

CQE BOK Map 2015

The Certified Quality Engineer (CQE) body of knowledge (BOK) has been updated to ensure that the most current state of practice is being tested in the examination. If you would like more information on how a BOK is updated, see a description of the process on page 4 in the [Certification Handbook](#) (PDF – 228 KB) on the www.asq.org website.

General comments about ASQ Body of Knowledge updates

When the Body of Knowledge (BOK) is updated for an ASQ exam, the majority of the material covered in the BOK remains the same. There are very few programs that change dramatically over a 5-year period. One of the points that we make to all of the exam development committees is that ASQ Certification Exams need to reflect “the state of practice” not “the state of the art” – this helps to keep the programs grounded in what people currently do, rather than being driven by the latest hot-topic improvement idea or trend. Typically, the biggest change in any updated BOK is in how the content is organized. When a new BOK is announced and posted on the ASQ website, we also include a “BOK Map” that highlights the changes between the two bodies of knowledge, as explained below:

2015 BOK Details	New Elements in 2015 BOK
↑ This column contains the complete content of the new BOK ↑	↑ This column provides brief comments highlighting what is new or changed in the new BOK and where content was moved from in the 2006 BOK. If it is blank , it means that only minor changes have been made, if any.

With regard to exam preparation materials, you should be able to use any of the reference books that are currently listed on the bibliography [see: [References for CQE](#)]. These are the source materials that the exam development committees use to write questions and verify answers.

Specific comments about 2015 CQE Body of Knowledge (BOK) update

Part of the updating process is to conduct a job analysis survey to determine whether the topics in the 2006 BOK are still relevant to the job role of quality engineer and to identify any new topics that have emerged since that BOK was developed. The results of the CQE job analysis survey showed that most of the topics that were in the 2006 BOK are still relevant to the job roles of engineers of quality in 2015.

The CQE exam still contains 160 multiple choice questions. The first CQE examination developed under the 2015 body of knowledge will be introduced at the December 5, 2015, administration. Both BOKs will be available online until February 29, 2016, at which time the 2006 BOK will be removed.

2015 BOK Details	New Element in 2015 BOK
I. Management and Leadership (18 Questions)	Increased # of questions from 15
A. Quality Philosophies and Foundations	
<p>1. Evolution of Quality Understand how modern quality has evolved from quality control through statistical process control (SPC) to total quality management and leadership principles (including Deming’s 14 points), and other continuous improvement tools, including lean, six sigma, and theory of constraints. (Understand)</p>	
<p>2. Continuous improvement tools Describe continuous improvement tools, including lean, six sigma, theory of constraints, statistical process control (SPC), and total quality management, and understand how modern quality has evolved from quality control through statistical process control (SPC) to total quality management and leadership principles (including Deming’s 14 points). (Understand)</p>	New section.
B. The Quality Management System (QMS)	
<p>1. Strategic planning Identify and define top management’s responsibility for the QMS, including establishing policies and objectives, setting organization-wide goals, and supporting quality initiatives. (Apply)</p>	
<p>2. Deployment techniques Define, describe, and use various deployment tools in support of the QMS such as:</p> <ul style="list-style-type: none"> a. Benchmarking Define the concept of benchmarking and why it may be used. (Remember) b. Stakeholder Define, describe and use stakeholder identification and analysis. (Apply) c. Performance Define, describe and use performance measurement tools. (Apply) d. Project management Define, describe and use project management tools, including PERT charts, Gantt charts, critical path method (CPM), and resource allocation. (Apply) 	Broke out deployment techniques and provided more detail for each technique.

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<p>3. Quality information system (QIS) Identify and describe the basic elements of a QIS, including who will contribute data, the kind of data to be managed, who will have access to the data, the level of flexibility for future information needs, and data analysis. (Understand)</p>	<p>Changed cognitive level from Remember to Understand.</p>
<p>C. ASQ Code of Ethics for Professional Conduct Determine appropriate behavior in situations requiring ethical decisions. (Evaluate)</p>	
<p>D. Leadership Principles and Techniques Analyze various principles and techniques for developing and organizing teams and leading quality initiatives. (Analyze)</p>	
<p>E. Facilitation Principles and Techniques</p>	<p>Expanded subtext to separate entries.</p>
<p>1. Roles and responsibilities Describe the facilitator's roles and responsibilities on a team. (Understand)</p>	
<p>2. Facilitation tools Apply various tools used with teams, including brainstorming, nominal group technique, conflict resolution, and force-field analysis. (Apply)</p>	
<p>F. Communication Skills Identify specific communication methods that are used for delivering information and messages in a variety of situations across all levels of the organization. (Analyze)</p>	
<p>G. Customer Relations Define, apply, and analyze the results of customer relation tools such as quality function deployment (QFD) and customer satisfaction surveys. (Analyze)</p>	
<p>H. Supplier Management</p>	<p>Expanded subtext to separate entries.</p>
<p>1. Techniques Apply various supplier management techniques, including supplier qualification, certification, and evaluation. (Apply)</p>	
<p>2. Improvement Analyze supplier ratings and performance improvement results. (Analyze)</p>	
<p>3. Risk Understand business continuity, resiliency, and contingency planning. (Understand)</p>	
<p>I. Barriers to Quality Improvement Identify barriers to quality improvement, analyze their causes and impact, and implement methods for</p>	

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improvement. (Analyze)	
II. The Quality System (16 Questions)	Increased # of questions from 15
A. Elements of the Quality System	Expanded subtext to separate entries.
1. Basic elements Interpret the basic elements of a quality system, including planning, control, and improvement, from product and process design through quality cost systems and audit programs. (Evaluate)	
2. Design Analyze the design and alignment of interrelated processes to the strategic plan and core processes. (Analyze)	New content.
B. Documentation of the Quality System	Expanded subtext to separate entries.
1. Document components Identify and describe quality system documentation components, including quality policies and procedures to support the system. (Understand)	
2. Document control Evaluate configuration management, maintenance, and document control to manage work instructions and quality records. (Evaluate)	
C. Quality Standards and Other Guidelines Apply national and international standards and other requirements and guidelines, including the Malcolm Baldrige National Quality Award (MBNQA), and describe key points of the ISO 9000 series of standards. [Note: Industry-specific standards will not be tested.] (Apply)	
D. Quality Audits	
1. Types of audits Describe and distinguish between various types of quality audits such as product, process, management (system), registration (certification), compliance (regulatory), first, second, and third party. (Apply)	
2. Roles and responsibilities in audits Identify and define roles and responsibilities for audit participants such as audit team (leader and members), client, and auditee. (Understand)	

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3. Audit planning and implementation Describe and apply the stages of a quality audit, from audit planning through conducting the audit. (Apply)	
4. Audit reporting and follow-up Apply the steps of audit reporting and follow up, including the need to verify corrective action. (Apply)	
E. Cost of Quality (COQ) Identify and apply COQ concepts, including cost categorization, data collection, reporting, and interpreting results. (Analyze)	
F. Quality Training Identify and apply key elements of a training program, including conducting a needs analysis, developing curricula and materials, and determining the program's effectiveness. (Apply)	
III. Product, Process, and Service Design (23 Questions)	Reduced # of questions from 25
A. Classification of Quality Characteristics Define, interpret, and classify quality characteristics for new and existing products, processes, and services. [Note: The classification of defects is covered in IV.B.3.] (Evaluate)	
B. Design Inputs and Review	Expanded subtext to separate entries.
1. Inputs Translate design inputs such as customer needs, regulatory requirements, and risk assessment into robust design using techniques such as failure mode and effects analysis (FMEA), quality function deployment (QFD), Design for X (DFX), and Design for Six Sigma (DFSS). (Analyze)	Removed Design for Manufacturability (DFM) and Design for cost (DFC).
2. Review Identify and apply common elements of the design review process, including roles and responsibilities of participants. (Apply)	Lowered cognitive level from Analyze.
C. Technical Drawings and Specifications Interpret specification requirements in relation to product and process characteristics and technical drawings, including characteristics such as views, title blocks, dimensioning and tolerancing, and GD&T	

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symbols. (Evaluate)	
D. Verification and Validation Interpret the results of evaluations and tests used to verify and validate the design of products, processes and services, such as installation qualification (IQ), operational qualification (OQ), and process qualification (PQ). (Evaluate)	Renamed section and revised subtext, added IQ, OQ and PQ.
E. Reliability and Maintainability	
1. Predictive and preventive maintenance tools Describe and apply the tools and techniques used to maintain and improve process and product reliability. (Apply)	Lowered cognitive level from Analyze.
2. Reliability and maintainability indices Review and analyze indices such as MTTF, MTBF, MTTR, availability, and failure rate. (Analyze)	
3. Reliability models Identify, define, and distinguish between the basic elements of reliability models such as exponential, Weibull, and bathtub curve. (Apply)	Lowered cognitive level from Analyze.
4. Reliability / Safety / Hazard Assessment Tools Define, construct, and interpret the results of failure mode and effects analysis (FMEA), failure mode, effects, and criticality analysis (FMECA), and fault tree analysis (FTA). (Evaluate)	Raised cognitive level from Analyze.
IV. Product and Process Control (25 Questions)	Reduced # of questions from 32
A. Methods Implement product and process control methods such as control plan development, critical control point identification, and work instruction development and validation. (Analyze)	Renamed section was previously Tools.
B. Material Control	
1. Material identification, status, and traceability Define and distinguish between these concepts, and describe methods for applying them in various situations. (Analyze)	
2. Material segregation Describe material segregation and its importance, and evaluate appropriate methods for applying it in	

2015 BOK Details	New Element in 2015 BOK
various situations. (Evaluate)	
3. Material classification Classify product and process defects and non-conformities. (Evaluate)	Renamed section was previously Classification of Defects.
4. Material review board (MRB) Describe the purpose and function of an MRB and evaluate nonconforming product or material to make a disposition decision in various situations. (Evaluate)	Raised cognitive level from Analyze.
C. Acceptance Sampling	
1. Sampling concepts Interpret the concepts of producer and consumer risk and related terms, including operating characteristic (OC) curves, acceptable quality limit (AQL), lot tolerance percent defective (LTPD), average outgoing quality (AOQ), and average outgoing quality limit (AOQL). (Analyze)	
2. Sampling standards and plans Identify, interpret, and apply ANSI/ASQ Z1.4 and Z1.9 standards for attributes and variables sampling. Identify and distinguish between single, double, multiple, sequential, and continuous sampling methods. Identify the characteristics of Dodge-Romig sampling tables and when they should be used. (Analyze)	
3. Sample integrity Identify and apply techniques for establishing and maintaining sample integrity. (Apply)	Lowered cognitive level from Analyze.
D. Measurement and Test	
1. Measurement tools Select and describe appropriate uses of inspection tools such as gage blocks, calipers, micrometers, and optical comparators. (Analyze)	
2. Destructive and nondestructive tests Identify when destructive and nondestructive measurement test methods should be used and apply the methods appropriately. (Apply)	Lowered cognitive level from Analyze.
E. Metrology Apply metrology techniques such as calibration, traceability to calibration standards, measurement error and its sources, and control and maintenance of measurement standards and devices. (Analyze)	
F. Measurement System Analysis (MSA) Calculate, analyze, and interpret repeatability and reproducibility (Gage R&R) studies, measurement correlation, capability, bias, linearity, precision, stability and accuracy, as well as related MSA quantitative	

2015 BOK Details	New Element in 2015 BOK
and graphical methods. (Evaluate)	
V. Continuous Improvement (27 Questions)	Reduced # of questions from 30
<p>A. Quality Control Tools Select, construct, apply, and interpret the following quality control tools:</p> <ol style="list-style-type: none"> 1. Flowcharts 2. Pareto charts 3. Cause and effect diagrams 4. Control charts 5. Check sheets 6. Scatter diagrams 7. Histograms (Analyze) 	Re-formatted to list instead of subtext.
<p>B. Quality Management and Planning Tools Select, construct, apply, and interpret the following quality management and planning tools:</p> <ol style="list-style-type: none"> 1. Affinity diagrams and force field analysis 2. Tree diagrams 3. Process decision program charts (PDPC) 4. Matrix diagrams 5. Interrelationship digraphs 6. Prioritization matrices 7. Activity network diagrams (Analyze) 	Re-formatted to list instead of subtext.
<p>C. Continuous Improvement Methodologies Define, describe, and apply the following continuous improvement methodologies:</p> <ol style="list-style-type: none"> 1. Total quality management (TQM) 2. Kaizen 3. Plan-do-check-act (PDCA) 4. Six sigma 5. Theory of constraints (TOC) (Evaluate) 	Renamed from Continuous Improvement Techniques. Removed 'Lean' and created new 'Lean' section V.D.
<p>D. Lean tools</p>	New Section, originally found in

2015 BOK Details	New Element in 2015 BOK
<p>Define, describe, and apply the following lean tools:</p> <ol style="list-style-type: none"> 1. 5S 2. Value-stream mapping 3. Kanban 4. Visual control 5. Waste (Muda) 6. Standardized work 7. Takt time 8. Single minute exchange of die (SMED) (Evaluate) 	<p>subtext of V.C.</p>
<p>E. Corrective Action Identify, describe, and apply elements of the corrective action process, including problem identification, failure analysis, root cause analysis, problem correction, recurrence control, and verification of effectiveness. (Evaluate)</p>	
<p>F. Preventive Action Identify, describe and apply various preventive action tools such as error-proofing/poka-yoke, robust design and analyze their effectiveness. (Evaluate)</p>	
<p>VI. Quantitative Methods and Tools (36 Questions)</p>	<p>Reduced # of questions from 43</p>
<p>A. Collecting and Summarizing Data</p>	
<p>1. Types of data Define, classify, and compare discrete (attributes) and continuous (variables) data. (Apply)</p>	
<p>2. Measurement scales Define and describe nominal, ordinal, interval, and ratio scales. (Understand)</p>	<p>Lowered cognitive level from Apply.</p>
<p>3. Data collection methods Describe various methods for collecting data, including tally or check sheets, data coding,</p>	

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automatic gaging, and identify the strengths and weaknesses of the methods. (Apply)	
<p>4. Data accuracy and integrity Apply techniques that ensure data accuracy and integrity, and identify factors that can influence data accuracy such as source/resource issues, flexibility, versatility, inconsistency, inappropriate interpretation of data values, and redundancy. (Apply)</p>	Renamed from 'Data Accuracy' and revised subtext to include data integrity.
<p>5. Descriptive statistics Describe, calculate, and interpret measures of central tendency and dispersion (central limit theorem), and construct and interpret frequency distributions, including simple, categorical, grouped, ungrouped, and cumulative. (Evaluate)</p>	
<p>6. Graphical methods for depicting relationships Construct, apply, and interpret diagrams and charts such as stem-and-leaf plots, and box-and-whisker plots. [Note: Scatter diagrams are covered in V.A.] (Analyze)</p>	
<p>7. Graphical methods for depicting distributions Construct, apply, and interpret diagrams such as normal and non-normal probability plots. [Note: Histograms are covered in V.A.] (Analyze)</p>	
B. Quantitative Concepts	
<p>1. Terminology Define and apply quantitative terms, including population, parameter, sample, statistic, random sampling, and expected value. (Analyze)</p>	
<p>2. Drawing statistical conclusions Distinguish between numeric and analytical studies. Assess the validity of statistical conclusions by analyzing the assumptions used and the robustness of the technique used. (Evaluate)</p>	
<p>3. Probability terms and concepts</p>	Lowered cognitive level from Apply.

2015 BOK Details	New Element in 2015 BOK
Describe concepts such as independence, mutually exclusive, multiplication rules, complementary probability, and joint occurrence of events. (Understand)	
C. Probability Distributions	
1. Continuous distributions Define and distinguish between these distributions such as normal, uniform, bivariate normal, exponential, lognormal, Weibull, chi square, Student's t and F. (Analyze)	
2. Discrete distributions Define and distinguish between these distributions such as binomial, Poisson, hypergeometric, and multinomial. (Analyze)	
D. Statistical Decision-Making	
1. Point estimates and confidence intervals Define, describe, and assess the efficiency and bias of estimators. Calculate and interpret standard error, tolerance intervals, and confidence intervals. (Evaluate)	
2. Hypothesis testing Define, interpret, and apply hypothesis tests for means, variances, and proportions. Apply and interpret the concepts of significance level, power, type I and type II errors. Define and distinguish between statistical and practical significance. (Evaluate)	
3. Paired-comparison tests Define and use paired-comparison (parametric) hypothesis tests, and interpret the results. (Apply)	
4. Goodness-of-fit tests Define chi square and other goodness-of-fit tests, and understand the results. (Understand)	Lowered cognitive level from Apply.
5. Analysis of variance (ANOVA)	

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Define and use ANOVAs and interpret the results. (Analyze)	
<p>6. Contingency tables Define and use contingency tables to evaluate statistical significance. (Apply)</p>	Lowered cognitive level from Analyze.
E. Relationships Between Variables	
<p>1. Linear regression Calculate the regression equation for simple regressions and least squares estimates. Construct and interpret hypothesis tests for regression statistics. Use linear regression models for estimation and prediction. (Analyze)</p>	Removed: [Note: Non-linear models and parameters will not be tested.]
<p>2. Simple linear correlation Calculate the correlation coefficient and its confidence interval, and construct and interpret a hypothesis test for correlation statistics. (Analyze)</p>	Removed: [Note: Serial correlation will not be tested.]
<p>3. Time-series analysis Define, describe, and use time-series analysis, including moving average to identify trends and seasonal or cyclical variation. (Apply)</p>	Lowered cognitive level from Analyze.
F. Statistical Process Control (SPC)	
<p>1. Objectives and benefits Identify and explain the objectives and benefits of SPC. (Understand)</p>	Revised subtext.
<p>2. Common and special causes Describe, identify, and distinguish between these types of causes. (Analyze)</p>	
<p>3. Selection of variable Identify and select characteristics for monitoring by control chart. (Analyze)</p>	
<p>4. Rational subgrouping</p>	

2015 BOK Details	New Element in 2015 BOK
Define and apply the principles of rational subgrouping. (Apply)	
<p>5. Control charts Identify, select, construct, and use various control charts, including \bar{X}-R, \bar{X}-s, individuals and moving range (ImR or XmR), moving average and moving range (MamR), p, np, c, and u. (Analyze)</p>	Removed CUSUM charts.
<p>6. Control chart analysis Read and interpret control charts and use rules for determining statistical control. (Evaluate)</p>	
<p>7. Pre-control charts Define and describe these charts and how they differ from other control charts. (Understand)</p>	Lowered cognitive level from Apply.
<p>8. Short-run SPC Identify and define short-run SPC rules. (Understand)</p>	Lowered cognitive level from Apply.
G. Process and Performance Capability	
<p>1. Process capability studies Define, describe, calculate, and use process capability studies, including identifying characteristics, specifications and tolerances, developing sampling plans for such studies, and establishing statistical control. (Analyze)</p>	
<p>2. Process performance vs. specifications Distinguish between natural process limits and specification limits, and calculate percent defective, defects per million opportunities (DPMO), and parts per million (PPM). (Analyze)</p>	Added DPMO and PPM.
<p>3. Process capability indices Define, select, and calculate C_p, C_{pk}, C_{pm}, and C_r, and evaluate process capability. (Evaluate)</p>	
<p>4. Process performance indices</p>	

2015 BOK Details	New Element in 2015 BOK
Define, select, and calculate P_p and P_{pk} , and evaluate process performance. (Evaluate)	
H. Design and Analysis of Experiments	
<p>1. Terminology Define terms such as dependent and independent variables, factors, levels, response, treatment, error, and replication. (Understand)</p>	
<p>2. Planning and organizing experiments Identify the basic elements of designed experiments, including determining the experiment objective, selecting factors, responses, and measurement methods, and choosing the appropriate design. (Analyze)</p>	
<p>3. Design principles Define and apply the principles of power and sample size, balance, replication, order, efficiency, randomization, blocking, interaction, and confounding. (Apply)</p>	
<p>4. One-factor experiments Construct one-factor experiments such as completely randomized, randomized block, and Latin square designs, and use computational and graphical methods to analyze the significance of results. (Analyze)</p>	
<p>5. Full-factorial experiments Construct full-factorial designs and use computational and graphical methods to analyze the significance of results. (Analyze)</p>	
<p>6. Two-level fractional factorial experiments Construct two-level fractional factorial designs and apply computational and graphical methods to analyze the significance of results. (Analyze)</p>	Removed reference to Taguchi, although Taguchi questions may appear in I.A.1
VII. Risk Management (15 Questions)	NEW AREA
A. Risk Oversight	

2015 BOK Details	New Element in 2015 BOK
<p>1. Planning and oversight Understand identification, planning, prioritization, and oversight of risk. (Understand)</p>	
<p>2. Metrics Identify and apply evaluation metrics. (Apply)</p>	
<p>3. Mitigation planning Apply and interpret risk mitigation plan. (Evaluate)</p>	
<p>B. Risk Assessment Apply categorization methods and evaluation tools to assess risk. (Analyze)</p>	
<p>C. Risk Control</p>	
<p>1. Identification and documentation Identify and document risks, gaps and controls. (Analyze)</p>	
<p>2. Auditing and Testing Apply auditing techniques and testing of controls. (Evaluate)</p>	