Australian Government

AUSTRALIAN APPRENTICESHIPS

Your Life. Your Career. Your Future.

Drilling Operations

Practice Aptitude Quiz

Practice Aptitude Quiz

Part 1: About this quiz

Use this quiz to prepare for an Apprenticeship in Drilling Operations

This quiz:

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

Quiz details

This quiz will:

- Take approximately 60 minutes to complete
- Ask you numeracy and literacy questions specific to the Drilling Operations industry
- Assess your literacy and numeracy at a Year 10 or 11 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 Drilling Operations 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 Drilling Operations industry

Visit www.yourcareer.gov.au/industries/b/mining

On this page you'll be able to:

- See the most popular Drilling Operations industry occupations
- Get general information and statistics about the industry
- Search for Drilling Operations 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 items into alphabetical order:

Sample	
Core	
Geology	
Drill bit	
Water quality	
Drilling rig	
Torque	
Velocity	
Auger	
Safety boots	

2. Read this information about the sectors of the Drilling Industry and then answer the questions that follow. You may have to use some logic as well as looking for facts in the information to answer them:

<u>Three types of drilling projects</u>

There are three types of drilling projects, each requiring specific job knowledge to make decisions on the drilling program:

- Exploration and investigation to gather information;
- Making production wells to extract something or injection wells to insert something; and
- Construction and rock breaking where drilling is used to make a hole for someone else to work in.

These 3 types of projects are covered by 11 industry sectors. Although there is some overlap, each sector has distinctive applications.

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There are 11 drilling industry sectors and applications

I. Geotechnical site investigation

This industry sector uses drilling to:

- determine soil composition and rock characteristics; and
- gather information about the nature and position of the water table.

This information is used to inform planning and construction of buildings, factories and plant, dams, wharves, civil works, tunnels and shafts, power stations and storage pits. For example, if a project cannot be repositioned, drilling can determine where the ground is weak or unstable and which special construction techniques are required.

II. Foundation and construction drilling

This industry sector uses drilling to:

- Establish stable foundations;
- Increase bearing capacity by drilling deeper to better strength rock;
- Provide shear strength between rock face and in situ concrete;
- Form foundations for buildings or other constructions, such as bridges, railways, factories, processing plants and wharves or dams; and
- Provide holes and casings that become part of a structure, such as piles, or large diameter holes in bedrock/firm ground filled with reinforced concrete that become foundations.

Under-reaming and caisson development are specific applications used in the foundation and construction sector. Under-reaming is the process of enlarging a hole underneath the casing to allow the casing to move down the hole – this is extremely useful when drilling ground that is not self-supporting and keeps collapsing. A Caisson is a large water tight structure in which underwater construction work may be carried out.

III. Environmental drilling

This industry sector uses specialised geotechnical drilling and water well drilling methods to:

- Monitor quality of ground water and assist control and remediation of ground water pollution;
- Test and monitor land fill sites, pollution of lagoons and sensitive sites, e.g. protected land, water supply well fields, housing developments on reclaimed land and chemical or hydrocarbon storage sites;
- Determine the source or extent of pollution problems;
- Sample and construct wells for recovering or remediating pollutants in ground water; and
- Support work at archaeological sites.

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IV. Water well drilling

97% of fresh water on Earth is underground. This industry sector uses drilling to:

- Source and deliver water for domestic or stock use and irrigation in farming;
- Source and deliver water for town water supplies or industrial/mineral treatment plants;
- Monitor water levels or wells;
- Dewater wells at mine and construction sites; and
- Create injection wells if water can be put back into the formation.

V. Mineral exploration drilling

This industry sector uses drilling to search for valuable minerals or materials. The two main methods of drilling are air drilling (the method of drilling used to lift chip samples from the hole) and core drilling (recovering a solid cylinder of rock or material from the hole as a sample).

Drilling is conducted to:

- Search for new ore bodies;
- Determine the size and grade of an ore body (resource definition);
- Collect stratigraphic information;
- Conduct geochemical surveys;
- Determine grade control, i.e. what is uneconomical to treat and what can be treated during the mining process (grade control drilling); and
- Check that no economic ore or materials are below sites for a proposed waste dump, dam, plant or building (sterilisation drilling).

VI. Mineral production and development

This industry sector involves drilling holes on the surface and underground to develop mines and produce ore. It includes drilling for:

- Services in underground mines such as electric cables, water pipes or compressed air lines; and
- Access ways, ventilation or fill-holes for sand or slurry.

Down hole hammer drilling, up hole hammer drilling and raise boring are three specific drilling methods used in this sector.

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VII. Blast hole drilling

This industry sector involves drilling holes to hold explosives used for removing rock, ore or minerals. The sector covers:

- Mines where surface and underground drilling is part of the extraction and processing of valuable ore, including removal of waste to allow access to the ore body;
- Quarries that produce road or construction materials and dimension stone; and
- Construction of road works, dam sites or breakwaters.

VIII. Seismic drilling

This industry sector usually involves operations in remote areas drilling shallow holes for explosives used in reflection and refraction surveys.

This type of drilling is rarely used in Australia now, but is usually associated with:

- Gaining knowledge of subsurface geology over large areas; and
- Identifying targets for mineral, oil, and gas exploration.

IX. Trenchless technology (horizontal directional drilling)

In this industry sector:

- Directional drilling is used to drill large diameter bores in hard rock or other difficult geology;
- Guided boring is used to drill small/medium diameter bores in moderate geology; and
- Product pipe is installed in a directionally drilled or reamed/widened hole, e.g. for methane drainage, services and pipes under roads, railways, buildings, dams, lagoons or lakes.

X. Oil and gas drilling: On-shore

In this industry sector, drilled holes are usually relatively deep and involve large equipment and the use of drilling mud to stabilise the holes and prevent blow outs. Drilling processes used in oil and gas drilling include:

- Stratigraphic drilling - to improve understanding of geology;
- Exploration drilling;
- Building production wells for oil and gas, including coal seam gas extraction; and
- Building water or gas injection wells for secondary recovery.

XI. Oil and gas drilling: Off-shore

This industry sector is similar to on-shore oil and gas drilling except that it is carried out from platforms or ships.

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Select the correct answer to the following questions about the Drilling Industry sectors:

a. Guided boring under roads and rail lines is a part of the trenchless technology sector.

TRUE FALSE

b. Drilling holes for the construction of bridges and dams is a part of the mineral exploration sector.

TRUE FALSE

c. The monitoring of potential pollution sources such as landfills and lagoons is a part of the geotechnical sector.

TRUE FALSE

d. Drilling holes to dewater mines is a part of the water well sector.

TRUE FALSE

e. Drilling holes to blast a cutting for a road is in the foundation and construction sector.

TRUE FALSE

f. Drilling holes to look for ore bodies is a part of the mineral exploration sector.

TRUE FALSE

Answers the following questions in the space provided:

g. Why do you think it's important to carry out geotechnical drilling before a dam is built?

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h. What percentage of the fresh water on Earth is underground?

i. Why do you think a local council might contract an environmental drilling company when they are planning to open up a site for housing which was formerly a manufacturing site or a petrol depot?

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3. Read the following information sourced from the Queensland Department of Mines and Energy (2011) and answer the questions that follow:

Coal seam gas

Coal seam gas (CSG), also called coal bed methane, is mostly methane in composition and is typically attached to the coal along its natural fractures and cleats. This gas is released when pressure on the coal seam is reduced, usually by removal of water from the seam.

CSG is an important energy resource in Queensland and production of this gas now makes up an increasing proportion of Queensland gas demand.

CSG operators are required to submit environmental management plans demonstrating how they plan to manage CSG water. The environmental management plan must include information about CSG water, such as:

- Expected flow rate, quantity and quality expected to be generated;
- Proposed management including use, treatment, storage or disposal;
- Criteria against which the CSG operator will monitor and assess the management of CSG water; and
- Proposed actions taken by the CSG operator should any management criteria not be satisfied.

CSG operators will also be required to submit an annual evaluation of how effective and appropriate management of CSG water has been.

Answer the following questions:

a. Why do you think taking water out of the coal seam allows gas to be extracted?

b. What are the elements of a CSG operator's water environmental management plan?

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4. Look at the typical shift handover sheet on the following page and answer the questions that follow: Note that shifts are usually 12 hours and include a handover.

ABC DRILLING

SHIFT HANDOVER SHEET

Date 27/11/2010 **End of Shift** Day 7:05 pm Scotty McD. Night

Outgoing Crew Scotty McDonald, Alan Kasunic, Joel Williams

Incoming Crew Dave Wairapa, Matt Beasley, Hank Williams

Bulk Fuel Tank Fuel at beginning of shift 1,040 litres. Fuel added to tank 8,000 litres

Fuel at end of shift 8,080 litres Fuel used

Services (Daily)

Rig oil change and service at 7:30 AM

All vehicles checked at 8:00 AM and 5:30 PM

Rig serviced at 5:45 PM

On Order

Goods Received

One pallet bentonite mud

One pallet cement

Hazards Water access road slippery.

Comments Rig and vehicles fuelled, serviced and ready to go.

No down hole problems

Hole depth 78.9 metres

Signed *Scotty McDonald*

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Questions:

a. The day shift Driller, Scotty, has forgotten to put in the fuel used during the shift. Please calculate it.

b. Does the incoming night shift have to service the rig before continuing work? Select the correct response.

◯ YES ◯ NO

c. What hazard has been noted for the incoming crew to be aware of?

5. Select the word that is closest in meaning to the underlined word.

a. In drilling, you will be expected to work independently and as part of a team.

◯ work group ◯ committee ◯ colleagues ◯ friends

b. Health and safety hazards can be minimised by enforcing good health and safety practices within the workplace.

◯ prevented ◯ deficient ◯ eluded ◯ reduced

c. Drilling companies have procedures in place for handling heavy or hazardous materials.

◯ suggestions ◯ tasks ◯ agreed routines ◯ agendas

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6. Read the following item about Personal Protective Equipment (PPE), then answer the questions that follow:

Personal protective clothing, overalls, hand protection and foot protection are often necessary 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 the risk of injury or disease.

Drilling companies have standard operating procedures which will require you to use PPE in the workplace where it is not reasonably practicable to control hazards by other means.

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, heat and cold
Feet	Crushing, slipping, abrasion, irritant substances, wetness, electric shock, static electricity, puncture, cold/heat.

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Using the pictures of PPE and signage above, answer the following questions:

a. Drilling rigs can cause drilling fluid to splash which has the potential to damage eyes. What PPE or signage could be used to guard against this hazard? (Note: there may be more than one answer in this case).

b. If you are manipulating drill rods, even with a mechanical rod handler, there is a risk of dropping the load on your feet. What PPE or signage offers protection from this hazard?

c. Drilling companies may need to use chemical agents to maintain or clean equipment, and as additives to drilling fluids. What two types of PPE or signage could be used to help protect you from inhaling chemical fumes and prevent contact between the chemicals and your hands?

d. Drilling rigs can operate at high noise levels. What PPE or signage can help protect a worker's hearing in these types of situations?

Practice Aptitude Quiz

Section 2: Numeracy

(A calculator may be used)

1. **Drilling equipment is manufactured all over the world and supplies are marked in either imperial measure inches (”) or metric. If you were asked to select a drill bit to drill a 4” hole which bit would you select from the following drill bit diameters? Use: 1 inch = 25.4 mm.**
   Select the correct response:

   ◯ 76.2 mm ◯ 101.6 mm ◯ 127.5 mm ◯ 97.3 mm

2. **How many litres are in a cubic metre?**

3. **Oil is measured in barrels. How many litres are there in an American barrel of oil which contains 42 US liquid gallons? Use: 1 gallon = 3.785 L. Round the answer to the nearest whole number.**

4. **If you were travelling at an average speed of 90 kms per hour, estimate how long it will take to travel 150 kilometres?**

5. **If a pump was pumping at a rate of 20 litres a minute, how many litres would be pumped in 8 hours?**

6. **What is the diameter in millimetres of a four and a half inch drill bit, to the nearest mm? Use: 1 inch = 25.4 mm.**

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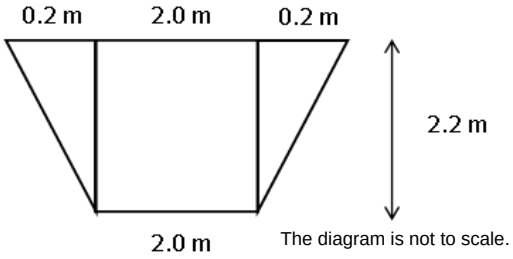
7. What is the area in square metres of a circle 125 cm diameter? Round to three decimal places Use: A = πr^2, where π = 3.14.

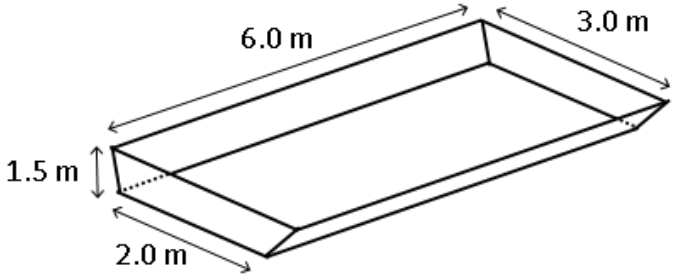
8. What is the volume in litres of a drill hole 200mm diameter and a length of 190 metres? Use: V = $\pi r^2 h$, where π = 3.14.

9. What is the area of the shape in the following diagram with the top length of 2.4 metres, bottom length of 2 metres and a height of 2.2 metres?



The diagram is not to scale.

10. Calculate the volume of a pictured rectangular mud pit with sloping sides (the ends do not slope). The top of the pit is 3 metres wide and 6 metres long; the bottom of the pit is 2 metres wide and 6 metres long. The pit is 1.5 metres deep. Express volume in litres:



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11. Calculate the estimated time of arrival for the following scenario:

You have to take supplies to another site and before leaving you have to let the drill site know your estimated time of arrival.

The site is 720 kilometres away and, because of reduced speed limits through towns and road conditions you expect to average a speed of 80 kms per hour. Your supervisor has told you to stop every 2 hours for a quarter hour rest and to check your vehicle and load.

You are to leave the workshop at 7.00 am. What time will you arrive?

12. You are at a site where a water well is being drilled. The driller is going to seal some sections of it. You are required to mix a grout containing 5% bentonite by weight of cement. How much bentonite will you mix per 20 kg bag of cement?

13. If the drill rig you were working on used 85 litres of diesel fuel per hour, how much fuel will you require for a 12 hour shift? (assuming the drill stops working for a total of one hour)

14. One metre column of pure water exerts a pressure at the base of the column of 9.81 kPa (kilopascals). What is the pressure at the bottom of a hole 200 metres deep if the hole was filled with pure water? Give the answer in kPa and pounds per square inch (psi). Use: 1 kPa = 0.145 psi.

15. One litre of water weighs 1 kg (kilogram). What is the weight of water in a rectangular tank 2.4 metres wide x 6 metres long x 1.2 metres high?

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ANSWERS

Section 1: Language and Literacy

1.

Auger
Core
Drill bit
Drilling rig
Geology
Safety boots
Sample
Torque
Velocity
Water quality

2. a. TRUE b. FALSE c. FALSE d. TRUE e. FALSE
f. TRUE

g. A dam would need to be constructed in a stable area and drilling can determine where ground is weak or unstable;
- To determine if the ground formation is suitable for constructing a dam.
- To gather information about the nature and position of the water table.

h. 97%

i. When they want to open up a site that has been used for other purposes, they want to check if it has been contaminated by spills, and if it to be cleaned up before housing can be built on that site. [test and monitor sites; determine the source or extent of pollution problems] The environmental drilling company will drill and take samples for testing.

3. a. The gas can be extracted when water is removed from the coal seam as it lowers the pressure and allows gas to be released.

b. Miners have to develop an environmental management plan which shows how much water they expect to get and what quality they expect it to be; what they will do with it; how they will monitor what they are doing, and what they will do if they have dificulty following the plan. They also have to report once a year.

4. a. Fuel used is 960 L b. No c. The water access road is slippery.

5. a. Work group b. reduced c. agreed routines

6. a. Photo C and Sign C: Goggles and Face Shield
b. Sign B: Foot protection
c. Photo B and Photo A: Breathing mask and gloves
d. Sign D: Hearing protection

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Section 2: Numeracy

1. 101.6 mm

2. 1000 litres

3. 159 litres

4. 1 hour and 40 minutes

5. 9600 litres

6. 114 mm

7. 1.227 square metres

8. 5966 litres^3

9. 4.84 square metres

10. 22500 litres^3

11. Arrive at 5PM

12. 1 kg

13. 935 litres

14. 284.49 psi and 1962 kPa

15. 17280 kgs