ATMAE

LEAD • INNOVATE • COLLABORATE

STUDY GUIDE

FOR THE

CERTIFIED IN ENGINEERING GRAPHICS (CEG)

CERTIFICATION

EXAM

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PREFACE TO THE ATMAE CERTIFIED IN ENGINEERING GRAPHICS (CEG) CERTIFICATION EXAM

We are pleased that you are considering certification in the area of engineering graphics. This engineering graphics exam is geared toward the industry standard expression of design ideas as contract documents – used within the industrial enterprise in areas such as manufacturing process planning, quality control, purchasing, and other areas of expertise.

In summary, the following premises were foundational to the development of this ATMAE CEG certification:

1. The ATMAE CEG certification will not include both engineering and architectural graphic topics. While many educational programs blend these two fields of drafting together, this certification will focus primarily on engineering graphic standards and practices, as exemplified foremost by the American Society of Mechanical Engineers (ASME) standards, under the umbrella of ANSI standards.
2. The ATMAE CEG certification will not include topics related to manual drafting equipment, and other practices that are no longer of primary use in industry.
3. The ATMAE CEG certification will not reference particular CAD systems, nor focus on CAD commands, especially with respect to brand-specific CAD tools such as AutoCAD™. A person can seek AutoCAD Certification and add such a credential through other avenues. In summary, this certification does not try to measure the knowledge or expertise one has with respect to a CAD system, but rather the graphic images (i.e. drawings, prints, etc.) that are created by them.

CONTENT FOR ATMAE CERTIFIED ENGINEERING GRAPHICS (CEG) CERTIFICATION EXAM

The 16 major content areas from which the exam is comprised are as follows:

Content Area	Number of Questions
1. ASME Standards, Terms, and Line Conventions	**10**
ASME and their role in standardizing engineering graphics	
Terms relevant within the scope of standardized engineering graphics	
Conventional lines and lettering used in standardized engineering graphic prints	
2. ASME Standard Sheets, Title Blocks, Revision Blocks, and Part Lists	**5**
Sheet sizes and layouts available for imperial and metric applications	
Common terms used for blocks on sheets and prints	
Techniques, such as zoning and parts lists, important to standardized prints	
3. Units, Measuring Devices, Scaling Issues, and Metric/Inch Conversion	**10**
Common units, decimal and fractional expression, imperial and metric	
Common devices, scales, calipers, rulers, etc.	
Various scaling issues for views and drawings	
Metric-to-inch conversion and expression	
4. Geometry Terms, Definitions, and Constructions (2D and 3D)	**10**
Geometric 2D & 3D shapes, terms, and characteristics	
Geometric relationships (parallelism, tangencies, perpendicularity, etc.)	
Various aspects of geometric construction (proportion, circumscribing, bisecting, etc.)	
5. Orthographic Projection Theory, Standard Representation, and Spatial Visualization	**25**
Orthographic projection theory and terms	
Projection planes (Frontal, Horizontal, and Profile)	
Measurements (Height, Width, Depth)	
Standard surface terms (Normal, Inclined, Oblique)	
Vertex numbering techniques	
Cylindrical surface intersections	
Fillets, rounds, & runout expression	
First angle versus third angle	
6. Sectional View Standards, Terms, and Conventional Practices	**10**
Standard lines for sectionals	
Types of sectionals	
Conventional practices for sectionals	
Special application techniques (S-breaks, webs, spokes, etc.)	
7. Auxiliary View Standards, Terms, and Conventional Practices	**5**
Purposes of primary and secondary auxiliary views	
Projection theory & terms for auxiliary view representation	
Standard applications of auxiliary views	
8. Pictorial Drawings and 3D Modeling Representation Methods	**5**
Basic projection theory of pictorial drawing methods	
Types of pictorial representation	
Standard applications of pictorial views	

9. Assembly Drawing Methods	**5**
ASME terms and types of assembly drawings	
Sectional practices for assembly drawings	
Exploded/unexploded pictorial/multiview methods for assemblies	
Part identification and parts list techniques for assemblies	
10. Dimensioning Standards, Including Choice and Placement Methods	**15**
ASME standard terms and types of lines used in dimensioning	
Dimensioning "mechanics" (i.e. spacing, arrow size, text format, etc.)	
Dimensioning "choice & placement" techniques	
Specialized dimensioning methods (tabular, coordinate, dual, etc.)	
11. Tolerancing Calculations and Practices	**10**
ASME standard terms and techniques of applying tolerance values	
Calculation of limits of fit, maximum material condition, & allowance	
Standardized precision fits and basic hole system calculations	
12. Geometric Dimensioning and Tolerancing (GDT)	**15**
Identification of GDT symbols, boxes, and datum identification	
Definitions of GDT geometric controls and symbols	
Identification and explanation of GDT tolerance zones and modifiers	
Reading feature control frames	
13. Machining Specifications, Callouts, and Surface Texture Symbols	**10**
Machining specifications (i.e. knurling, heat treating, broaching, etc.) ASME standard callouts for drilling, counterboring, countersinking etc. Appearance of machined features (i.e. holes, keyways, threads, spotfaces, etc.) Surface texture symbols and basic surface texture specification	
14. Screw Thread Representation	**5**
ASME standard thread notes, thread types, and related callouts	
ASME detailed, schematic, and simplified thread representation	
Thread terminology (pitch, lead, form, etc.)	
15. Springs and Fasteners	**5**
Graphic representation of springs and fasteners	
Types of threaded bolts and screws, including head and tip types	
Types of pins, keys, springs, set screws, etc.	
16. Specialized Examples – Gears, sheet metal, welding, castings, plastics, etc…	**15**
Graphic representation of various gears, with typical terms and specifications	
Graphic representation characteristic of sheet metal development prints	
Graphic representation and drafting practices for welding and welding symbols	
Graphic representation characteristics of cast or molded metal parts	
Graphic representation characteristics of molded plastic parts	
Basic electronic (PC board, schematic, etc.) drafting and graphic representation	

SAMPLE QUESTIONS FROM EACH OF THE CONTENT AREAS

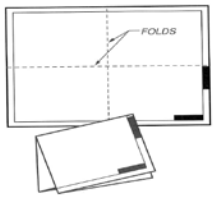
1. The governing body that sets the standards for engineering and technical drawings in the United States is:

   A. ASME
   B. SME
   C. IEEE
   D. EIA
   E. SPE

2. According to standards, how many different line thicknesses can be present in a drawing?

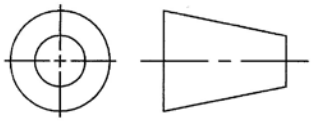
   A. One – all lines the same
   B. Two – thick and thin
   C. Three – thick, medium, and thin
   D. Four – very thick, thick, medium, and thin
   E. Five – very thick, thick, medium, thin, very thin

3. In this illustration, what size paper is being folded to 8.5" x 11"?



   A. A
   B. B
   C. C
   D. D
   E. E

4. If the graphic image shown here appears in the title block, what does it establish?



   A. Method of projection
   B. Unit of measure
   C. ASME standards are to be used
   D. Rounding mode
   E. Roundness tolerance

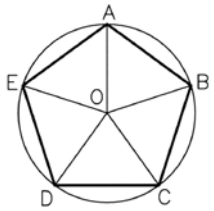
5. What measurement is indicated on this enlarged view of a machinist's scale?

   A. 3.625"
   B. 3.5"
   C. 3-21/32"
   D. 3-43/64"
   E. 3-3/4"

6. A detail drawing of a 165mm x 200mm part is being placed on A-size paper. What scale would allow the part to be drawn as large as possible?

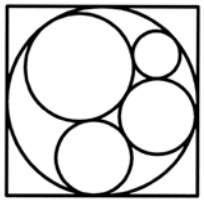
   A. 1:3
   B. 1:2
   C. 1:1
   D. 2:1
   E. 3:1

7. Examine the illustration of the inscribed pentagon below. How many degrees are in angle COE?



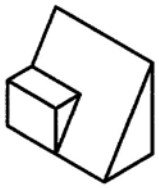
   A. 60°
   B. 72°
   C. 100°
   D. 120°
   E. 144°

8. How many points of tangency does this graphic diagram include?



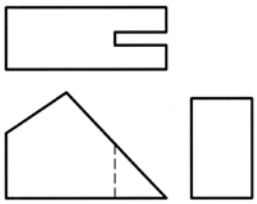
   A. 8
   B. 9
   C. 10
   D. 12
   E. 13

9. If the definition of a normal surface is one that is parallel to a principal plane of projection (frontal, horizontal, or profile), then for the object pictured, how many normal surfaces are there? (Count <u>ALL</u> surfaces)



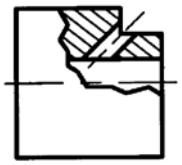
   A. 4
   B. 5
   C. 6
   D. 7
   E. 8

10. At minimum, how many visible <u>and</u> hidden line segments will it take to complete the "missing line problem" to create a correct multiview drawing?



   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

11. What type of sectional view is illustrated here?

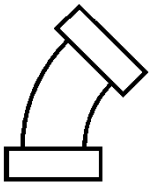


   A. Removed
   B. Half
   C. Quarter
   D. Broken-out
   E. Aligned

12. Which of the following statements about cutting plane lines is <u>FALSE</u>?

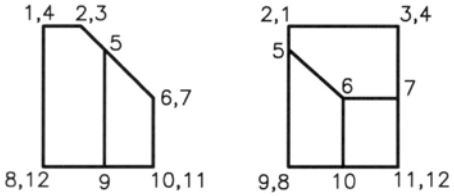
   A. ASME approves two different appearances, or dash types
   B. Can bend if necessary, such as with offset sections
   C. Are to be drawn thin, and should always be omitted if center lines coincide with them
   D. Are usually omitted for broken-out sections
   E. For a half section view, will only have an arrow on one end

13. Given this front view of a pipe elbow, what type of view would be used to show the true size and shape of the upper flange instead of a top view?



A. Perspective
B. Auxiliary
C. Isometric
D. Sectional
E. Oblique

14. An auxiliary view of the object pictured below could be projected from the front view to show the true shape and size of which surface?

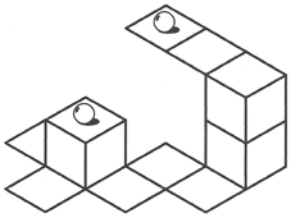


A. 1-2-3-4
B. 1-2-3-9-8
C. 2-5-6-7-3
D. 5-6-10-9
E. 6-10-11-7

15. The 3D block lettering shown here was drawn using the principles of _____ projection.

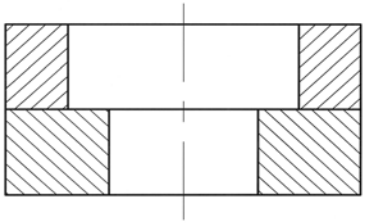
A. oblique
B. isometric
C. orthographic
D. dimetric
E. trimetric

16. In this isometric illustration of 1" square planes and 1" cubes, what is the center-to-center distance between the two marbles, each centered on a 1" square plane?



A. 1.41"
B. 2.00"
C. 2.24"
D. 2.83"
E. 3.61"

17. Based on the illustration, which of the following can be determined?

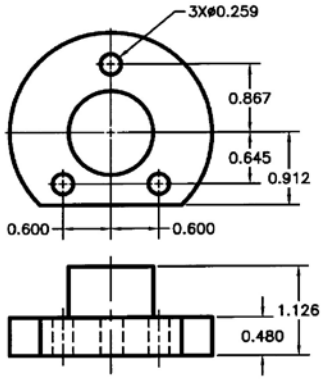


A. The hole is a counterbore
B. The part is made of brass
C. The part is cylindrical
D. The hole is a countersink
E. This is two parts in assembly

18. Which of the following terms is often applied to certain types of assembly drawings?

A. Constrained
B. Exploded
C. Parallel
D. Toleranced
E. Included

19. For this part, how many additional dimensions will be required to fully dimension it?



    A. 0
    B. 1
    C. 2
    D. 3
    E. 4

20. Which of the following statements about dimensioning is FALSE?

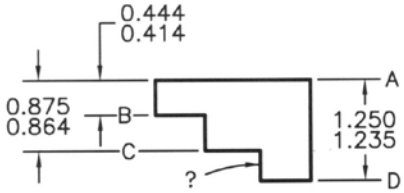
    A. Dimension lines should be spaced at least 10mm (3/8") away from the part outline
    B. Dimension figures must be oriented to read from the bottom of the drawing
    C. Where a leader is directed to an arc, its direction should be radial
    D. Dimensions should be placed outside the outline of a view if possible
    E. It is not permissible for extension lines to cross each other

21. A hole with a size dimension of .356 +.012 /-.000 mates with a shaft dimensioned .345 ±.004. What are the limits of fit for this relationship?

    A. 008"-.012"
    B. .015"-.021"
    C. .007"-.021"
    D. .007"-.027"
    E. .008"-.027"

22. As dimensioned, this part will have a vertical distance from surface C to surface D within what range of size?

    A. .375"-.386"
    B. .371"-.386"
    C. .360"-.386"
    D. .371"-.375"
    E. .360"-.375"



23. What term is defined as the theoretically perfect feature that serves as a reference for dimensions and tolerances, including geometric tolerances?

    A. Datum
    B. Feature Control Frame
    C. Tolerance
    D. Allowance
    E. Modifier

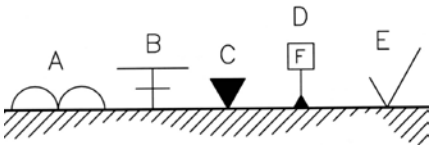
24. What respect to this feature control frame, what is the geometric control specified?

    A. Flatness
    B. Concentricity
    C. Runout

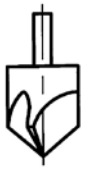
D. True Position
E. Circularity

25. According to ASME Y14.36, which of the symbols in the illustration below is the basic surface texture symbol?

A. A
B. B
C. C
D. D
E. E

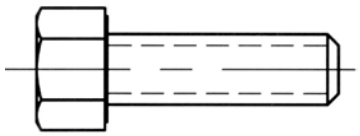


26. Which operation is performed by the machining bit illustrated here?



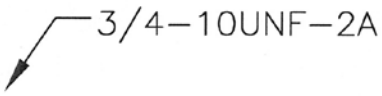
A. Spotface
B. Keyway
C. Broach
D. Countersink
E. Counterbore

27. Which method of thread representation is used in this view?



A. Detailed
B. Schematic
C. Hidden
D. Simplified
E. Phantom

28. In the thread note shown, what does the "F" stand for?



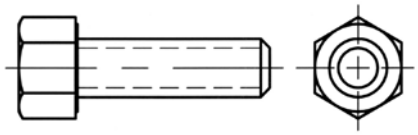
A. Fillister
B. Form
C. Fillet
D. Fastener
E. Fine

29. To which of the following do these words describe a type? SQUARE, SLOTTED, FILLISTER, HEX SOCKET?

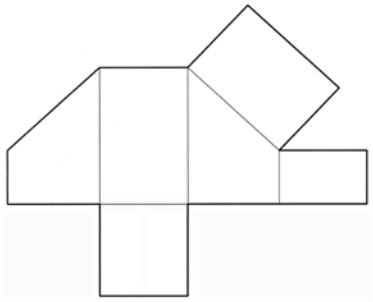
A. Knurl
B. Fastener head
C. Spring
D. Key
E. Gear

30. Which is a FALSE interpretation of this cap screw drawing?

A. The bolt is "unfinished"
B. The thread is represented in the simplified method
C. Bolt body is chamfered
D. The bolt head is a "hex head"
E. The bolt head is chamfered

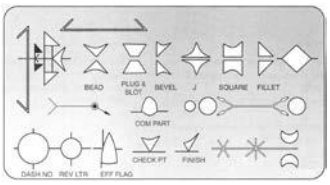


31. What term is usually applied to this foldout of a truncated prism?



A. prismation
B. development
C. auxiliary
D. displacement
E. schematic

32. In the former years of traditional drafting, this template would have been used to help the drafter add symbols to the drawing. Based on what you know about engineering graphics, which of the following areas of drafting utilized this template?



A. Welding drawings
B. Electronic circuit drawings
C. Plastic part drawings
D. Piping diagrams
E. PC board artwork

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Screw Thread Representation: ANSI Y14.6-2001. The American Society of Mechanical Engineers, 2001. ISBN 0791827445

Recommendations for taking the ATMAE CEG Exam

- Thoroughly review this study guide and review the reference textbooks.
- You do NOT have to pass each section. Only a composite passing score is required.
- Rest well the night before the exam.
- Do NOT leave any questions blank. All questions are multiple choice, so make an educated guess at questions containing content you may not be familiar with.
- Pace yourself. There are 160 questions and you have 120 minutes (2 hours) to finish.
- Don't spend too much time on one question because all questions are worth the same.
- Flag questions you are unsure of and come back to them at the end if you have time.
- Maintain a positive attitude. You can always retake the exam if you do not pass.

Answers for the Sample Questions

1. A	9. D	17. E	25. E
2. B	10. E	18. B	26. D
3. C	11. D	19. C	27. D
4. A	12. C	20. E	28. E
5. C	13. B	21. D	29. B
6. C	14. C	22. C	30. A
7. E	15. A	23. A	31. B
8. E	16. C	24. D	32. A

ATMAE CEG Examination & Certification General Information

Examination Information / Program Assessment

The ATMAE Certified in Engineering Graphics Certification Examination is currently available for use for individual certification and as a program assessment examination. The exam is designed for individuals with a background in the expression of industrial design ideas through engineering graphics, including geometric construction, orthographic views, and standardized annotations. This exam can be used for program assessment for both 2-year and 4-year programs that emphasize engineering graphics in their curriculum.

The exam is an online-only, open book, 160-question, multiple choice examination focusing on engineering graphic standards and practices, as exemplified foremost by the American Society of Mechanical Engineers (ASME) standards, under the umbrella of ANSI standards. The questions fall into 16 main content areas, as detailed beginning at page 4 of this study guide.

Group & Individual Examinations

The examination may be scheduled for a group or individually. See the Certification section of www.atmae.org for complete information about scheduling exam sessions and exam session fees -
Individuals interested in taking the exam on an individual basis should contact ATMAE to make arrangements. Individuals must pay an examination fee of $20 to sit for the exam. If the individual passes and wants to become certified, they will be responsible for submitting an application and paying the appropriate ATMAE membership fee and certification documentation fee.
Note: *If you are an individual with disabilities and need academic accommodations, please call ATMAE at (919) 635-0335 to make the necessary arrangements for you to take the test.*

Program Assessment

When used for program assessment purposes, the exam fees are typically paid by the Program or Department using the exam. Aggregate exam scores, and comparative score information, are released to the Program or Department contact after the exams have been scored and the examination fee has been paid. For more information about the ATMAE Certification Examination or to obtain scores and determine your ATMAE Membership status before applying for certification, contact ATMAE by phone at **(919) 635-0335** or by email at **admin@atmae.org**

Certification after Examination

Examinees who have passed the ATMAE Certified in Engineering Graphics Examination and who apply for ATMAE Certification will be certified by ATMAE upon receipt of their application and payment of all applicable fees. The ATMAE Office usually has confirmation of examination results within two weeks of the date of the examination. Applicants must be ATMAE members or join ATMAE in order to be certified. **You can become a ATMAE member by simply applying and paying online at www.atmae.org or by calling ATMAE at (919) 635-0335.** If applying for certification after passing the exam, you will need to pay relevant membership fees and indicate on the application form the approximate date of the exam and the location at which you took the exam so that ATMAE can verify your exam results.

Certificates

Certificates appropriate for framing are issued for one-year periods upon initial certification and upon annual renewal. In addition, individuals who passed the certification exam and stay current with all applicable membership and certification dues will be listed on the ATMAE Certification home page for recognition status by employers and colleagues.

Purpose of ATMAE Certification

The purpose of the Association of Technology, Management, and Applied Engineering (ATMAE) certification program is to provide recognition of the attainment of certain standards by professionals working in industry, business, government, and academia.

Benefits of Certification: Why get certified?

- ATMAE Certification states that you have a recognized level of expertise in a specific field, a distinction that sets you apart.
- ATMAE Certification provides external validation of your knowledge and competence among others not familiar with the profession, improving your marketability.
- ATMAE Certification shows your commitment to the profession and your own professional growth, factors that can affect career advancement.
- ATMAE Certification requires dedication to continuing education, and continued growth and development as a professional.
- ATMAE Certification may help you access travel grants for educational activities that support your organization's continuous improvement efforts and your professional development.
- ATMAE Certification is a link between you, ATMAE and others professionals, a bond of support, strength, and belonging.

Eligibility for ATMAE Professional Certification

Education: Have a technical, technology-related degree (AS, BS, MS or Doctorate) or an equivalent degree, teach or serve as an administrator in a technical or technology-related degree program, or be professionally employed in a capacity related to the discipline of manufacturing, industry, or technology. Individuals are also eligible in the last semester prior to receiving their AS or BS degree, if their impending graduation is verified on the application by their academic advisor.

ATMAE Membership: Applicants for certification must be ATMAE members (or join ATMAE at the time of application for certification).

Certified in Engineering Graphics (CEG) Certification Levels

Certified in Engineering Graphics (CEG): CEG is the initial certification status awarded to eligible applicants. Members may stay at this level indefinitely as long as they pay their membership and certification dues annually. Upon completion of the initial three-year CEG certification and acquisition of 30 Professional Development Units (PDUs), a certified member can elect to become a Certified Senior Technical Professional.

Certified Senior in Engineering Graphics (CSEG): CSEG is awarded to eligible applicants with three years of post- graduate professional experience who have completed 30 PDUs of continuing education activity in the three years prior to their application. CSEG certification is renewable every three years and requires 30 PDUs of continuing education activity within the prior 3-year CSEG period.

Documentation for CSEG at Application

Appropriate documentation of professional experience and PDUs must be included on the application for certification. ATMAE reserves the right to verify degree status, professional experience, and PDUs.

Certification Program Fees

Each ATMAE member receiving certification will be required to pay the following fees:

Certified in Engineering Graphics (CEG)
$25 - Examination Fee (unless paid by institution)
$50 - Application Fee (paid once at initial application) or $25 application fee for students
$35 - Annual Renewal Fee (paid at end of first year and each year thereafter) or $25 annual fee for Students

Certified Senior in Engineering Graphics (CSEG)
$25 - Examination Fee (unless paid by institution)
$50 - Application Fee (paid once at initial application) or $25 application fee for students
$35 - Annual Renewal Fee (paid at end of first year and each year thereafter) or $25 annual fee for Students

The annual renewal fee will be paid at the same time as the ATMAE membership fee. ATMAE members applying for initial CEG or CSEG certification will receive credit for a portion of their existing dues and the ATMAE office will prorate their existing dues to establish a new membership renewal date coincident with the certification renewal date. ATMAE Membership and Certification are billed simultaneously and both the membership fee and the certification renewal fee must be paid annually to maintain a valid ATMAE Certification.

Certification status must be continuous throughout the certification period. Failure of individuals to pay the annual ATMAE membership fee and/or the annual certification fee within 60 days of the date due will result in suspension of certification. Upon payment of all fees that are owed, the certification will be reinstated as long as the certified member is in compliance with all other relevant policies. As certification status must be continuous, ATMAE reserves the right to treat a request for reinstatement of a certification as a new application. This is most common when a certification has been lapsed for three years or more and database and hard copy records of the certification are no longer available; in such cases, ATMAE may require the holder of the lapsed certificate to provide documentary evidence of their prior ATMAE Certification.

*prices subject to change.