
Passwell

TEST PREP

NATIONWIDE

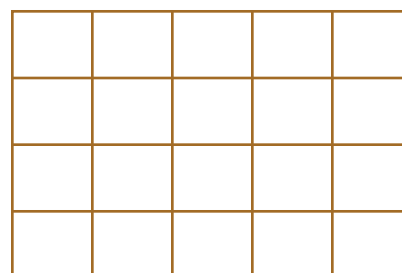
PV ASSOCIATE

NABCEP PV Associate

STUDY GUIDE

A clear rule. A worked example. A reason behind every answer.

PVA



OCTOBER 2026 / FIRST EDITION

Independent study material. Editorial review edition.

Build understanding before speed

Independent original launch candidate. Subject-matter accuracy approval remains pending; no exam-owner affiliation or endorsement is claimed.

Covers all six current PVA domains: Safety, Core Knowledge, Economics, Design, Installation, and Operations and Maintenance. The April 2026 JTA supersedes the older five-domain summary still present in the linked handbook.

This book does not grant registered-provider course completion, qualifying experience, work authorization or a guaranteed examination result. It teaches conceptual selection and interpretation; actual electrical and construction work requires the relevant qualified personnel and procedures.

Codes, utility rules, product instructions and incentive eligibility vary. Fictional arithmetic uses stated assumptions and does not approve a real installation or recommend a particular investment.

The exam at a glance

Current content outline. NABCEP PVA JTA v.2026.2, effective April 7, 2026: six domains.

Official format. 70 four-option multiple-choice questions: 60 scored and 10 unidentified unscored pilot items.

Official time. Up to 2 hours, according to the currently linked Associate Candidate Handbook.

Passing standard. Scaled score 65. This is not a raw 65% correct requirement.

Eligibility. Qualifying education through a NABCEP registered provider, or the applicable experience pathway requiring at least six months equivalent direct relevant experience; verify documentation with NABCEP.

Credential scope. Associate-level knowledge credential; not PV Installation Professional certification, an electrical license or authorization for unqualified field work.

Use all three kinds of practice

Start with the lessons and chapter checks. Use the flashcards to retrieve rules after a delay, and use the one-sheets to untangle similar ideas. Take each practice exam once under the stated conditions before reading its explanations. Repeatedly memorizing the same answers is not evidence that a new question is mastered.

Keep an error log

For every missed or guessed answer, record the topic, the decisive fact you missed, the rule in your own words, and a new example. Revisit the lesson, then answer the question aloud after at least one day. A practice score is a study signal, not a validated prediction or guarantee of passing.

Your study route

Week 1 / Electrical and system fundamentals

- Study chapters 1-6 and write the energy path for direct-coupled, stand-alone, grid-connected and multimode systems.
- Solve each worked calculation without looking at the result; keep units on every line.
- Review the first 18 cards and explain each missed chapter check in your own words.

Week 2 / Safety, customer needs and resource

- Study chapters 7-13; draw a source and exposure map for a fictional roof-plus-storage site.
- Compare financing structures and build a simple load schedule.
- Practice the power/energy and safety one-sheets, then revisit weak chapter checks.

Week 3 / Design and installation

- Study chapters 14-20; perform cold-voltage, loss and autonomy examples.
- Trace a one-line diagram conceptually and list separate permit, interconnection and commissioning milestones.
- Complete Form A in 120 minutes; record core and supplemental results separately and diagnose every error.

Week 4 / Operations and final review

- Study chapters 21-24 and distinguish monitoring faults, clipping, curtailment and protective trips.
- Review all 72 cards in mixed order and rehearse the four one-sheets.
- Complete fresh Form B in 120 minutes; revisit missed domains and verify current sponsor eligibility and appointment instructions.

Contents

Build understanding before speed	2
Your study route	3
Exam coverage map	6
01 / The associate role and the four system families	7
02 / Voltage, current, resistance, power and energy	10
03 / Series, parallel and circuit configuration	13
04 / Modules, irradiance, temperature and the I-V curve	16
05 / Inverters, trackers and balance-of-system functions	19
06 / Storage, usable capacity and supported loads	22
07 / Hazard identification and the hierarchy of controls	26
08 / Electrical sources, isolation and safe boundaries	29
09 / Working at height, access and material handling	32
10 / Environmental hazards, PPE and the site safety plan	35
11 / Customer goals, bills and load profiles	38
12 / Project economics, financing and maintenance costs	42
13 / Solar resource, orientation and shade	45
14 / Datasheets, string voltage and equipment compatibility	48
15 / Energy estimates, system sizing and loss accounting	52
16 / Plans, codes, structural review and interconnection	56

17 / Mounting systems, attachments and installation sequence	59
18 / Conductors, connectors, grounding and labels	62
19 / Storage installation and operating boundaries	65
20 / Commissioning, documentation and owner handover	68
21 / Test instruments and meaningful measurements	71
22 / Monitoring, metering and performance metrics	74
23 / Performance deviations, protective trips and troubleshooting	78
24 / Maintenance planning, work orders and service records	82
Quick-reference definitions	86
Sources & edition record	91

Exam coverage map

Match the public exam topics to the chapters below. Official weights are identified where published. Publisher-selected practice allocations are labeled in the rows or practice instructions; they are not official exam weights. Topic rows without separate weights remain part of their parent domain. This map describes coverage, not official endorsement.

SAFE / Safety (JTA 1): hazard hierarchy, environmental and chemical hazards, ergonomics and tools, site plans and emergency access, electrical sources and energy control, arc/shock hazards, PPE, heights, ladders and rigging.

Weight: 20%; 12 of the 60 core practice items. | Chapters: 07, 08, 09, 10, 19, 21 | Source 1

CORE / Core Knowledge (JTA 2): system families, uses and benefits, modules and BOS, inverters and module electronics, storage and controls, PV effect, Ohm's law, power/energy, AC/DC, series/parallel, grounding and bonding.

Weight: 20%; 12 core items. | Chapters: 01, 02, 03, 04, 05, 06, 18 | Source 1

ECON / Economics (JTA 3): customer goals and property, load and tariff assessment, resilience and autonomy, market and lifecycle costs, incentives, cash/loan/lease/PPA/PACE structures, production and degradation, warranties, maintenance and roof replacement.

Weight: 10%; 6 core items. | Chapters: 11, 12, 24 | Source 1

DES / Design (JTA 4): datasheets and STC, Voc/Isc and temperature, inverter/service/storage compatibility, listings and standards, AHJ/codes/permits/utility, resource and shading, sizing and losses, DC/AC ratios, drawings, conductor/protection considerations, structural loads and roof/rack design.

Weight: 18.3%; rounded to 11 core items. | Chapters: 04, 13, 14, 15, 16, 18 | Source 1

INST / Installation (JTA 5): structural attachments and mounting, manufacturer requirements and torque, bonding, equipment placement, wiring/connectors/terminations, storage chemistry and clearances, visual and electrical commissioning, settings, records, permission to operate and owner handover.

Weight: 18.3%; rounded to 11 core items. | Chapters: 17, 18, 19, 20 | Source 1

OM / Operations and Maintenance (JTA 6): meters, insulation resistance/I-V/thermal instruments, battery tools, weather/temperature/I-V/MPPT effects, DAS/SCADA/CT/PT and energy metering, SOC, expected performance, shading/soiling/curtailment/clipping, faults, inspection, replacement, cleaning and service records.

Weight: 13.3%; rounded to 8 core items. | Chapters: 04, 19, 21, 22, 23, 24 | Source 1

LESSON 01

01 / The associate role and the four system families

- Trace generation, conversion, protection and load before evaluating a system.
- Match architecture to the required service, especially outage operation.
- Keep exam preparation separate from eligibility and authority to perform electrical work.

Begin with the energy path

A photovoltaic system converts solar radiation into electrical energy. The useful mental model is a chain: sunlight reaches a module; interconnected cells produce direct current; conductors and protective equipment carry that energy; power electronics control or convert it; and a load, battery or utility receives it. A module is only one part of this chain. A perfectly functioning module cannot overcome an open connection, an incompatible inverter or a missing permission to operate. Trace the whole path before judging a system from one component.

A cell is a small semiconductor device. Cells are assembled into a module, modules may be connected into a string, and multiple modules or strings form an array. The term panel is commonly used for a module but can be ambiguous in technical drawings. Read the equipment schedule and symbols rather than assuming every rectangle represents the same thing. Balance of system means the supporting electrical and mechanical equipment beyond the modules, including wiring, racking, disconnects and associated controls.

Choose the architecture from the required service

A PV-direct system powers a suitable load when adequate sunlight is available, without necessarily using a battery or utility. A remote water pump may be designed to pump more water in strong sunlight and store water instead of electricity. This is different from a stand-alone electrical system that must supply loads when sunlight is unavailable. Stand-alone systems commonly use batteries and may include another source, such as a generator. Their design must account for both energy over time and the power demanded at any instant.

A conventional grid-tied system operates in coordination with the utility. Its inverter normally stops energizing the utility connection when required grid conditions disappear. Therefore, having modules on a roof does not by itself provide backup during a power outage. A multimode system is designed for more than one operating mode, often including grid-connected operation and an intentionally isolated backup mode. It needs compatible controls, switching, storage or other sources, and a defined supported-load arrangement. Do not infer those features solely from the presence of a battery.

The architecture also changes the ownership conversation. A person who wants lower annual electricity cost may need a different system from a person who must keep a critical pump running through an outage. Distributed generation places generation near loads; utility-scale generation generally supplies a broader network. Residential, commercial and utility-scale describe context and scale, not a guarantee of any specific topology.

Separate a knowledge credential from work authority

The NABCEP Photovoltaic Associate credential recognizes foundational knowledge and is distinct from the more advanced PV Installation Professional certification. It does not replace an electrical license, an employer's qualification process, supervised training or the local authority's requirements. Education-path eligibility normally requires completing a course with a registered provider; the experience pathway requires documented relevant experience. An independent study companion does not supply either requirement.

The current examination follows six domains introduced in the 2026 JTA. The linked handbook describes 70 four-option questions, with 60 scored and 10 unidentified pilot items, and a two-hour limit. A passing scaled score of 65 is not the same as answering 65 percent correctly on a practice set. Scaling relates performance to the examination standard. Use practice results to identify weak reasoning, while checking current eligibility and scheduling instructions directly before applying.

Work it through / Apply the idea

A homeowner has a grid-tied array and asks whether it will power the refrigerator during a utility outage.

1. Identify whether the inverter and switching support an intentional isolated mode.
2. Check storage, supported loads and manufacturer documentation rather than relying on the array rating.
3. Separate the presence of generation from the ability to operate independently.

Result. Ordinary grid-tied PV alone does not establish backup capability.

Grid-tied / Multimode

Grid-tied operation follows the utility connection; a properly designed multimode system can support specified additional modes, including isolated backup.

Keep these ideas

- Trace generation, conversion, protection and load before evaluating a system.
- Match architecture to the required service, especially outage operation.
- Keep exam preparation separate from eligibility and authority to perform electrical work.

Source references: 1, 2, 4, 7

Check your understanding

1. A remote pump runs only when sunlight is sufficient and fills an elevated tank. No electrical storage or utility connection is present. Which architecture fits?
 - A. PV-direct
 - B. Battery stand-alone
 - C. Grid-tied
 - D. Multimode backup

2. A buyer requests backup but the proposal lists only a conventional grid-following inverter. Which question resolves the mismatch?

- A. Is the inverter's grid-connected AC rating larger than the refrigerator load?
- B. Can the existing revenue meter record energy in both directions?
- C. Does the annual PV energy exceed the annual household consumption?
- D. Does the design include an approved isolated operating mode and supported-load controls?

3. A learner completes this independent book and wants to use it as registered-provider course completion. What is the correct distinction?

- A. Any book replaces the registered course.
- B. Study preparation does not establish the education-path requirement.
- C. A practice score grants the credential.
- D. The associate credential is an electrical license.

Check the reasoning

1. Answer A / CORE

The load uses available PV output directly; water storage does not make it a battery-based electrical system.

- B. The scenario specifically has no electrical storage.
- C. No utility connection is described.
- D. No alternate operating mode or isolation controls are stated.

Source references: 1, 2, 4, 7

2. Answer D / CORE

Backup requires a complete compatible architecture, not simply installed modules.

- A. A sufficient grid-connected rating does not establish outage operation.
- B. Metering exports is different from forming an isolated backup system.
- C. Annual energy balance does not establish an isolated operating mode or instantaneous power capability.

Source references: 1, 2, 4, 7

3. Answer B / CORE

Eligibility is a separate sponsor process requiring qualifying education or experience.

- A. Independent reading is not registered-provider completion.
- C. The sponsor's examination and eligibility requirements remain.
- D. Credential knowledge and legal work authority are distinct.

Source references: 1, 2, 4, 7

LESSON 02

02 / Voltage, current, resistance, power and energy

- Keep power and energy units distinct throughout a calculation.
- Use voltage and current from the same operating condition.
- State efficiency, power factor and operating assumptions before applying a formula.

Give each quantity a job

Voltage is electrical potential difference, measured in volts. Current is the rate of charge flow, measured in amperes. Resistance describes opposition to current under the stated conditions and is measured in ohms. For a simple resistive circuit, Ohm's law connects them: $V = I \times R$. A voltage value alone does not tell you the current because the circuit and load matter. Likewise, a conductor's apparent physical size is not a measurement of the current flowing through it.

Power is the rate of energy transfer. In a DC calculation, $P = V \times I$ when the values describe the same operating point. A 40-volt module delivering 10 amperes is producing 400 watts at that point. Multiplying its open-circuit voltage by its short-circuit current does not give operating power, because those values occur at different points on its characteristic curve. The distinction prevents an attractive but physically inconsistent calculation.

Keep rates separate from accumulated energy

Energy accumulates over time. A steady 500-watt load operating for four hours uses 2,000 watt-hours, or 2 kilowatt-hours. A kilowatt is 1,000 watts; a kilowatt-hour is energy, not a power rating. A battery may have a 10-kWh energy capacity and a 5-kW continuous power limit. The first quantity relates to how long it can supply energy under stated assumptions; the second limits the rate of delivery. A load requiring 7 kW can exceed that power limit even when the battery is fully charged.

Variable output requires adding energy across intervals. If an inverter averages 2 kW for one hour and 4 kW for the next two hours, the total is $2 \times 1 + 4 \times 2 = 10$ kWh. Taking the highest reading and multiplying it by the whole period would overstate production. A meter reading of cumulative kWh should be compared with another cumulative reading to find interval energy; a momentary kW display is not interchangeable with that total.

Efficiency compares useful output with input on a consistent basis. If a device receives 1,000 watts and supplies 950 watts, its efficiency at that condition is 95 percent. The missing 50 watts is associated with losses, commonly including heat. Efficiency varies with equipment, temperature and operating point. Do not treat a published peak value as a promise for every hour of operation.

Use a dimensional calculation routine

Write the requested quantity first, convert prefixes, substitute values and retain units through each step. If a question asks for amperes from 1.2 kW at 120 V in an ideal stated case, convert 1.2 kW to 1,200 W before dividing. The result is 10 A. A result of 0.01 A reveals that the kilo prefix was ignored. Estimation provides a second check: one thousand watts at roughly one hundred volts should require roughly ten amperes.

AC systems add concepts such as frequency, phase and power factor. U.S. utility frequency is ordinarily 60 hertz, meaning 60 cycles per second. In a simple AC real-power problem, the question must specify the assumptions needed; $V \times I$ is apparent power when using appropriate RMS values, while real power can also depend on power factor and phase configuration. Do not apply a single-phase expression blindly to a three-phase system. At associate level, recognize the distinction, identify whether a problem supplies power factor, and avoid inventing missing conditions.

Work it through / Apply the idea

A 600-W load operates for 3 hours. An ideal 3-kWh battery begins full; ignore losses and reserve limits.

1. Convert 600 W to 0.6 kW.
2. Calculate energy used: $0.6 \text{ kW} \times 3 \text{ h} = 1.8 \text{ kWh}$.
3. Subtract 1.8 kWh from 3 kWh.

Result. The ideal remaining energy is 1.2 kWh; actual usable energy depends on operating limits and losses.

kW / kWh

kW measures a rate; kWh measures accumulated energy. A device can satisfy one limit and fail the other.

Keep these ideas

- Keep power and energy units distinct throughout a calculation.
- Use voltage and current from the same operating condition.
- State efficiency, power factor and operating assumptions before applying a formula.

Source references: 1, 4

Check your understanding

1. A constant 250-W communications load runs for 8 hours. How much energy does it use?
 - A. 2 kWh
 - B. 250 kWh
 - C. 2000 kWh
 - D. 0.03125 kWh

2. An ideal DC load draws 8 A at 30 V. What is its power?

- A. 3.75 W
- B. 38 W
- C. 0.24 W
- D. 240 W

3. A battery stores 12 kWh but has a 4-kW output limit. A proposed load needs 6 kW continuously. What prevents operation as specified?

- A. The load can operate for exactly two hours because 12 divided by 6 is two.
- B. The battery would work if its reserve were reduced from 20% to 10%.
- C. The load needs a battery with at least 6 kWh of stored energy.
- D. The required power exceeds the output limit.

Check the reasoning

1. Answer A / CORE

$250\text{ W} \times 8\text{ h} = 2000\text{ Wh} = 2\text{ kWh}$.

- B. This ignores both duration and the watt-to-kilowatt conversion.
- C. 2000 is the watt-hour result, not the kilowatt-hour result.
- D. Dividing power by time does not calculate energy.

Source references: 1, 4

2. Answer D / CORE

$P = V \times I = 30 \times 8 = 240\text{ W}$.

- A. V/I gives resistance in this simple case, not power.
- B. Adding voltage and current combines unlike units.
- C. The given values do not require a kilo conversion.

Source references: 1, 4

3. Answer D / CORE

Energy capacity does not override the maximum delivery rate.

- A. That energy calculation is conditional on adequate power capability, which is absent.
- B. More available energy does not remove the specified output-power limit.
- C. The battery already has 12 kWh; the stated obstacle is its 4-kW power limit.

Source references: 1, 4