Mechanical Engineering

Practice Aptitude Quiz

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Part 1: About this quiz

Use this quiz to prepare for an Apprenticeship in Mechanical Engineering

This quiz:

- Is <u>NOT</u> a formal assessment tool or pre-requisite for any job application
- Shows key learning standards for the Mechanical Engineering industry
- Has been developed with the help of industry leaders, TAFE and high schools

Quiz details

This quiz will:

- Take approximately 90 minutes to complete
- Ask you numeracy and literacy questions specific to the Mechanical Engineering industry
- Assess your literacy and numeracy at a Year 10 standard
- Allow you to use a calculator
- Share correct answers at the end

Who should take this quiz?

You should complete this quiz if you:

- Are thinking about starting an Apprenticeship in the Mechanical Engineering industry
- Want to practise for a formal aptitude test

Need help with your literacy and numeracy skills?

If you want to improve your literacy and numeracy skills, reach out to any of the below:

- Australian Apprenticeship Support Network providers
- Your Registered Training Organisation when you start training
- Reading Writing Hotline:
  1300 655 506
  www.readingwritinghotline.edu.au
- Careers advisers and your teachers (if you're in high school)

More information about the Mechanical Engineering industry

Visit www.yourcareer.gov.au/industries/e/construction

On this page you'll be able to:

- See the most popular Mechanical Engineering industry occupations
- Get general information and statistics about the industry
- Search for Mechanical Engineering industry courses

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How to use this quiz

This is an interactive form that can be filled out on your computer.

You can either:

- Fill it out on your computer; OR
- Print it out; OR
- Write your answers down on paper as you go.

Use the answers section at the end of the quiz to see how you went.

How to complete this quiz on your computer

1. Download and save the quiz onto your computer
2. Open the file from your computer
3. Fill in the form using a keyboard and mouse

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Part 2: The Quiz

Section 1: Language and Literacy

1. **Write the following words in alphabetical order:**

finish	
roughness	
diameter	
width	
length	
hardness	
measurement	
standard	
calliper	
accuracy	

2. **The following text has 10 spelling errors. As you find each word, list them in the space below using the correct spelling:**

Occupational Helth and Safety 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 workplase. 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.

1.	2.
3.	4.
5.	6.
7.	8.
9.	10.

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3. **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. Match the tools in the list below with the listed material:**

    Screwdriver   Rivet Gun   Hammer   Spanner

Nut	
Chisel	
Screw	
Rivet	

4. **Read the following passage 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.

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Article continued:

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 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:

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:

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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:

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5. Read the following passage and answer the questions on the next page:

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 machines such as lathes, drills, borers and mills are regularly utilised for production of large sized or small quantities of general parts.

Manual Lathe

Automated machinery such as Computer Numerical Control (CNC) 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.

CNC Machining Centre

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.

Coordinate Measuring Machine Probe

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Questions:

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?

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6. **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	Breathing Mask	Goggles
Photo A	Photo B	Photo C

Sign A	Sign B	Sign C	Sign D
THIS IS A HARD HAT AREA SAFETY HELMETS MUST BE WORN	FOOT PROTECTION MUST BE WORN IN THIS AREA	FACE SHIELD MUST BE WORN IN THIS AREA	HEARING PROTECTION MUST BE WORN IN THIS AREA

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

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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 2: Numeracy

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?**

Practice Aptitude Quiz

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 it 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?

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

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

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Section 3: General Mechanical Engineering Knowledge

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

Top View

Front View

Side View
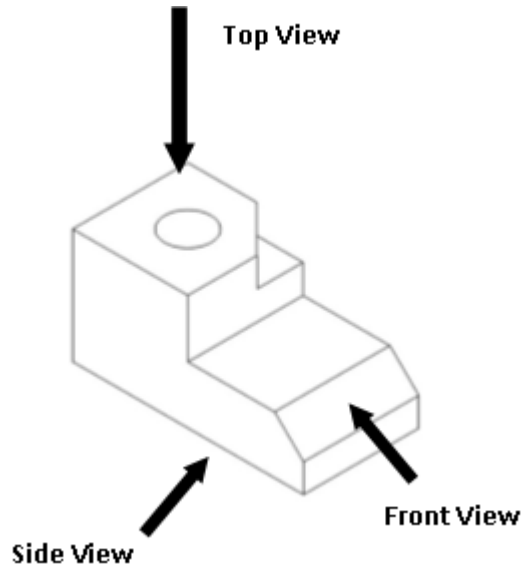
1. What would the clamp block look like if viewed from the top view? Select the correct answer:

A   B   C   D

2. What would the clamp block look like when viewed from the front view? Select the correct answer:

A   B   C   D

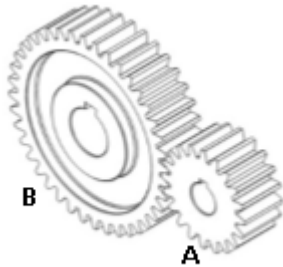3. What would the clamp block look like from the side view? Select the correct answer/s:

A   B   C   D

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4. **Read the following passage and answer the questions that follow:**

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?

5. **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. Answer the following questions using the diagram below:**
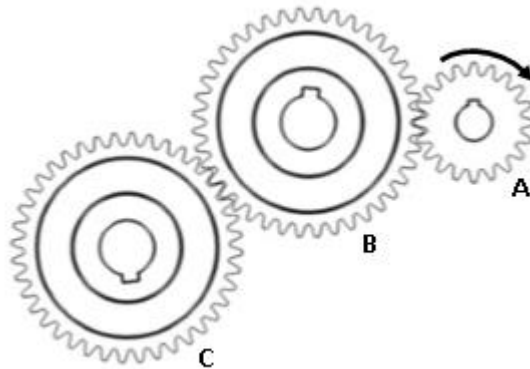
a. In what direction will gear C rotate?

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

c. How many times will gear A need to rotate to make gear (B) rotate three complete times
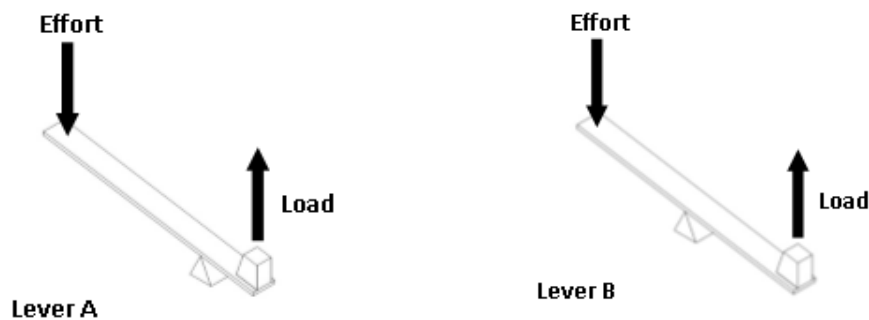
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6. A belt drive transmits power between pulleys using a vee shaped belt. The top pulley (A) is rotating anti-clockwise. Answer the following questions using the diagram below:
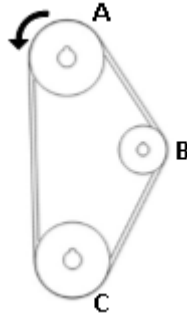
a. What direction will the bottom pulley (C) rotate?

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

7. A lever is a mechanical device used to multiply force such as those shown below. Answer the following questions using the diagram 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?

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8. **A winch uses two different size pulleys to multiply force. The large pulley (A) is three times larger than the small pulley (B). Answer the following questions using the diagram below:**
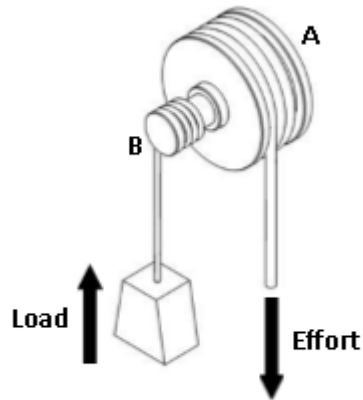
a. If 100 kg of effort is used to pull the rope around the large pulley (A) downward, how much load can be lifted by the rope around the small pulley (B)?

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

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Answers

Section 1: Language and Literacy

1.

accuracy
caliper
diameter
finish
hardness
length
measurement
roughness
standard
width

2. Health, equipment, mandatory, workplace, equipment, goggles, steel, resistant, must, heavy

3. Spanner – Nut, Hammer – Chisel, Screwdriver – Screw, Rivet gun - Rivet

4.
   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

5.
   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

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

Section 2: Numeracy

1. 14
2. 8
3. 15 minutes
4. 90 minutes
5. 20
6. 60° degrees

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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 3: General Mechanical Engineering Knowledge

1. C
2. B
3. A and C
4. 50
5. a. Clockwise   b. 6   c. 6
6. a. Anti clockwise   b. Faster
7. a. A   b. B
8. a. 300 kg   b. Slower