



GACA[®] Exam Content Overview 3/1/20

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Introduction

The Green Advantage Certified Associate® (GACA®) Exam has 60 items (questions, problems, or exercises). These are drawn from material presented in the GACA Study Guide. The Study Guide is approved by the GA International Green Builder Certification Board. The outline of the Study Guide below gives readers a more detailed idea of the topics that make up the GACA Exam. The GACA Study Guide is provided to those who register to take the GACA Exam.

A. CONTENT FEATURES

The Study Guide is organized and written to enhance the knowledge, skills, and abilities of commercial and residential construction field personnel. The information it contains is:

- Applicable across building trades
- Compatible with multiple green building rating systems, standards, and codes
- Evidence-based and rigorously sourced
- Results-oriented, promoting achievement of:
 - ✓ Environmental goals.
 - ✓ Health, safety and productivity goals.
 - ✓ Successful delivery of green buildings and accompanying infrastructure technologies, methods, and best practices.
 - ✓ Enhanced quality of the production, installation, and operation of construction-related products.
 - ✓ Disaster resistance/resilience.
 - ✓ Building security and blast resistance.
 - ✓ Problem-spotting in the field.
 - ✓ Insurance and financial claim reductions.
 - ✓ Cost containment goals and reduced callbacks.
 - ✓ Reduction of building operational and maintenance costs.
 - ✓ Enhanced work communication, coordination, collaboration, and efficiency within and among trades.

B. CONTENT ORGANIZATION

Green building is a holistic approach to construction. Hence, descriptions of the field often run into problems common to web-like, holistic systems - namely, the idea that *everything relates to everything*. Efforts to carve up the field into categories can yield great overlap and duplication. To address this, Green Advantage has broadly organized the Study Guide relative to the widely accepted thematic categories that appear in the following:

- ASHRAE 189.1. (American Society of Heating, Refrigerating, and Air Conditioning Engineers)
- Green Globes® Rating System, Green Building Initiative.
- "High Performance Buildings Database," U.S. Department of Energy.
- International Green Construction Code (IgCC), International Code Council.
- LEED® Green Building Rating Systems, U.S. Green Building Council.
- National Green Building Standard®, International Code Council/National Association of Home Builders.

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The resulting broad topics are: Sites, Water, Energy, Materials, and Indoor Environmental Quality. Assigning content to categories is a difficult task. We do not assume that there is one way to outline green building. We assigned content to minimize duplication and cross-referencing. We also sought to make material easy for exam candidates to access.

In order to make the Study Guide more approachable for exam candidates, it is divided into two large parts. Part A describes environmental and human health problems related to conventional building approaches. This part summarizes the compelling case for green building, including the perspectives of planetary and human health. These are two of the three dimensions of the “Triple Bottom Line” of Sustainability. The triple bottom line includes Environmental, Social/Human Health, and Economic considerations. **Part A offers valuable information to the GACA Exam Candidate, but this material is NOT INCLUDED in the GACA Exam.**

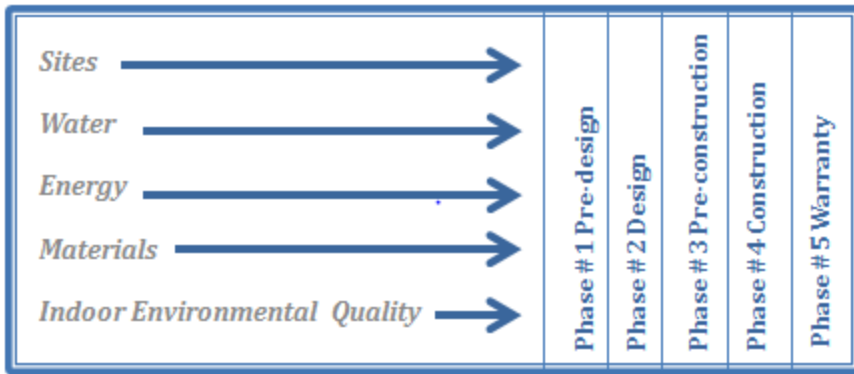
Part B of the Study Guide presents green building approaches. **Part B provides the basis for the GACA Exam.** Part B is divided into topic areas. Topics include Sites, Water, Energy, Materials, and Indoor Environmental Quality. Each of these topic areas, in turn, is divided into subsections as follows:

- 1) ***Definitions, Measurements & Standards*** presents common green building vocabulary and significant measurements and standards. These apply to information presented in the category. For example, “graywater” is a defined term in the Water section. “Gallons per minute” is a measurement that is presented in the Water section. Many terms are also defined within the text, and not listed separately in the Definitions section.
- 2) ***Green Building Approaches & Best Practices with Associated Construction Phasing*** presents information about green alternatives. These serve to counter conventional approaches. The general format lists features and types of specific green building approaches and their advantages. Green approaches generally apply to residential and commercial buildings.

GA believes that superior green buildings result from robust cross-disciplinary approaches. Thus, the Study Guide features “best practices.” Best practices demonstrate how and when to apply green building approaches. They provide examples and underline the importance of content previously presented in green building approaches. Best practices should be known and understood by all building personnel involved in a green construction project. Best practices include a list of construction phases (#1-#5 below) in which these practices can be enacted. There are over 200 best practices listed in the GACA Study Guide. These best practices are applicable to construction trade personnel.

Construction phases are applied across the five major topics as represented in the diagram below. While the major topics reflect how designers “think,” construction phasing reflects how contractors approach their work over the course of a project.

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In addition to the five major topics that deal with construction deliverables, GA has created: *Green Building Context* and *Green Building Process*. *Green Building Context* focuses on the broad Financial Rationale for green building. This is the third dimension of a Triple Bottom Line approach. It answers the question, “why Green Building?” from the basic perspective of dollars and cents.

Green Building Process focuses on the operations of construction activity. *Green Building Process* also presents construction phasing information. This section conveys information that has emerged from years of green building experience. Green construction projects do not always fulfill their promise. And in fact, they can represent special risks to construction companies and construction workers. Knowing this, companies and workers can take proper precautions to protect themselves.

C. CONTENT RENEWAL

GA plans to update this document triennially. It will do this with the expert assistance of the GA International Green Builder Certification Board, trainers who use the document to devise training materials, and individuals who use it to prepare for a GA Certification Exam®. All comments are welcome.

D. SAMPLE EXAM ITEMS

GACA EXAM ITEMS COME FROM PART B OF THE STUDY GUIDE. Sample items can help candidates understand the typical difficulty of items on the exam. Answers are located in the Answer Key below.

- 1) Which is a true statement about the finances of green building?
 - A. Capital costs are much less than conventional building
 - B. Operating costs are reduced compared to conventional building
 - C. Occupant productivity is similar to levels in conventional building
 - D. Rental value and resale value are about the same as in conventional building
- 2) In most states, green building codes are:
 - A. increasing building energy performance requirements
 - B. not adopted
 - C. not addressing building energy performance requirements
 - D. reducing building energy performance requirements
- 3) Smart Growth suggests that development should occur:
 - A. on Greenfields
 - B. in wooded areas

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- C. near wetlands
 - D. on Brownfields
- 4) Which material absorbs the least heat?
- A. White concrete
 - B. Gray concrete
 - C. Dark brown concrete
 - D. Black asphalt
- 5) Fill in the blanks: Clear the site of _____ plants. Mechanically remove _____ plants when clearing site. Avoid spreading the seeds of _____ plants during removal process.
- A. native
 - B. non-native
 - C. invasive
 - D. drought-tolerant
- 6) Purple pipe water:
- A. is sewage that should be properly treated
 - B. is reclaimed water to use for landscape irrigation
 - C. is potable water that is safe for drinking
 - D. contains mostly blackwater and some graywater
- 7) A solar thermal energy system:
- A. heats water from sunlight to provide hot water in a building
 - B. is also called a photovoltaic system
 - C. produces about the same amount of heat on cloudy and sunny days
 - D. produces about the same amount of heat during the day at night
- 8) Building energy performance can be improved by:
- A. Creating small holes in the building envelope so the building can “breathe”
 - B. Durably sealing the building envelope to prevent air infiltration
 - C. Making extra openings between conditioned and unconditioned space
 - D. Performing one blower door test immediately prior to occupancy
- 9) Which type of appliance is more energy efficient?
- A. Side by side refrigerator and freezer instead of refrigerator on top and freezer on bottom
 - B. Top loading washer instead of front loading washer
 - C. Front loading washer instead of top loading washer
 - D. Water cooler instead of drinking fountain
- 10) The amount of energy used to produce and install a material on a project is called?
- A. Transmission energy
 - B. Embodied energy
 - C. Source energy
 - D. Site Energy
- 11) Incorporate pozzolans, such as _____, into all concrete.
- A. Urbanite

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- B. Fiberglass
- C. Flyash
- D. Gypsum

12) Best Practice: *Foam cutting is not recommended for optimal insulation performance. Eliminate the need to cut channels through the foam. This can be done by installing conduit prior to the pour.* What material used for construction of the walls of a building envelope is being referenced?

- A. Adobe
- B. Compressed earth block
- C. Earth sheltering/earth berming
- D. Insulated concrete form

13) Moisture and mold resistant flooring should be installed in moisture-prone areas. These are particularly important to use in basements or ground floors that are flood-prone. Identify an example of this flooring:

- A. Bamboo
- B. Recycled oak fence post
- C. Recycled wood parquet
- D. Stained concrete

14) What type of insulation fills cavities most completely?

- A. Rigid
- B. Wet spray
- C. Batt
- D. Loose fill

15) It is important that electrical boxes are airtight. What is the correct way to make sure this happens?

- A. Seal the leaks that exist around the holes in the back of the box where the cable enters
- B. Fill electrical boxes full of spray foam
- C. Make sure electrical boxes are flush with the mount and properly leveled
- D. Avoid locating breaker boxes in occupant use areas

16) Which statement is true about Low-VOC and zero-VOC water-based paints and finishes?

- A. They are not durable or cost-effective
- B. They are widely available
- C. They are difficult to find
- D. They have a strong odor and are slow to dry

17) You are installing drywall. You notice that wet spray insulation has dried and settled in a wall cavity leaving a 6" gap. What best practice should you use?

- A. Notify your supervisor when s/he arrives at the end of the day
- B. Find some batt insulation and fill the gap with it
- C. Continue working because it is a minor problem
- D. Get the immediate attention of the onsite supervisor

18) Your subcontractor team is considering what type of recycling program to set up. What is the safest best practice?

- A. Contract with a recycling company to collect comingled recycled materials
- B. Segregate waste in dumpsters and make sure one of your team corrects improper segregation daily
- C. Segregate waste in dumpsters and make sure one of your team corrects improper segregation weekly

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- D. Segregate waste in dumpsters and make sure two of your team members correct improper segregation daily
- 19) What should be done to protect stored onsite absorptive materials from moisture damage? Material examples include insulation, carpeting, ceiling tile, and gypsum wallboard.
- A. Remove protective packaging from all materials upon arrival to enable proper ventilation
 - B. Keep protective packaging on materials until installation
 - C. Avoid grouping materials in a staging or storage area; establish separate areas for each material onsite
 - D. Avoid “just in time” deliveries in order to prevent damage to materials arriving during rain events
- 20) Select the best practice regarding vehicle idling:
- A. Limit idling to 15 minutes per vehicle
 - B. Allow idling for diesel fuel vehicles only
 - C. Permit idling at entrances to the building only
 - D. Eliminate vehicle idling onsite

Answer Key: 1-B; 2-A; 3-D; 4-A; 5-C; 6-B; 7-A; 8-B; 9-C; 10-B; 11-C; 12-D; 13-D; 14-B; 15-A; 16-B; 17-D; 18-A; 19-B; 20-D

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PART B. GREEN BUILDING APPROACHES

(EXAM ITEMS ARE DRAWN FROM THIS SECTION, NOT PART A)

I. GREEN BUILDING CONTEXT – constitutes approximately 6% of GACA Exam Items

- A. Definitions, measurements, & standards
- B. Green building financial rationale
 - 1. Building capital cost
 - 2. Building operating cost
 - 3. Building value
 - 4. Green building codes, standards, and rating systems

II. SITES – constitutes approximately 10% of GACA Exam Items

- A. Site selection
 - 1. Definitions, measurements, & standards
 - 2. Green building approaches & best practices with associated construction phasing
 - a. Smart Growth
 - 1. Features of Smart Growth
 - 2. Advantages of Smart Growth

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- b. Brownfield development
 - 1. Features of brownfield development
 - 2. Advantages of brownfield development

B. Site development

- 1. Definitions, measurements, & standards
- 2. Green building approaches & best practices with associated construction phasing
 - a. Ecological landscaping
 - 1. Site features that reduce heat island effect and support beneficial microclimates surrounding a building
 - 2. Building exterior features that reduce heat island effect
 - 3. Features of an ecologically sustainable vegetative landscape
 - 4. Advantages of an ecologically sustainable vegetative landscape
 - b. Stormwater as a long-term resource
 - 1. Overall features of environmentally friendly stormwater management
 - 2. Types and features of long-term, environmentally friendly stormwater management
 - 3. Advantages of conserving water onsite
 - c. Dark sky
 - 1. Features of environmentally friendly exterior lighting
 - 2. Advantages of environmentally friendly exterior lighting

III. **WATER – constitutes approximately 5% of GACA Exam Items**

A. Water conservation

- 1. Definitions, measurements, & standards
- 2. Green building approaches & best practices with associated construction phasing
 - a. Matching sources with uses
 - 1. Features of matching sources with uses
 - 2. Advantages of matching water sources with uses
 - b. Using municipal reclaimed water
 - 1. Features of municipal reclaimed water (purple pipe water)
 - 2. Advantages of using municipal reclaimed water

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- c. Rainwater harvesting
 - 1. Overall features of rainwater harvesting (rainwater catchment)
 - 2. Specific features of a functional catchment system
 - 3. Advantages of rainwater harvesting
- d. Low water use devices & waterless technologies
 - 1. Features of low water use devices
 - 2. Types of low water use appliances
 - 3. Types and features of waterless technologies
 - 4. Advantages of waterless technologies

B. Ecological water discharge

- 1. Definitions, measurements, & standards
- 2. Green building approaches & best practices with associated construction phasing
 - a. Ecological water treatment
 - 1. Features of ecological water treatment
 - 2. Types of ecological water treatment systems
 - 3. Advantages of ecological water treatment systems
 - b. Onsite advanced “wastewater” treatment systems
 - 1. Features of onsite advanced water treatment systems
 - 2. Advantages of onsite advanced water treatment systems

IV. ENERGY – constitutes approximately 19% of GACA Exam Items

A. Energy sources and impacts of source selections

- 1. Definitions, measurements, & standards
- 2. Green building approaches & best practices with associated construction phasing
 - a. Energy sourcing
 - 1. Possibilities
 - 2. Widely used strategies for energy sourcing
 - 3. Overall advantages of onsite renewable energy production
 - 4. Options for onsite renewable energy

B. Limiting energy demand through building envelope design & construction

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1. Definitions, measurements, & standards
2. Green building approaches & best practices with associated construction phasing
 - a. Bioclimatic Design (Climate-Responsive Design; Passive Solar Design)
 1. Overall features of Bioclimatic Design
 2. Advantages of Bioclimatic Design
 - b. Preservation of solar access
 1. Features of solar access preservation
 2. Advantages of solar access preservation
 - c. High quality construction and energy performance testing
 1. Features of high quality air sealing of the building envelope
 2. Features of high quality building envelope insulation
 3. Types and features of energy performance tests (used during and after construction to ensure energy performance requirements are met)
 4. Advantages of high quality construction and energy performance testing
- C. Meeting residual energy demand for building conditioning with HVAC
 1. Definitions, measurements, & standards
 2. Green building approaches & best practices with associated construction phasing
 - a. Environmentally friendly HVAC systems (overview)
 1. Overall features of an environmentally friendly HVAC system
 2. Overall advantages of an environmentally friendly HVAC system
 - b. HVAC equipment testing
 1. Features of HVAC equipment testing
 2. Types of HVAC equipment tests:
 3. Advantages of HVAC equipment testing
- D. Meeting user needs through building equipment
 1. Definitions, measurements, & standards
 2. Green building approaches & best practices with associated construction phasing
 - a. Water heating & hot water distribution systems
 1. Types and features of environmentally friendly water heating

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2. Types of environmentally friendly hot water distribution systems
 3. Advantages of environmentally friendly water heating and hot water distribution systems
- b. Artificial lighting
1. Features of environmentally friendly artificial lighting
 2. Features and advantages of environmentally friendly artificial lighting controls
- c. Appliances
1. Types and features of environmentally friendly appliances

V. **MATERIALS – constitutes approximately 29% of GACA Exam Items**

A. Environmentally friendly materials selection criteria

1. Definitions, measurements, & standards
2. Green building approaches & best practices with associated construction phasing
 - a. Life Cycle Assessment (LCA)
 1. Features of an LCA
 2. Balancing selection criteria
 - b. Green building product rating
 1. Overall features of green building product rating systems
 2. Types and features of prominent green building product rating systems

B. Commonly used building materials

1. Definitions, measurements, & standards
2. Green building approaches & best practices with associated construction phasing
 - a. Concrete
 - b. Masonry
 - c. Metals
 - d. Wood, plastics, and composites
 - e. Thermal & moisture protection
 - f. Openings
 - g. Finishes
 - h. Cabinets, casework, and countertops

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- i. Paints and stains
- j. Adhesives and sealants
- k. Fire suppression
- l. Plumbing
- m. Electrical

VI. INDOOR ENVIRONMENTAL QUALITY (IEQ) – constitutes approximately 5% of GACA Exam Items

- 1. Definitions, measurements, & standards
- 2. Green building approaches & best practices with associated construction phasing
 - a. Indoor air quality
 - 1. Strategies to avoid introduction of outdoor toxins
 - 2. Strategies to avoid generation of indoor toxins
 - 3. Types and features of environmentally friendly air purification strategies and devices
 - 4. Types and features of air quality monitoring approaches
 - b. Indoor visual quality
 - 1. Overall features and advantages of daylighting
 - 2. Features of an environmentally friendly approach to color
 - c. Indoor water quality
 - 1. Overall strategies for environmentally friendly water testing and filtering
 - d. Indoor acoustical quality
 - 1. Types and features of an environmentally friendly approach to acoustics
 - e. Indoor navigation
 - 1. Types, features, and advantages of environmentally friendly indoor navigation strategies

VII. GREEN BUILDING PROCESS – constitutes approximately 16% of GACA Exam Items

- A. Reducing the business risks of green building
 - 1. Definitions, measurements, & standards
 - 2. Green building approaches & best practices with associated construction phasing
 - a. Reducing business risks of green building through preparation of personnel
 - b. Reducing business risks of green building through collaboration across trades
- B. Protecting the health & safety of green builders

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1. Green building approaches & best practices with associated construction phasing
 - a. Types of green builder hazards and related risk reduction approaches
- C. Lightening the environmental impacts of the construction process
 1. Definitions, measurements, & standards
 2. Green building approaches & best practices with associated construction phasing
 - a. Lightening environmental impacts of the construction process through managing staging & storage
 - b. Lightening environmental impacts of the construction process through managing waste
 - c. Lightening environmental impacts of the construction process through site preparation, excavation, & grading
 - d. Lightening environmental impacts of the construction process through managing transportation during construction
 - e. Lightening environmental impacts of the construction process through environmentally friendly site lighting during construction
 - f. Lightening environmental impacts of the construction process through managing stormwater during construction
 - g. Lightening environmental impacts of the construction process through green cleaning during construction
- D. Reducing the risks of infection and other risks in health care facilities
- E. Reducing the risks related to building security and blasts