large pulley (A)?



Section 1 - Literacy, Reading and Comprehension

1. a.

| | |
|-----|-------------|
| 1. | accuracy |
| 2. | caliper |
| 3. | diameter |
| 4. | finish |
| 5. | gauge |
| 6. | hardness |
| 7. | length |
| 8. | measurement |
| 9. | roughness |
| 10. | standard |
| 11. | tolerance |
| 12. | width |

- b. Health, Safety, equipment, mandatory, workplace, equipment, goggles, steel, resistant, must, heavy
 c. Screwdriver – Screw, Spanner – Nut, Hammer – Chisel, Rivet gun – Rivet

2.

- a. Assembly and Maintenance
 b. Metal products, plastics, food and beverage, paper products mining, forestry
 c. Production facilities, mechanical workshops, onsite and outdoors, underground in a mine
 d. Cranes, Elevated work platforms, Forklifts, Mining equipment, Power transmissions, Gearboxes, Conveyors, Lifts, Rolling mills, Food production machinery, Packaging machinery
 e. Sockets, spanners, torque wrenches, hammers, chisels, scrapers, screwdrivers
 f. Energy usage, vibration, temperature, amount of wear particles in lubricating fluids

3.

- a. Plastics, steel, aluminium, brass
 b. To manufacture parts to the correct size and surface finish required
 c. Manually operated lathes, drills, borers and mills
 d. CNC machining centres and lathes
 e. Five
 f. Manufacture a part using minimal amount of material, in the shortest amount of time
 g. Accuracy and speed
 h. Micrometers and gauges

Section 2 - Workplace Health and Safety

1. a. Photo C and Sign C b. Sign B c. Sign D

Section 3 - Problem Solving and Numeracy

Problem Solving

1. 14 (Fourteen)
 2. 8 (Eight)
 3. 15 (Fifteen) minutes
 4. 1 ½ (One and a half) hours
 5. 20 (Twenty)
 6. 60 ° (Sixty) degrees

Numeracy (Basic Mathematics)

7.
 - a. 134
 - b. 1119
 - c. 2999
 - d. 279
 - e. 871
 - f. 976
 - g. 13.5
 - h. 50
 - i. 45
 - j. 3.5
 - k. 120
 - l. 300
 - m. 6
 - n. 3
 - o. 80
 - p. 9000

Section 4 - Visual Perception

1. C
2. B
3. C

Section 5 - Mechanical Aptitude

Ratio and Proportion

1. 50
2.

| | | |
|--------------|------|------|
| a. Clockwise | b. 6 | c. 6 |
|--------------|------|------|
3.

| | |
|-------------------|-----------|
| a. Anti clockwise | b. Faster |
|-------------------|-----------|

Levers and Forces

4.

| | |
|------|------|
| a. A | b. B |
|------|------|
5.

| | |
|-----------|-----------|
| a. 300 kg | b. Slower |
|-----------|-----------|

Contributions

This Practice Aptitude Quiz was developed by:



Australian Apprenticeships Pathways Website - www.aapathways.com.au

This website provides sample Australian Apprenticeships job descriptions and links to more Australian Apprenticeships information and resources. The site is funded by the Department of Industry.



Manufacturing Skills Australia - www.mskills.com.au

Manufacturing Skills Australia (MSA) is one of 12 Industry Skills Councils funded by the Australian Government to support skills development. MSA is addressing the skills needs of over 250,000 manufacturing and other businesses employing over 1.1 million Australians. MSA represents a range of industries including: Metal and Engineering; Manufacturing; Aerospace; Chemicals, Hydrocarbons & Refining; Plastics, Rubber and Cablemaking; Laboratory Operations; Manufactured Mineral Products; Furnishing; and Textiles, Clothing and Footwear.



TAFE NSW Illawarra Institute - www.illawarra.tafensw.edu.au

TAFE NSW is Australia's leading provider of vocational education and training with more than 500,000 enrolments in NSW each year.

Illawarra TAFE provides high quality customised training and enrolls over 33,000 students each year. Whether you're an individual looking for your first job, a promotion, a career change or a pathway to a degree or you're an employer seeking training solutions for your workforce, TAFE Illawarra can deliver a range of courses and services to suit your needs. Some programs are delivered Australia wide.



The Career Education Association of Victoria - www.ceav.vic.edu.au

The CEAV is the Victorian peak body for secondary school career practitioners, work experience coordinators, VET coordinators and MIPS coordinators. The CEAV provides professional development opportunities for members and also works with business, industry, and the education and training sector.



Industry Training Australia P/L - www.itaust.com.au

Industry Training Australia (ITA) delivers consultancy services to government and non-government organisations in the education and training sector. ITA develops and delivers information and communication services, including the Australian Apprenticeships Pathways website, for service provider networks and the general public.

For enquiries about this Practice Aptitude Quiz contact the Australian Apprenticeships and Traineeships Information Service on 1800 338 022.