



Apprentice Gas Control Technician (AGCT) Entrance Exam

Preparation Guide

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Apprenticeship Entrance Exam for Gas Control Technicians

Purpose

The Apprentice Gas Control Technician (AGCT) Entrance Exam is a computer-based knowledge exam that is used in the selection process for hiring employees into the GPOM Apprenticeship program.

About the Exam

- The AGCT Entrance Exam allows you to demonstrate your knowledge, aptitude, and understanding of the fundamentals of basic mathematics, basic electricity, and mechanical concepts, as well as your preparedness for advanced technical training throughout your apprenticeship.
- There are **80** multiple choice and fill-in-the-blank questions on the test and the total allotted time to take the exam is 2 hours and 45 minutes (165 minutes).

Topics Covered in the Test

- Mathematics
 - Addition, subtraction, multiplication, division
 - Fractions and decimals
 - Ratios
 - Algebra
 - Trigonometry
 - Geometry
 - Logic
- Basic Electricity
 - Ohms Law
 - AC/DC power systems
- Instrumentation
 - Basic components
 - ANSI/ISA-95 Standard Symbology
- Mechanics
 - Ratios
 - General Mechanical Knowledge
- Tools
 - Basic knowledge of hand tools
- Physics and Chemistry
 - Pressure forces

During the Exam

It is important that you follow the directions of the Test Administrator. If you have any questions about the test session, be sure to ask before testing begins.

Once you start the exam, you will **NOT** be able to leave the room. Food or beverages are **NOT** allowed in the testing room, except for bottled water. You should consider these factors before beginning the exam.

All cellular devices, smart phones, smart watches, music players, ear phones, personal calculators, cameras, or other electronic equipment will **NOT** be allowed in the testing area. Please secure these items **before** entering the testing location.

You will **NOT** be able to use your own calculator during testing. The Test Administrator will provide you with a non-programmable scientific calculator that you must use for the exam.

The Test Administrator will provide the following materials:

- Calculator: **Texas Instruments TI-30Xa**
- Scratch Paper
- Pencils

Once the exam has been submitted for scoring, the Test Administrator will collect all material. You will be able to leave quietly as others may be testing.



Computer-Based Test Directions

The AGCT Entrance Exam is a computer-based test.

You will be seated at a computer testing station. The Test Administrator will assist with launching the test. You will be asked to enter your candidate ID and password; this information will be provided by the Test Administrator.

You only need minimal computer experience and typing skills. You will only use the keyboard for minimal entries (information to identify you and a password). You will answer all questions with a computer mouse.

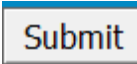
A test time will be visible throughout the exam in the top right corner. The time will start once you launch the exam. The test automatically closes when the time limit expires. If the exam times out before you submit, the exam will end and any unanswered questions are scored as incorrect.

Block 1 of 1 Time remaining:: 02 : 15 : 00  

When you have selected your answer to a question, click the “Next Question” button to move to the next question. To return to a question, click the “Previous Question” button.

Answers can be changed any time during the test until the time runs out or when you click the “Submit” button. **Once you click “Submit”, you cannot change your answers.** Please do not select “Submit” until all questions have been answered. If you click “Submit” by mistake, you will receive a display warning box. Click “Cancel” if you want to continue working.

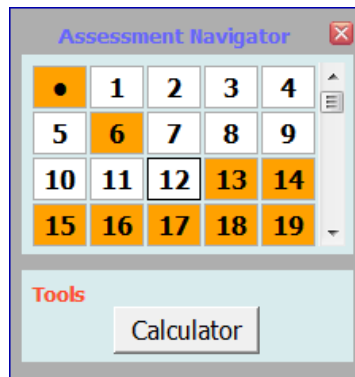



The “Assessment Navigator” will help identify questions that have been answered.

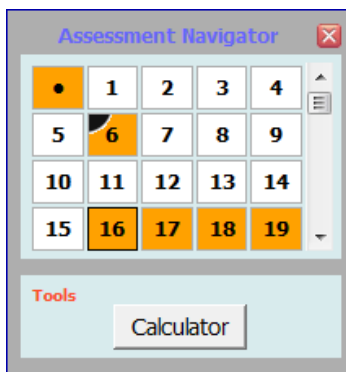
- Orange = unanswered question
- White = answered question

In the example below, questions 6 and 13-19 have not been answered, while 1-5 and 7-12 have been answered.

In addition, you can use the “Assessment Navigator” to jump to a question by clicking on the question number.



The “Flag” button , at the bottom of the window, allows you to mark a question for further review. When you click on the “Flag” button, this adds a black corner to the question number in the “Assessment Navigator”. In the example below, question 6 has been flagged. Click the “Flag” button again to un-flag the question.



Below is an example of what you can expect to see when taking the computer-based test.

The screenshot shows a test interface for PG&E Academy. At the top, it displays the date 'Apr 16 2014', the user 'Logged In as: Testers Name', 'Block 1 of 1', and 'Time remaining:: 02 : 15 : 00'. The main question area contains the text '83 of 95 Potentiometers have ___ terminals, while rheostats have ___ terminals.' followed by three radio button options: '2, 3', '3, 2', and '4, 2'. A 'Question with responses' box points to these options. A 'Time Remaining' box points to the timer. A 'Font Size increase/decrease and contrast icons' box points to the icons next to the timer. Below the question, there are navigation buttons: '< Previous Question', 'Next Question >', 'Assessment Navigator', and 'Submit'. A 'Flag icon, mark a question for further review' box points to a flag icon next to the 'Assessment Navigator' button. A 'To move forward to the next questions or backwards' box points to the 'Previous Question' and 'Next Question' buttons. A 'To send in the test, click Submit.' box points to the 'Submit' button. An 'Assessment Navigator' window is open, showing a grid of question numbers from 75 to 94. The grid has a header row (75-79), a second row (80-84), a third row (85-89), and a fourth row (90-94). The number 81 is highlighted in orange. Below the grid is a 'Tools' section with a 'Calculator' button. A box states 'The Assessment Navigator will help identify questions that have been answered' with an arrow pointing to the grid.

Note: During the exam if you experience any technical issues, raise your hand for assistance.

Resources

The Internet is an excellent resource for much of the information to prepare for this exam. Many excellent mathematics, basic electricity, and electronics books are available from libraries, bookstores, and on-line resources. A general reference book is invaluable as a supplement to other textbooks from classes or specific subjects, and as an instrument for general review in preparing for qualifying tests. However, it is not a substitute for formal education and training.

The following are suggested resources to review:

- *Electricity: Principles and Applications* by Richard Fowler
- *Instrumentation and Process Control* by Kirk, Weedon, and Kirk
- *Control Loop Foundation – Batch and Continuous Processes* by Blevins and Nixon
- ANSI/ISA-95 Instrumentation Standards

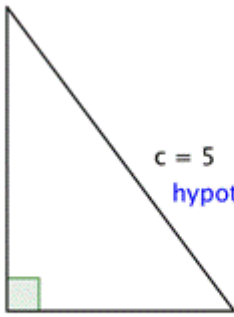
Additional resources for improving understanding of the concepts may be found at local libraries, online, and bookstores.

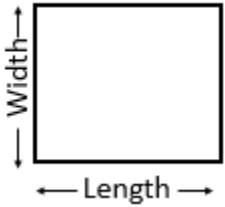
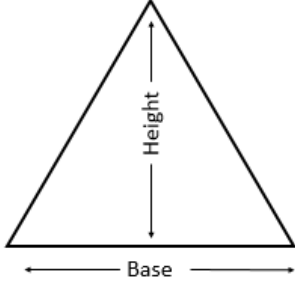
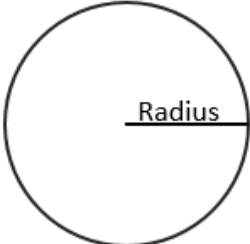
Make sure that you are physically and mentally alert when you are scheduled to take your exam.

We hope you find this information helpful. Pacific Gas and Electric Company wishes you the best of luck in qualifying on your exam.

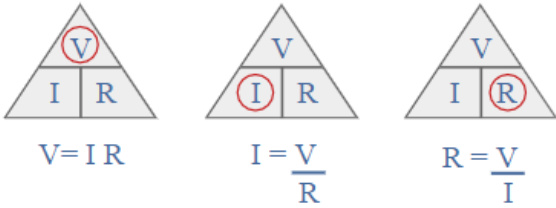
Formulas and Symbols

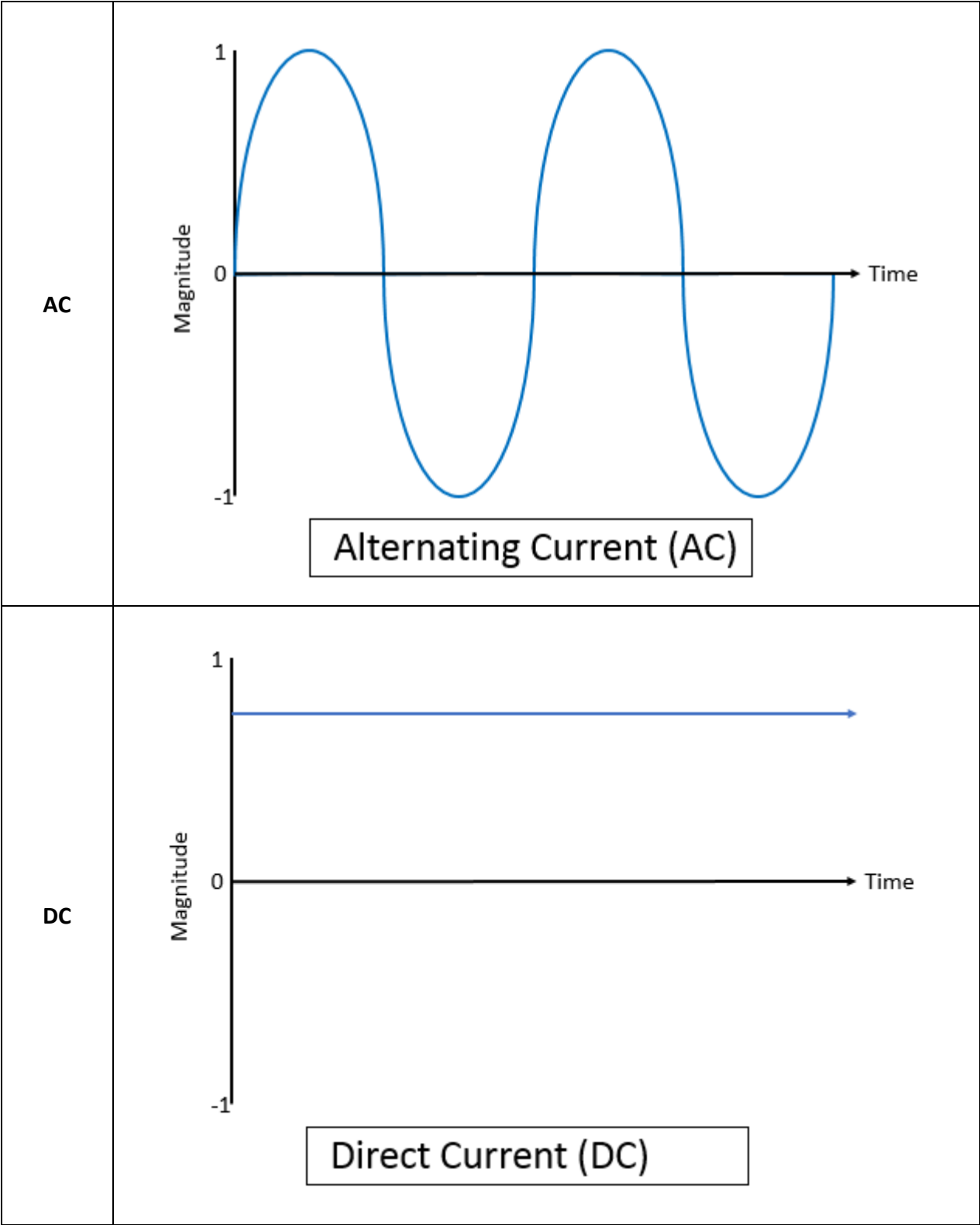
The following formulas and symbols will be helpful when taking the test.

Mathematics	
Order of Operations	PEMDAS= Parenthesis, Exponents, Multiply or Divide, before you Add or Subtract
Basic Operations	Addition Subtraction Multiplication Division Place values (tenths, hundredths, thousandths, etc.) Ratios Fractions <ul style="list-style-type: none"> • Simplest Terms • Addition • Subtraction • Multiplication • Division
Pythagorean Theorem	$a^2 + b^2 = c^2$  <p style="margin-left: 100px;"> $a^2 + b^2 = c^2$ $(3)^2 + (4)^2 = (5)^2$ $9 + 16 = 25$ </p>

Area	Rectangle 	<i>Area = Length x Width</i>
	Triangle 	<i>Area = $\frac{(Base \times Height)}{2}$</i>
	Circle 	<i>Area = $\pi \times radius^2$</i>

Basic Electricity

Ohm's Law	
	<p>V = voltage expressed in Volts I = current expressed in Amps R = resistance expressed in Ohm</p>

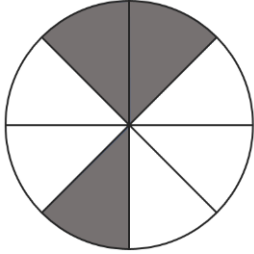


Instrumentation																			
ANSI/ISA-95 Standard Symbology	<p>Please refer to the following ANSI/ISA-95 standard symbols for examples of process and instrumentation control. Please note that these do NOT cover ALL symbols.</p> <p>ISA-5.1, Figure 7-11: General Instrumentation or Symbol Function</p> <p>ISA-5.1, Figure 7-12: Valve Body and Damper Symbols</p> <p>ISA-5.1, Figure 7-13: Actuator Symbols</p> <p>ISA-5.1, Figure 7-14: Symbols for Other Devices</p>																		
Mechanics																			
	<p>Sample tool list used by Gas Control Technicians:</p> <table border="0" style="width: 100%;"> <tr> <td>Screwdrivers</td> <td>Drills</td> <td>Drill Bits</td> </tr> <tr> <td>Tape Measure</td> <td>File</td> <td>Saws</td> </tr> <tr> <td>Torque Wrench</td> <td>Vise</td> <td>Pipe Wrench</td> </tr> <tr> <td>Crescent Wrenches</td> <td>Tubing Benders</td> <td>Pressure Gauges</td> </tr> <tr> <td>Wire Strippers</td> <td>Wire Cutters</td> <td>Multimeter</td> </tr> <tr> <td>Mallets/Hammers</td> <td>Pipe Cutter</td> <td></td> </tr> </table>	Screwdrivers	Drills	Drill Bits	Tape Measure	File	Saws	Torque Wrench	Vise	Pipe Wrench	Crescent Wrenches	Tubing Benders	Pressure Gauges	Wire Strippers	Wire Cutters	Multimeter	Mallets/Hammers	Pipe Cutter	
Screwdrivers	Drills	Drill Bits																	
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Wire Strippers	Wire Cutters	Multimeter																	
Mallets/Hammers	Pipe Cutter																		
Physics																			
Gas Laws	<p>Boyle's Law</p> $P_1 \cdot V_1 = P_2 \cdot V_2$ <p>Charles's Law</p> $\frac{V_1}{V_2} = \frac{T_1}{T_2} \text{ or } \frac{V_1}{T_1} = \frac{V_2}{T_2}$ <p>Ideal Gas Law</p> $P \cdot V = m \cdot R \cdot T$																		

Practice Problems

Math

1. What part of the object is shaded?

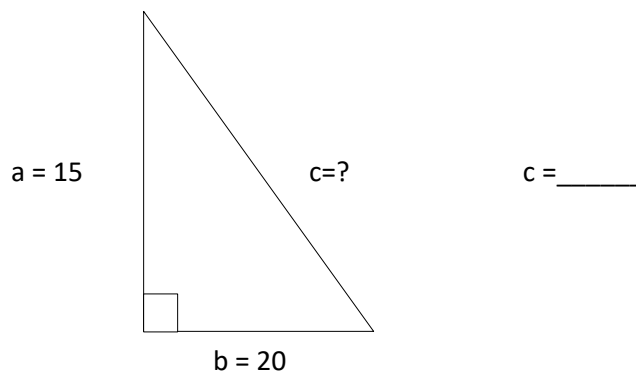


_____ fraction

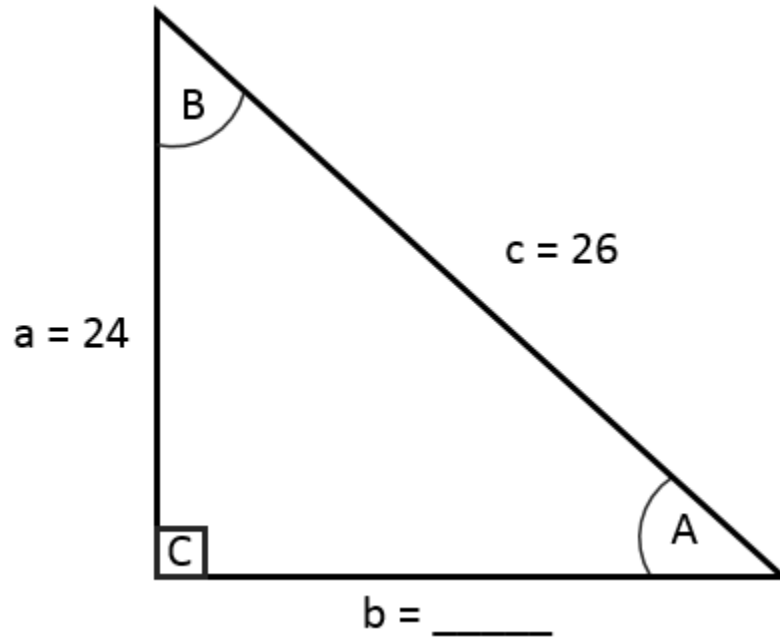
_____ decimal

_____ percent

2. Find the length of "c" in the triangle below:



Use the triangle below for the next four questions.



3. What is the length of side "b" in the triangle below? Side b = _____
4. What is the measurement of angle A, to the nearest tenth? $\angle A = \underline{\hspace{2cm}}$
5. What is the measurement of angle B, to the nearest tenth? $\angle B = \underline{\hspace{2cm}}$
6. What is the measurement of angle C, to the nearest tenth? $\angle C = \underline{\hspace{2cm}}$

7. Complete the pattern? 12, 16, 20, _____, 28

8. How many meters are there in 900mm?

9. Solve the following equation, rounding to the nearest hundredth:

$$2.25(3.14)(0.678)$$

10. What is 9% of 64.52, rounded to the nearest hundredth?

11. Solve the following equation:

$$-1 \times (-4)$$

12. Solve the following equation:

$$\frac{(-8 + 3)}{(7 + (-3))}$$

13. Subtract and express in simplest terms:

$$15\frac{2}{3} - 3\frac{1}{2}$$

14. A pressure transducer with a range of 0 – 1000 psig is installed in a control system where it outputs 1 – 5 vdc. What voltage signal would you expect when the pressure transducer senses 675 psig?

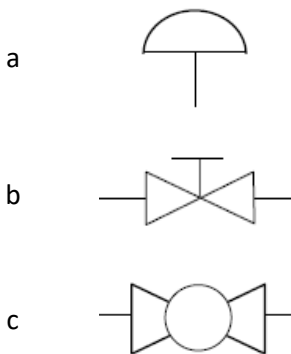
15. Assuming $\pi = 3.14$, what is the area of a circle with a diameter of 5 feet, rounded to the nearest hundredth?

Electrical

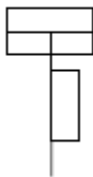
16. According to Ohm's Law, what happens to current as resistance increases?
17. If three 6V 30 amp/hr batteries are installed in series, what is the available voltage?
- 6V
 - 12V
 - 18V
18. If two 6V 30 amp/hr batteries are installed in parallel, what is the available current?
- 15 amp/hr
 - 30 amp/hr
 - 60 amp/hr
19. What electrical component allows current to flow in only one direction?
- Transformer
 - Conductor
 - Diode

Instrumentation

20. Which of the below symbols represents a Hand Valve on a Piping and Instrumentation Diagram, according to the ANSI/ISA-95 standards?



21. What instrument does the following symbol represent on a Piping and Instrumentation diagram?



- Motor
- Pressure Gauge
- Linear piston actuator with positioner

Practice Problem Answer Key

1. $\frac{3}{8}$, 0.375, 37.5%
2. 25
3. 10
4. 67.4
5. 22.6
6. 90.0
7. 24
8. 0.9 m
9. 4.79
10. 5.81
11. 4
12. -1.25
13. $12\frac{1}{6}$
14. 3.70 vdc
15. 19.63
16. Decreases
17. C – 18V
18. C – 60 amp/hr
19. C – Diode
20. B
21. C