CQI

CERTIFIED QUALITY INSPECTOR

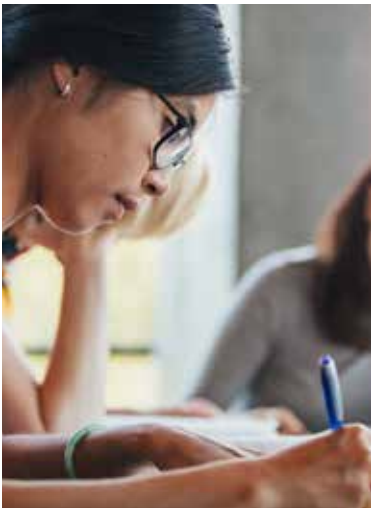
Quality excellence to enhance your career and boost your organization's bottom line

asq.org/cert

ASQ

Excellence Through Quality™

Certification from ASQ is considered a mark of quality excellence in many industries. It helps you advance your career, and boosts your organization's bottom line through your mastery of quality skills. Becoming certified as a Quality Inspector confirms your commitment to quality and the positive impact it will have on your organization.



Examination

Each certification candidate is required to pass an examination that consists of multiple-choice questions that measure comprehension of the body of knowledge.

Certified Quality Inspector

The Certified Quality Inspector (CQI) is an inspector who, in support and under the direction of quality engineers, supervisors, or technicians, can use the proven techniques included in the body of knowledge. Under professional direction, the CQI evaluates hardware documentation, performs laboratory procedures, inspects products, measures process performance, records data, and prepares formal reports.

CQI

Computer Delivered - The CQI examination is a one-part, 110-question exam and is offered in English only. 100 questions are scored and 10 are unscored. Total appointment time is four-and-a-half hours, exam time is 4 hours and 18 minutes.

Paper and Pencil – The CQI examination is a one-part, 100-question, four-hour exam and is offered in English only.

Work Experience

CQI requires two years of work experience, OR successful completion of an ASQ-approved* accredited technical/apprenticeship training course. If you do not have a high-school diploma or GED, you must have THREE additional years work experience.

Requires preapproval. Please contact **cert@asq.org for more details.*

For comprehensive exam information on the Quality Inspector certification, visit **asq.org/cert**.

BODY OF KNOWLEDGE

Certified Quality Inspector (CQI)

Topics in this body of knowledge (BoK) include additional detail in the form of subtext explanations and the cognitive level at which the questions will be written. This information will provide useful guidance for both the Exam Development Committee and the candidate preparing to take the exam. The subtext is not intended to limit the subject matter or be all-inclusive of what might be covered in an exam. It is meant to clarify the type of content to be included in the exam. The descriptor in parentheses at the end of each line of subtext refers to the maximum cognitive level at which the topic will be tested. A complete description of cognitive levels is provided at the end of this document.

NOTE: Approximately 20% of the questions in each exam will require calculation.

I. Technical Mathematics (19 Questions)

A. Basic Shop Math
Solve basic shop math problems using addition, subtraction, multiplication, division of fractions and decimals, squares, and square roots. Use methods such as truncating and rounding to obtain significant digits for positive and negative numbers. (Apply)

B. Basic Algebra
Solve or simplify first-degree and single-variable equations. (Apply)

C. Basic Geometry
Calculate general parameters such as area, circumference, perimeter, and volume for basic geometric shapes. Calculate complementary and supplementary angles. (Apply)

D. Basic Trigonometry
Solve for angles and lengths using trigonometric functions such as sine, cosine, tangent, and the Pythagorean theorem. (Apply)

E. Measurement Systems
Convert units within and between English and metric measurement systems (SI) such as inch to micro-inch, liter to quart, and meter to millimeter. (Apply)

F. Numeric Conversions
Use various numbering methods such as scientific notation, decimals, and fractions, and convert values between these systems. (Apply)

II. Metrology (26 Questions)

A. Common Gauges and Measurement Instruments

1. **Variable gauges**
   Identify and use variable gauges, including micrometers, calipers, dial indicators, and Coordinate Measuring Machines (CMMs). Understand linear scales, such as steel rule, and gauge blocks. Use borescopes, thermometers, and temperature probes. (Apply)

2. **Attribute gauges**
   Identify and use attribute gauges, including thread plugs, progressive rings, flush pins, pin gauges, and radius gauges. (Apply)

3. **Transfer gauges**
   Identify and use transfer gauges, including small-hole gauges, telescoping gauges, and spring calipers. (Apply)

4. **Measurement scales**
   Describe and distinguish between dial, digital, and vernier scales. (Remember)

B. Special Gauges and Applications

Identify and describe the following basic tools and components. (Remember)

1. **Electronic gauging tools:** oscilloscopes, multimeters, and pyrometers.
2. **Automatic gauging components:** machine vision, ultrasonic, X-ray, and laser.
3. **Pneumatic gauging components:** air columns, probes, and rings.
4. **Force gauging:** torque wrenches.
5. **Environment instrumentation:** hygrometers, chart recorders, and data loggers.

C. Gauge Selection, Handling, and Use

1. **10:1 rule**
   Understand the 10:1 rule: inspection measurements require better than the tolerance of a dimension by a factor of 10, and calibration standards require better than the inspection measurements by a factor of 10. (Understand)

2. **Gauge selection**
   Select gauges according to the feature or characteristic to be measured, the applicable tolerance and the accuracy, environment, and the resolution and capability of the test instrument. Determine whether the type of measurement should be direct, differential, or transfer. (Apply)

3. **Gauge handling, preservation, and storage**
   Identify and apply various methods of cleaning, handling, and storing gauges. (Apply)

4. **Gauge correlation**
   Identify and apply methods for establishing the correlation between measurement instruments such as gauge-to-gauge or manual-to-automated process. (Apply)

D. Surface Plate Tools and Techniques

1. **Surface plate equipment**
   Select and use height gauges, V-blocks, and other indicators to measure various types of features. Understand the care, cleaning, calibration, and lapping of a surface plate. (Apply)

2. **Angle measurement instruments**
   Identify and use protractors, sine bars, and angle blocks. (Apply)

E. Specialized Inspection Equipment

1. **Measuring mass**
   Describe and apply weights, balances, and scales. (Apply)
2. **Measuring finish**
   Describe and apply profilometers, and fingernail comparators. (Apply)
3. **Measuring shape and profile**
   Describe and apply mechanical comparators, roundness testers, precision spindles, and profile tracers. (Apply)
4. **Optical equipment**
   Describe and apply optical comparators, optical flats, and microscopes. (Apply)
5. **Software-based measurement systems**
   Define and describe the use of digital cameras, in-line optical sensors, vision inspection systems (white light/blue light), articulating arms, laser trackers, contracers, and other digital systems for product inspection. Recognize software limitations with regard to locating functional datums, target points and areas, hole positions, and the basic operation of the x, y, and z axes. (Understand)
6. **Measuring inclination**
   Define and describe the measurement of the slope or slant of various equipment (mechanical/laser). (Understand)

F. Calibration

1. **Calibration systems**
   Describe the principles and purpose of a calibration system, including the importance of establishing calibration intervals and uncertainty. Identify and use basic tracking and identification methods such as logs, stickers, radio frequency identifications (RFID), barcodes, and other identification codes to control calibration equipment. (Apply)
2. **Calibration standards and equipment traceability**
   Describe the hierarchy of standards, from working standards through international standards and the documentation process of a measurement device traceable to the international standards. (Remember)
3. **Gauge calibration environment**
   Describe the effects that environmental conditions have on the calibration process, such as temperature, humidity, vibration, and cleanliness of the gauge. (Apply)
4. **Out-of-calibration effects**
   Describe the effects that out-of-calibration instruments can have on product acceptance and the actions to take in response to this situation. (Apply)

G. Measurement System Analysis (MSA)

Define and describe the following elements of MSA. (Remember)

1. **Bias**
2. **Stability**
3. **Precision**
4. **Accuracy**
5. **Linearity**
6. **Repeatability and reproducibility (R&R) studies**

III. Inspection and Test (33 Questions)

A. Blueprints, Drawings, Geometric Dimensioning and Tolerancing (GD&T), and Model-Based Definitions

1. **Blueprints, engineering drawings, and model-based definitions**
   Define and interpret various sections of technical drawings: title blocks, tolerances, change or revision blocks, including notes, scale, and size details. (Apply)

2. **Terminology and symbols**
   Define and interpret drawing views and details for product specifications or other controlling documents. Define and use various terms and symbols from the ASME Y14.5M standard. (Analyze)

3. **Position and bonus tolerances**
   Calculate position and bonus tolerances from various drawings. (Analyze)

4. **Part alignment and datum structure**
   Determine part alignment and setup using the datum structure. (Analyze)

B. Sampling

Define and interpret the following terms related to sampling. (Apply)

1. **Acceptance quality limit (AQL)**
2. **Random sampling**
3. **Lot and sample size**
4. **Acceptance number**
5. **Sampling plans**

C. Inspection Planning and Processes

1. **Inspection types**
   Define and distinguish between inspection types such as incoming material, first-article (first-piece), in-process, and final. (Apply)

2. **Inspection errors**
   Identify potential inspection errors such as bias, fatigue, flinching, distraction, and poor time management. (Apply)

3. **Product traceability**
   Identify methods to trace products and materials such as age control, shelf life, first-in first-out (FIFO), barcoding, date codes, and lot and part numbering. (Apply)

4. **Identification of nonconforming material**
   Describe various methods of identifying nonconforming material such as tagging, labeling, and segregating. (Apply)

5. **Level of severity**
   Define and describe levels of severity (critical, major, and minor) and apply them to product features and defects. (Apply)

6. **Disposition of nonconforming material**
   Describe disposition methods including rework, reprocess, reinspect, scrap, and customer waiver, as determined by a material review board (MRB) or other authority. (Apply)

D. Testing Methods

Define and use the following methods in various situations. (Apply)

1. **Nondestructive testing:**
   X-ray, eddy current, ultrasonic, dye penetrant, magnetic particle, optical, visual, and profile.

2. **Destructive testing:**
   tensile, force testing, and drop test.

3. **Functionality testing:**
   tension, torque, leak testing, and compression.

4. **Hardness testing:**
   Brinell, Rockwell, durometer, and micro-hardness scales.

E. Software for Test Equipment

Identify and describe basic tools (safeguarding, functional checks, comparison of test results, identification of attributes and parameters) used to ensure that the software for test equipment adequately and correctly performs its intended functions. (Remember)

IV. Quality Assurance (22 Questions)

A. Basic Statistics and Applications

1. **Measures of central tendency**
   Calculate mean, median, and mode. (Apply)

2. **Measures of dispersion**
   Calculate range, standard deviation, and variance. (Apply)

3. **Measures of proportion**
   Calculate percentage and ratio measures for various data sets. (Apply)

4. **Graphical displays**
   Define, interpret, and use scatter diagrams, tally sheets, and bar charts to display data effectively in various situations. (Apply)

5. **Normal distribution**
   Describe various characteristics of a normal distribution: symmetry, bell curve, and central tendency. (Understand)

B. Statistical Process Control (SPC)

1. **Common and special cause variation**
   Explain the difference between these causes of variation. Determine whether a process is in statistical control by analyzing data patterns (runs, trends, and hugging), and identify what actions should be taken in response. (Evaluate)

2. **Control limits and specification limits**
   Define, describe, and distinguish between these limits as used in SPC. (Apply)

3. **Variables charts**
   Identify characteristics and uses of $\bar{X}$–R and $\bar{X}$–s charts. (Apply)

4. **Attributes charts**
   Identify characteristics and uses of p, np, c, and u charts. (Apply)

5. **Process capability analysis**
   Define and distinguish between C_p, C_{pk}, P_p, and P_{pk} studies and identify their application to various types of data. (Understand)

C. Quality Improvement

1. **Terms and concepts**
   Define basic quality improvement concepts such as defect detection and prevention, the cost of poor quality, total quality management (TQM), and the importance of customer satisfaction. (Understand)

2. **Products and processes**
   Define and distinguish between products and processes. Describe the interrelationships of product design, materials used, manufacturing processes, and final output, and how individual steps in a process can affect the final product or the system as a whole. (Understand)

D. Quality Audits

1. **Types of audits**
   Define and describe various types of audits, including internal, external, system, product, and process. (Understand)

2. **Audit process**
   Define and describe various stages of the audit process (planning, performance, and closure), including audit scope and purpose, resources needed, audit schedule, opening meeting, interviewing, data gathering, document and record review, analysis of results, closing meeting, audit documentation (reporting), recordkeeping, and verification of corrective actions. (Understand)

3. **Audit tools**
   Define and describe the purpose of checklists, log sheets, sampling plans, record reviews, document reviews, and forward- and backward-tracing. (Understand)

4. **Communication tools and techniques**
   Define and describe the use of graphs, charts, diagrams, and other aids for written and oral presentations including interview techniques and listening skills. (Understand)

5. **Corrective action requests (CARs)**
   Describe how CARs from audits can support quality improvement. (Understand)

E. Quality Tools and Techniques

Define and use the following quality tools and techniques. (Apply)

1. **Pareto charts**
2. **Cause and effect diagrams**
3. **Flowcharts**
4. **Control charts**
5. **Check sheets**
6. **Scatter diagrams**
7. **Histograms**

F. Problem-solving Tools and Continuous Improvement Techniques

Describe and use the following tools and techniques in various situations. (Apply)

1. **Plan-do-check-act (PDCA) or plan-do-study-act (PDSA) cycles**
2. **Lean tools for eliminating waste:** 5S, error-proofing, value-stream mapping; and **lean concepts:** kaizen, flow, pull
3. **Six Sigma phases:** define, measure, analyze, improve, control (DMAIC)
4. **Failure mode and effects analysis (FMEA)**
5. **8D methodology**
6. **5 Whys**
7. **Fault tree analysis**

G. Resources

1. **Environmental and safety support**
   Define and use various resources related to personal and environmental safety: safety data sheets (SDS), material data sheet (MDS), and personal protective equipment (PPE). (Apply)

2. **Reference documents**
   Identify and use national and international standards (ISO, ANSI, ASTM, QS) and customer requirements as authorities that support processes and procedures used to ensure quality products. (Apply)

3. **Employees as resources**
   Describe how employees can be empowered and the value they add to project teams or quality improvement teams. Describe typical team roles and responsibilities: facilitator, ground rules, project, or team charter. Describe the four stages of team development: forming, storming, norming, performing. (Remember)

4. **Quality documentation**
   Basic quality documentation including correct form/revision for the process (ISO 9001, First Article Inspection Report, ISIR, PPAPs). Proper usage of policy, procedure, work instructions and forms, proper documentation practices such as document control, filling out forms completely, correcting misspellings, and initialing changes. (Apply)

LEVELS OF COGNITION

Based on Bloom's Taxonomy—Revised (2001)

In addition to **content** specifics, the subtext for each topic in this BoK also indicates the intended **complexity level** of the test questions for that topic. These levels are based on "Levels of Cognition" (from Bloom's Taxonomy—Revised, 2001) and are presented below in rank order, from least complex to most complex.

REMEMBER | Recall or recognize terms, definitions, facts, ideas, materials, patterns, sequences, methods, principles, etc.

UNDERSTAND | Read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, etc.

APPLY | Know when and how to use ideas, procedures, methods, formulas, principles, theories, etc.

ANALYZE | Break down information into its constituent parts and recognize their relationship to one another and how they are organized; identify sublevel factors or salient data from a complex scenario.

EVALUATE | Make judgments about the value of proposed ideas, solutions, etc., by comparing the proposal to specific criteria or standards.

CREATE | Put parts or elements together in such a way as to reveal a pattern or structure not clearly there before; identify which data or information from a complex set is appropriate to examine further or from which supported conclusions can be drawn.

Visit **asq.org/cert** for comprehensive exam information.

Enhance your career with ASQ certification today!

Visit **asq.org/cert** for additional certification information including:

- Applications
- Available certifications and international language options
- Reference materials
- Study guides and test-taking tips
- Comprehensive exam information
- ASQ sections
- International contacts
- Endorsements

2018 CQI BoK

Item B0080

ASQ Certified Quality Inspector
Excellence Through Quality™