

PDF STUDY GUIDE

HiSET

Study Guide

220+ High-Yield Terms & Concepts for the High School Equivalency Test

Reading - Writing - Mathematics - Science - Social Studies. Scoring,

220+ High-Yield Terms & Concepts (High School Equivalency Test)

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How to Use This Guide

The HiSET (High School Equivalency Test) is your path to a high school equivalency credential -- accepted by employers and colleges as the equivalent of a diploma, in the states and territories that offer it. It is built around five subtests: Language Arts - Reading, Language Arts - Writing, Mathematics, Science, and Social Studies. Each is scored 1-20, and to pass you need 8 or higher on every subtest, 2 or higher on the Writing essay, and a combined total of 45 or better. This guide maps the five subtests the way the exam actually runs -- with the question counts, timing, and content domains of the current (2026) test: Reading 50 questions/65 minutes, Writing 60 questions + 1 essay/120 minutes, Math 55 questions/90 minutes (calculator allowed, formula sheet provided), Science 60 questions/80 minutes, and Social Studies 60 questions/70 minutes. Each concept gives you Key Facts, a Strategy Tip, and a worked Example. Work Part 1 to learn the rules of the credential, then grind the content parts in the order that matches your weakest subtest, and finish with Part 14 for your test-day plan. Honest positioning: this is an independent study aid, NOT approved, endorsed, or produced by ETS. The official HiSET Test Taker Bulletin, practice tests, and sample questions are free at hiset.org -- use them alongside this workbook.

Exam Overview: The HiSET

Five subtests, each scored 1-20. Passing requires ALL THREE: (1) at least 8 on each of the five subtests; (2) at least 2 out of 6 on the Writing essay; (3) a combined total of at least 45 across all five. Format: Reading 50 MC / 65 min; Writing 60 MC + 1 essay / 120 min; Math 55 MC / 90 min with calculator and formula sheet; Science 60 MC / 80 min; Social Studies 60 MC / 70 min. Some questions on each test are pretest items that do not count toward your score. Subtests can be scheduled in any order; all five take about 7.5 hours if taken in one day. Offered on computer or paper, at a proctored test center or at home with remote proctoring (options vary by state). Fees vary by state; two free retakes are included within 12 months of each subtest purchase. College & Career Readiness: 15+ on a subtest.

Part 1: The HiSET Exam -- Format, Scoring & Registration (14 Concepts)

What the credential is, how the five subtests are built, and the rules of passing.

#	Term	Key Facts	Strategy Tip	Example
1	The HiSET Exam	High School Equivalency Test: ETS's alternative to a high school diploma and the GED, offered in about 26 states and 5 territories. Passing earns a state-issued high school equivalency credential and transcript.	Employers and colleges treat it as a diploma equivalent -- list the credential, not just the test.	An adult without a diploma passes HiSET and uses the credential to qualify for a job that requires a high school education.
2	The Five Subtests	Language Arts - Reading, Language Arts - Writing (with essay), Mathematics, Science, and Social Studies. Each is a separate, schedulable test.	You can take and pass subtests one at a time -- the order is your choice.	

A candidate schedules Math first (weakest subject) so it gets the most focused study time.

3

The 1-20 Scale

Every subtest is scaled 1-20. Your scaled score depends on the raw score converted through equating, so different forms are comparable.

Scaled scores, not raw percentages, are what count -- aim well above the 8-floor to be safe.

A 16-point raw performance on one form and 15 on another both convert to the equivalent scaled score.

4

Passing Requirement 1: 8 on Each

You must score at least 8 on EACH of the five subtests. Failing one means you retake that subtest, not the whole battery.

No subtest is optional -- the weakest link decides whether the battery passes.

A candidate scores 12, 11, 9, 10 on four subtests but 6 on Social Studies -- only Social Studies needs a retake.

5

Passing Requirement 2: The Essay

The Writing essay is scored on a 0-6 scale; you need at least 2 out of 6, and your Writing subtest score combines the multiple-choice and essay results.

Keep it organized and on-topic -- a clear 4-5 paragraph structure usually clears the 2-floor easily.

A focused five-paragraph essay that earns a 4 clears the 2.0 requirement comfortably; the essay score is combined with the 60 multiple-choice items in your Writing subtest total.

6

Passing Requirement 3: Combined 45

Your five subtest scores must total at least 45. High scores on strong subjects can offset a weaker one -- as long as every subtest is still 8+.

Always max out your strongest subjects; the combined floor rewards it.

Scores of 8, 9, 9, 9, 10 total 45 -- a passing battery by exactly the margin.

7

College & Career Readiness

Scoring at least 15 on any subtest (Writing: 15 total AND 4 on the essay) flags CCR -- comparable to college-credit-ready performance.

15+ is a distinction, not a pass requirement -- but it looks great on transcripts.

A candidate's 16 on Math earns the CCR indicator on that subtest's individual report.

8

Pretest Questions

Each subtest may contain unscored pretest questions mixed into the scored items -- you cannot tell which they are.

Answer every question at full effort; a pretest item still costs time if you stall.

A test taker completes 60 Science items, 5 of which were experimental and don't count -- but all 60 were treated as real.

9

Scheduling Flexibility

Subtests can be scheduled in any order and at your own pace. All five can be taken in one day (about 7.5 hours) but that is rarely recommended.

Space subtests across weeks so each gets its own study block.

A candidate books Math and Science one weekend, then Reading, Writing, and Social Studies the next.

10

Delivery Options

Computer or paper; at a proctored test center or at home/school with online remote proctoring. Options vary by state and site.

Pick the format you'll actually practice in -- familiarity with the interface matters.

A candidate who struggles with typed essays chooses paper so the essay is handwritten, as practiced.

11

Registration & My HiSET

You register through your My HiSET account: schedule, pay per subtest, reschedule, and view scores. Register with your name EXACTLY as on your ID.

A name mismatch on test day means you cannot test and the fee is forfeited.

A candidate's account says "Robert" but the ID says "Bob" -- the test center rejects

the check-in until corrected.

12	Fees & the Free Retakes	Fees vary by state and site. Two FREE retakes come with each subtest purchase within 12 months of that purchase date.	Use the free retakes strategically -- don't waste one on a subtest you can pass with more prep.	A candidate fails Math once, studies for a month, and uses the first free retake to pass -- the second stays in reserve.
13	Rescheduling & Refunds	Cancel at least 24 hours before your appointment to get a refund or reschedule without penalty; missing without notice forfeits the fee.	Set a calendar reminder the day before -- a forgotten appointment is a wasted purchase.	A candidate reschedules a Sunday test on Saturday morning with no fee; a no-show would have cost the full price.
14	Score Reports & Validity	Scores stay valid and are recognized across states and by employers and colleges; the Comprehensive Report shows your highest scores and pass status.	Scores don't expire -- but always confirm a specific employer's or college's policy.	A candidate who passed two years ago shows the employer the state-issued credential without retesting.

Part 2: Language Arts - Reading (22 Concepts)

50 questions / 65 minutes (80 minutes in Spanish). Literary + informational text; comprehension, interpretation, and analysis.

#	Term	Key Facts	Strategy Tip	Example
15	Main Idea	The central point a passage communicates -- what the whole text is about, not one detail. Often stated in the first or last paragraph.		

Read the first and last sentences of each paragraph; the main idea emerges from their overlap.

A passage about honeybee communication repeatedly shows how bees use dances -- the main idea is that bees share information through movement.

16

Supporting Details

Facts, examples, and reasons that develop and prove the main idea. They answer who, what, when, where, why, and how.

Ask "Does this sentence prove or explain the main idea?" when test questions ask which detail supports the point.

The claim "bees communicate" is supported by details: the angle of the dance shows direction; its duration shows distance.

17

Inference

A conclusion drawn from evidence in the text that is not stated directly. The correct answer is always the most reasonable, evidence-backed option.

Eliminate options that contradict the text or require outside knowledge; stick to what the passage implies.

If a passage says a character "glanced at the clock three times in ten minutes," you can infer she is in a hurry.

18

Author's Purpose

Why the author wrote the text: to inform, persuade, entertain, or express. Academic passages are usually informative; ads and editorials persuade.

Identify the genre first -- a scientific article informs, an opinion piece persuades.

An editorial urging readers to vote "no" on a levy is written to persuade; the data it cites serves that purpose.

19

Tone

The author's attitude toward the subject, communicated through word choice: serious, playful, sarcastic, somber, enthusiastic.

Look for emotionally loaded words; neutral, factual diction signals an objective tone.

Words like "tragic," "outrageous," and "unfair" signal an indignant tone; "reported," "stated," "noted" signal neutrality.

20

Point of View

First person (I/we), second person (you), or third person (he/she/they); third-person limited shows one character's thoughts, omniscient shows many.

Ask who the narrator is and whose thoughts you can access -- that determines the POV label.

A passage told with "I" and "my" is first-person; if it also reveals two characters' private thoughts, it's third-person omniscient.

21

Theme vs. Subject

The subject is WHAT the story is about (war); the theme is the insight it offers (war dehumanizes everyone). Theme is a statement, not a single word.

Phrase a theme as a complete sentence about life or human nature -- a one-word answer is a subject.

The subject of a story is "friendship"; its theme is "real friendship survives distance and time."

22

Figurative Language

Simile (like/as), metaphor (is), personification (human traits to non-humans), hyperbole (exaggeration). They create images and emphasize ideas.

Similes announce themselves with like/as; metaphors do not -- that's the usual test distinction.

"Her voice is silk" is a metaphor; "Her voice is like silk" is a simile; "The wind screamed" is personification.

23

Context Clues

The words around an unknown vocabulary word that reveal its meaning -- synonyms, antonyms, definitions, or examples.

Replace the unknown word with each answer choice and pick what makes sense in the sentence.

In "an arid desert, bone-dry for years," the words "dry" and "bone-dry" are context clues for arid: very dry.

24

Cause & Effect

A cause makes something happen; an effect is what happens. Signal words: because, since, therefore, as a result, consequently.

When a question asks "why," look for the cause; when it asks "what happened," look for the effect.

Because the dam broke (cause), the valley flooded (effect); "as a result" marks the effect clause.

25

Compare & Contrast

Comparing shows similarities; contrasting shows differences. Signal words: both, similarly, unlike, whereas, however.

Re-read the question: "similar" asks for comparison, "different" asks for contrast.

Both passages describe the same battle (compare), but they disagree about the general's motives (contrast).

26

Fact vs. Opinion

A fact can be verified; an opinion is a belief or judgment, often marked by should, best, worst, beautiful, important.

Test claim with "Can this be proven?" -- verifiable = fact, personal value = opinion.

"The law was passed in 1965" is a fact; "it was the most important law of the century" is an opinion.

27

Drawing Conclusions

Combining evidence from the text with proper reasoning to reach a supported judgment beyond the literal words.

The right conclusion must follow from the cited evidence -- choose the option with the strongest textual support.

A passage states rising temperatures and migrating species in the same region -- a supported conclusion is that the climate is changing there.

28

Sequence & Chronology

The order of events, marked by signal words: first, then, next, finally, before, after, meanwhile.

Look for time markers to reconstruct order; "before" flips the order you might assume.

"Before she cooked dinner, she shopped for groceries, after locking the door" -- the

shopping preceded the cooking.

29

Text Structure

How a passage is organized: chronological, problem/solution, cause/effect, compare/contrast, or descriptive.

Identify the dominant pattern by the signal words and the relationships between paragraphs.

A passage that opens with a pollution problem and closes with a cleanup plan uses problem/solution structure.

30

Summarizing

Condensing a passage into its main idea plus the most important supporting points, without opinions or minor details.

A correct summary = main idea + key evidence; drop statistics and anecdotes that don't carry the main point.

Summarizing a passage on the Great Migration: millions of Black Americans moved north for jobs and freedom -- the pull of industry and the push of Jim Crow drove the shift.

31

Character & Characterization

Characterization reveals personality through actions, dialogue, thoughts, and what others say. Flat characters stay the same; round characters change.

Test items ask what a character's actions reveal -- answer with an inferred trait, not a plot fact.

A character who shares lunch with a hungry stranger is characterized as generous through his actions.

32

Plot Elements

Exposition introduces; rising action builds tension; climax is the turning point; falling action resolves; denouement concludes.

Locate the climax where the central conflict peaks -- the answer is the highest-tension moment.

In a story, the protagonist finally confronts the bully (climax), and the resolution shows the school's response.

33

Setting

Where and when a story happens -- time, place, culture -- and its effect on mood, characters, and plot.	Ask how the setting constrains or shapes the characters: a desert setting forces survival choices.	A story set on a 19th-century prairie shapes a character's isolation; moving it to a modern city would change the whole plot.
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34	Foreshadowing & Flashback	Foreshadowing drops hints about future events; a flashback interrupts the present to show the past. Both add depth and dramatic tension.	A detail that "pays off" later is foreshadowing; an abrupt shift to earlier time is a flashback.	A character notices a loose railing early in the story; an accident on that railing later proves the hint was foreshadowing.
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35	Informational Text Features	Headings, subheadings, captions, charts, graphs, bold terms, and sidebars organize information and direct the reader.	Before reading, scan headings and captions -- they preview the structure and main points.	A science article's bolded terms and captioned diagrams let a reader locate the key findings without reading every word.
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36	Persuasive Techniques	Appeals to emotion (pathos), logic (logos), and credibility (ethos); loaded language, bandwagon, and glittering generalities push a viewpoint.	Identify the appeal the writer leans on: facts = logic, fear/pride = emotion, expert quotes = credibility.	An ad citing "9 out of 10 dentists" leans on credibility; one showing a smiling family leans on emotion.
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Part 3: Language Arts - Writing (18 Concepts)

60 questions + 1 essay / 120 minutes. Editing/revision skills + one essay prompt; standard American English.

#	Term	Key Facts	Strategy Tip	Example
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37

The Writing Subtest

Two parts in one session: 60 multiple-choice editing/revision questions plus one essay. The essay scores 0-6; you need 2+ to pass, and your Writing subtest score combines both parts.

Budget time: save ~35-40 minutes for the essay so it isn't rushed.

A candidate spends 70 minutes on the MC section and 45 minutes writing a four-paragraph essay with time to proofread.

38

Essay Prompt Types

The prompt asks you to take a position on an issue (argument) or respond to a quotation -- and to support your position with reasons and examples.

Answer the prompt directly in the first paragraph -- a clear thesis is non-negotiable.

Prompt: "Should schools require community service?" A strong opening states your position in one sentence plus your two supporting reasons.

39

Thesis Statement

One sentence stating your main argument. Everything else in the essay supports it.

Put the thesis at the end of the first paragraph and mirror its language in the conclusion.

Thesis: "Schools should require community service because it builds civic skills and connects students to their communities."

40

Paragraph Structure

Each body paragraph = topic sentence + supporting details + a concluding or transition sentence.

One idea per paragraph; start each with a topic sentence that previews that idea.

A body paragraph on civic skills opens "Community service builds practical civic knowledge," then cites examples of students organizing food drives.

41

Essay Organization

Introduction (hook + thesis), body paragraphs in a logical order, and a conclusion that restates the thesis without repeating it word-for-word.

Draft a quick outline before writing:
thesis -> 2-3 reasons ->
conclusion.

Outline: intro (position), body 1 (civic skills), body 2 (community ties), body 3 (counterpoint), conclusion (restate + look ahead).

42

Transitions

Words that connect ideas: however, therefore, for example, in addition, as a result, on the other hand. They make the essay flow.

Use a transition at the start of most body paragraphs; a missing transition reads as choppy.

"In addition to civic skills, service hours introduce students to neighbors they would never otherwise meet."

43

Standard English Conventions

Grammar, usage, and mechanics: subject-verb agreement, verb tense, pronoun agreement, capitalization, punctuation, and spelling.

Read MC answers aloud -- an error that "sounds wrong" usually is wrong.

"Each of the students ARE ready" -> "Each of the students IS ready": the subject is each, which is singular.

44

Subject-Verb Agreement

A singular subject takes a singular verb; plural takes plural. Watch for phrases between subject and verb that can fool you.

Strip prepositional phrases: "The group of workers [was/were]" -- group is the subject, so "was."

"The list of requirements WAS long" (list, not requirements) vs. "The requirements WERE long."

45

Pronoun Agreement & Case

A pronoun must match its antecedent in number and gender, and use the right case: subject (I, she, they) vs. object (me, her, them).

Find the antecedent; "everyone," "each," and "everybody" are singular.

"Everyone must bring THEIR lunch" -> "his or her lunch" (or rewrite): everyone is singular.

46

Verb Tense Consistency

Don't shift tenses without reason; if a passage starts in the past, keep past-tense narration throughout.

Underline verbs in a sentence pair and check they agree in time.

"She walked to the store and buys milk" -> "and BOUGHT milk": the shift from past to present is the error.

47

Sentence Fragments

A fragment is an incomplete sentence -- missing a subject, a verb, or both, or left as a dependent clause.

A complete sentence must stand alone; if it can't, it's a fragment.

"Because the traffic was heavy." is a fragment; "The bus was late because the traffic was heavy." is complete.

48

Run-On Sentences & Comma Splices

Two independent clauses joined with no punctuation (run-on) or only a comma (comma splice). Fix with a period, semicolon, or conjunction.

Check every comma that joins two complete thoughts -- it usually needs a conjunction or a period.

"It was raining, I took the bus" (comma splice) -> "It was raining, so I took the bus."

49

Modifiers & Dangling Modifiers

A modifier must clearly attach to the word it describes; a dangling modifier has nothing logical to modify.

Put the modifier next to what it modifies -- "Walking home, the rain started" wrongly describes rain.

"Walking home, I got soaked." Fixed: the implied actor "I" is right after the clause.

50

Parallel Structure

Items in a list or comparison must be in the same grammatical form: "to run, to swim, to bike" not "to run, swimming, and bike."

Check that each list item starts with the same part of speech.

"She likes reading, hiking, and to cook" -> "She likes reading, hiking, and cooking."

51

Commonly Confused Words

Their/there/they're, your/you're, its/it's, to/too/two, affect/effect, then/than, and who's/whose trip up many test takers.

Memorize the contraction trick: if "it is" fits, use "it's"; otherwise "its."

"The dog wagged ITS tail" (possessive, no apostrophe) vs. "It's raining" (it is).

52

Capitalization

Capitalize proper nouns, the first word of a sentence, titles before names, and the pronoun I.

Months, days, and languages are proper nouns; seasons are generally not.

"Doctor Chen practices medicine in Ohio every July" -- Doctor (title), Chen, Ohio, July all capitalized.

53

Punctuation: Commas

Commas separate items in a series, set off introductory phrases and appositives, and join clauses with a conjunction (FANBOYS).

Read aloud; a comma marks a natural pause -- but don't splice two full sentences with just a comma.

"After the storm, the crew cleared the road, and the town reopened schools."

54

Punctuation: Apostrophes & Semicolons

Apostrophes show possession (the dog's bone) and contractions (don't). Semicolons join two closely related independent clauses.

A semicolon can replace "and" between two full sentences; use apostrophe-s only for ownership, never plurals.

"The workers' tools" (plural possessive) vs. "The worker's tools" (one worker).

Part 4: Mathematics -- Numbers & Operations (16 Concepts)

55 questions / 90 minutes, calculator allowed, formula sheet provided. Quantitative problem-solving.

#	Term	Key Facts	Strategy Tip	Example
55	Place Value & Rounding	Each digit's position determines its value		

(ones, tens, hundreds...); rounding uses the digit to the right -- 5 and up rounds up.

Write numbers in expanded form when comparing; round only at the final step of a problem.

Round 47,832 to the nearest thousand: the hundreds digit is 8 -> 48,000.

56

Operations with Integers

Positive/negative number arithmetic: same signs add to positive; a negative times a negative is positive; subtraction flips the sign and adds.

For multiplying or dividing, count negative signs -- an even number of negatives gives a positive.

$(-6) \times (-4) = +24$; $(-6) + (-4) = -10$; $(-12) \div 3 = -4$.

57

Order of Operations

PEMDAS: Parentheses, Exponents, Multiplication/Division (left to right), Addition/Subtraction (left to right).

Work left to right WITHIN each rank -- multiplication is not always before division.

$12 \div 4 \times 3 = 3 \times 3 = 9$ (left to right), NOT $12 \div 12 = 1$.

58

Fractions

Parts of a whole: numerator over denominator. Add/subtract needs common denominators; multiply straight across; divide by flipping and multiplying.

Keep a common-denominator shortcut: multiply the two denominators for a safe common base.

$1/3 + 1/6 = 2/6 + 1/6 = 3/6 = 1/2$; $(2/3) \div (4/5) = 2/3 \times 5/4 = 10/12 = 5/6$.

59

Decimals

Place-value fractions: $0.1 = 1/10$, $0.01 = 1/100$. Align decimal points when adding or subtracting.

When comparing decimals, add trailing zeros to equalize length: 0.4 vs 0.375 -> 0.400 > 0.375 .

$2.5 + 0.75 = 3.25$; $8.0 \div 3.25 = 4.75$.

60

Percentages

Percent = parts per hundred. Percent of a number: multiply by the decimal form (25%

= 0.25).

Convert "X% of Y" into $X/100 \times Y$ -- and remember 10% = one tenth, 50% = half.

30% of \$80 = $0.30 \times 80 = \$24$. A \$60 jacket at 25% off costs $60 \times 0.75 = \$45$.

61

Ratios & Rates

A ratio compares two quantities (3:2); a rate compares different units (miles per hour). Both simplify like fractions.

Set up ratios with consistent units -- match order to the question ("boys to girls" ? "girls to boys").

A recipe uses 2 cups sugar to 3 cups flour -> ratio 2:3; 4 cups sugar needs 6 cups flour.

62

Proportions

Two equal ratios: $a/b = c/d$. Cross-multiply to solve: $ad = bc$.

Identify the unknown with a variable, set the cross-product equation, and solve in one step.

$2/3 = x/12 \rightarrow 3x = 24 \rightarrow x = 8$.

63

Unit Conversions

Convert between units using equivalent factors: 12 in = 1 ft, 3 ft = 1 yd, 16 oz = 1 lb, 4 qt = 1 gal, 1000 m = 1 km.

Multiply by a fraction equal to 1 (e.g., 12 in/1 ft) so units cancel.

5 feet = $5 \times (12 \text{ in}/1 \text{ ft}) = 60 \text{ inches}$. 2.5 km = $2.5 \times 1000 = 2500 \text{ m}$.

64

Exponents

A base multiplied by itself the exponent number of times: $2^3 = 8$. Zero exponent = 1; negative exponent = reciprocal ($2^{-3} = 1/8$).

Same base rules: multiply -> add exponents, divide -> subtract, power of a power -> multiply.

$2^3 \times 2^4 = 2^7 = 128$; $(3^2)^3 = 3^6 = 729$; $5^0 = 1$.

65

Square Roots

The square root of a number is the value that multiplies by itself to give it: $?81 = 9$. $?(a \times b) = ?a \times ?b$.

Memorize perfect squares 1-144 and factor out perfect squares to simplify.

$?72 = ?(36 \times 2) = 6?2$? 8.49. $?144 = 12$.

66

Prime Numbers & Factors

Primes (2, 3, 5, 7, 11, 13...) have exactly two factors. Prime factorization breaks a number into primes: $60 = 2^2 \times 3 \times 5$.

Prime factorizations find LCM and GCF quickly -- compare exponent lists.

GCF of 24 ($2^3 \times 3$) and 36 ($2^2 \times 3^2$) = $2^2 \times 3 = 12$; LCM = $2^3 \times 3^2 = 72$.

67

Mean, Median, Mode, Range

Mean = average; median = middle value (ordered); mode = most frequent; range = max ? min.

Sort the data before finding the median -- an unsorted list gives the wrong middle.

Data {2, 5, 5, 8, 10}: mean 6, median 5, mode 5, range 8.

68

Averages & Weighted Averages

Average = total $\div$ count; a weighted average multiplies each value by its weight before dividing.

Rebuild the total: if average $\times$ count = total, you can find missing values.

Grades 80 (weight 2) and 90 (weight 1): $(80 \times 2 + 90 \times 1) / 3 = 250 / 3 \approx 83.3$.

69

Estimating & Reasonableness

Round numbers to friendly values to check whether an exact answer makes sense.

After solving, re-estimate: if the answer is wildly off from the estimate, recheck.

$287 \times 19 \approx 300 \times 20 = 6000$; the exact answer 5453 is in the right ballpark.

70

Word Problem Translation

Key phrases map to operations: "more than" (+), "less than" (?), "of" ($\times$), "per" ($\div$), "difference" (?), "total" (+).

Underline numbers and the operation words; write the equation before computing.

"8 more than twice a number is 30" $\rightarrow 2n + 8 = 30 \rightarrow n = 11$.

Part 5: Mathematics -- Algebra & Functions (16 Concepts)

Solving equations, inequalities, and working with functions -- a major share of the Math subtest.

#	Term	Key Facts	Strategy Tip	Example
71	Variables & Expressions	A variable represents an unknown value (x, y); an expression combines numbers, variables, and operations ($3x + 5$).	Translate words into an expression before solving -- a written equation prevents arithmetic slips.	The expression for "3 times a number, plus 5" is $3x + 5$.
72	Solving Linear Equations	Isolate the variable by undoing operations with inverse operations on BOTH sides: add/subtract first, then multiply/divide.	Whatever you do to one side, do to the other -- check by plugging back in.	$2x + 6 = 18 \rightarrow 2x = 12 \rightarrow x = 6$. Check: $2(6) + 6 = 18$
73	Solving Inequalities	Same as equations, EXCEPT multiplying or dividing by a NEGATIVE number flips the inequality sign.	Flip the sign only on negative multiplication/division -- the most common missed step.	$-3x \leq 12 \rightarrow x \geq -4$ (sign flipped). Graph with an open circle for $\leq$ or $\geq$.
74	Combining Like Terms	Terms with the same variable and exponent combine: $3x + 5x = 8x$; $3x$ and $3x^2$ do NOT combine.	Circle like terms before combining; keep variable parts attached to their coefficients.	$4a + 2b + a + 3b = 3a + 5b$.
75	The Distributive Property	$a(b + c) = ab + ac$. Multiply the outside term by EVERY term inside the parentheses.	Distribute the sign too: $-(x + 3) = -x + 3$.	$3(2x + 4) = 6x + 12$; $2(x + 3y) = 2x + 6y$.
76	Slope of a Line	Slope = rise/run = $(y_2 - y_1)/(x_2 - x_1)$.		

Positive slope rises left to right; negative falls; zero is horizontal; undefined is vertical.

Label your points (x1,y1) and (x2,y2) to keep the subtraction order consistent.

Points (1,2) and (3,8): slope = $(8 - 2)/(3 - 1) = 6/2 = 3$.

77

Slope-Intercept Form

$y = mx + b$, where m is slope and b is the y-intercept (where the line crosses the y-axis).

To graph, plot b, then count rise over run from there.

$y = 2x + 1$ crosses the y-axis at (0,1) and rises 2 for every 1 across.

78

Graphing Linear Equations

A line needs two points; find them with a table of values or intercepts (set x=0, then y=0).

Check your graph: the line's steepness must match the slope sign and size.

For $y = -x + 4$: intercepts at (0,4) and (4,0); line descends through them.

79

Systems of Equations

Two equations, two unknowns. Solve by substitution (replace a variable) or elimination (add/subtract to cancel one variable).

Pick the method with the least algebra: substitution when one variable is already isolated.

$x + y = 10$ and $y = 2x \rightarrow x + 2x = 10 \rightarrow x = 10/3, y = 20/3$.

80

Linear Functions & Tables

A linear function changes by a constant amount; check tables for a steady difference in y when x increases by 1.

Slope from a table = change in y ÷ change in x between any two rows.

x: 0,1,2,3 -> y: 2,5,8,11: y grows by 3 each step -> slope 3, y-intercept 2.

81

Functions: Domain & Range

Domain = all possible x (inputs); range = all possible y (outputs). A function gives exactly one output per input.

Vertical-line test: a graph is a function if no vertical line hits it twice.

$f(x) = x^2$ has domain all real numbers;

range $y \geq 0$.

82

Function Notation

$f(x)$ means the function named f evaluated at input x . $f(3)$ replaces every x with 3.

Substitute the number in parentheses for x everywhere, then simplify.

$$f(x) = 2x + 1 \rightarrow f(3) = 2(3) + 1 = 7.$$

83

Evaluating Formulas

Plug known values into a formula and solve for the unknown -- the formula sheet gives the equations.

Write the formula first, then substitute -- don't skip straight to arithmetic.

The area of a circle: $A = \pi r^2$. If $r = 4$, $A = 3.14 \times 16 \approx 50.24$ sq units.

84

Exponents & Scientific Notation

Scientific notation writes numbers as $a \times 10^n$ with $1 \leq a < 10$. Moving the decimal right means a negative exponent.

Count decimal places moved -- the exponent direction follows the decimal's motion.

$$3,200,000 = 3.2 \times 10^6; 0.00045 = 4.5 \times 10^{-4}.$$

85

Ratios in Word Problems

Part-to-part and part-to-whole ratios; scale factors multiply both parts.

Label units in every ratio step so the order stays correct.

A class has 3 boys per 4 girls; 28 students total $\rightarrow$ 12 boys, 16 girls.

86

Applying the Pythagorean Theorem

$a^2 + b^2 = c^2$ for right triangles (c = hypotenuse). Also used for distance and diagonal problems.

The hypotenuse is ALWAYS opposite the right angle -- the longest side, c .

$$\text{Legs 6 and 8: } c^2 = 36 + 64 = 100 \rightarrow c = 10.$$

Part 6: Mathematics -- Geometry & Measurement (16 Concepts)

Shapes, angles, area, perimeter, volume, and units -- with the formula sheet, this section rewards knowing WHICH formula to use.

#	Term	Key Facts	Strategy Tip	Example
87	Perimeter	The distance around a shape: add all side lengths. Rectangle: $P = 2(l + w)$.	For polygons, sum every side; a formula only helps rectangles, squares, and circles.	A rectangle 8 m by 5 m: $P = 2(8+5) = 26$ m.
88	Area of Rectangles & Squares	$A = l \times w$ (rectangle); $A = s^2$ (square). Measured in square units.	Identify the base (length) and height (width) -- they are perpendicular sides.	A rug 6 ft by 9 ft covers $A = 54$ sq ft.
89	Area of Triangles	$A = \frac{1}{2} \times \text{base} \times \text{height}$, where height is the perpendicular distance from the base to the opposite vertex.	The height is NOT a slanted side -- it must be perpendicular to the base.	Base 10, height 6: $A = \frac{1}{2} \times 10 \times 6 = 30$ sq units.
90	Area of Circles	$A = \pi r^2$. Memorize $\pi \approx 3.14$ (the formula sheet provides it).	Square the radius BEFORE multiplying by π -- order matters.	Radius 5: $A = \pi \times 25 \approx 78.5$ sq units.
91	Circumference	The distance around a circle: $C = 2\pi r$ or $C = \pi d$ (d = diameter = $2r$).	Match the formula to what you're given -- given diameter, use πd .	Circle with diameter 14: $C = 3.14 \times 14 \approx 43.96$ units.
92	Angles: Types & Measures	Acute $< 90^\circ$, right = 90° , obtuse 90° - 180° , straight = 180° . A full circle = 360° ; a triangle's angles sum to 180° .	Angles on a straight line sum to 180° -- find a missing angle by subtracting from 180.	A triangle with 50° and 60° has a third

angle of 70°.

93

Complementary & Supplementary Angles

Complementary angles sum to 90°; supplementary sum to 180°.

The "c" in complementary = corner (90°); "s" in supplementary = straight (180°).

A 35° angle's complement is 55°; its supplement is 145°.

94

Parallel & Perpendicular Lines

Parallel lines never meet (same slope); perpendicular lines meet at 90° (slopes are negative reciprocals, e.g., 2 and -1/2).

Transversals cut parallel lines creating equal corresponding and alternate angles.

Lines $y = 2x + 1$ and $y = 2x - 4$ are parallel; $y = -\frac{1}{2}x$ is perpendicular to both.

95

Polygons

Closed shapes with straight sides: triangles (3), quadrilaterals (4), pentagons (5), hexagons (6), octagons (8).

Interior angle sum of an n-gon = $(n - 2) \times 180^\circ$.

A hexagon (6 sides): $(6 - 2) \times 180 = 720^\circ$ total interior angles.

96

Quadrilaterals Family

Square (4 equal sides, 4 right angles), rectangle (opposite sides equal, 4 right angles), parallelogram (opposite sides parallel), trapezoid (one pair of parallel sides), rhombus (4 equal sides).

Ask "how many pairs of parallel sides and equal sides?" to classify.

A rhombus has 4 equal sides but no right angles; a rectangle has right angles but only opposite sides equal.

97

Volume of Rectangular Prisms

$V = l \times w \times h$ (cubic units). A cube: $V = s^3$.

Box volume problems: multiply all three dimensions; watch units (cm³, ft³).

A box $4 \times 5 \times 3 = 60$ cubic units; a 3-cm cube: $V = 27 \text{ cm}^3$.

98

Surface Area

Total area of all faces. Rectangular prism: $SA = 2lw + 2lh + 2wh$. Cube: $SA = 6s^2$.

Find the area of each unique face and double it (opposite faces match).

A $4 \times 5 \times 3$ prism: $SA = 2(20) + 2(12) + 2(15) = 94$ sq units.

99

Volume of Cylinders & Cones

Cylinder: $V = \pi r^2 h$. Cone and pyramid: $V = \frac{1}{3} \times \text{base area} \times \text{height}$. Sphere: $V = \frac{4}{3} \pi r^3$.

A cone or pyramid is always one-third of the prism with the same base and height.

Cylinder $r=3$, $h=10$: $V = \pi \times 9 \times 10 \approx 282.6$ cubic units.

100

Similar Figures

Same shape, different size; corresponding sides are proportional (scale factor k), and areas scale by k^2 .

Set up a proportion between corresponding sides; never mix non-corresponding sides.

A 4×6 rectangle enlarged by scale factor 2 becomes 8×12 ; area quadruples from 24 to 96.

101

Transformations

Translation (slide), rotation (turn), reflection (flip), dilation (resize). Translations and rotations preserve size and shape.

Track one vertex to see how the whole figure moved.

A triangle slid 3 right and 2 up is a translation; every point moves by the same (3, 2).

102

Coordinate Plane

Points are (x, y): x is horizontal, y vertical. Distance between points = absolute difference in one coordinate when aligned.

Plot before you solve; drawing the points makes midpoint and distance obvious.

Points (2,3) and (8,3) are 6 apart (same y). Midpoint of (2,3) and (8,3) is (5,3).

Part 7: Mathematics -- Data Analysis & Probability (12 Concepts)

Reading graphs, interpreting data, and calculating chances -- practical math the HiSET loves.

#

	Term	Key Facts	Strategy Tip	Example
103	Reading Bar Graphs	Bars represent categories; the height (or length) shows the value. Compare bars directly to answer "how many more" questions.	Read the axis scale carefully -- a graph may not start at zero, which changes the visual comparison.	A bar graph shows Monday sales of \$400 and Tuesday of \$600 -- Tuesday's bar is 1.5× Monday's height.
104	Line Graphs & Trends	Lines connect data points over time; the slope between points shows the rate of change.	To find a trend, compare the first and last points and describe the general direction.	A line graph of a stock rising from \$20 to \$50 over a year shows an upward trend with a few dips.
105	Pie Charts (Circle Graphs)	A pie chart shows parts of a whole; each slice's angle/percentage corresponds to its share.	Convert a slice's percent to a count by multiplying the total by the percent.	A pie chart shows 25% of a budget goes to rent; with a \$2,000 budget, rent = \$500.
106	Stem-and-Leaf Plots	A display that keeps actual data values: the stem is the leading digit(s), the leaf the final digit.	Reconstruct the list, then find median/range as usual -- the plot is just an ordered list.	Stem 1
107	Scatterplots & Correlation	Points plot two variables (x, y). Positive correlation: both rise together; negative: one falls as the other rises; no correlation: random scatter.	Correlation is NOT causation -- a scatterplot can't prove one variable causes the other.	Ice cream sales and temperature rise together (positive correlation) -- heat causes both, not the ice cream.

108	Probability Basics	$P(\text{event}) = \text{favorable outcomes} \div \text{total possible outcomes}$, expressed as a fraction, decimal, or percent.	Count the total outcomes FIRST; the probability must be between 0 and 1.	Rolling a 4 on a die: $1 \text{ favorable} \div 6 \text{ total} = 1/6 \approx 16.7\%$.
109	Compound Probability	AND multiplies: $P(A \text{ and } B) = P(A) \times P(B)$ for independent events. OR adds for mutually exclusive events.	Identify independence: coin flips and die rolls are independent; drawing cards without replacement is not.	Two coin flips both heads: $1/2 \times 1/2 = 1/4$.
110	Expected Value	The long-run average = ? (outcome $\times$ probability). Used to compare decisions.	Multiply each outcome by its chance and add -- a fair game has expected value 0.	A \$1 ticket wins \$0 with .9 chance and \$10 with .1 chance: expected value = $0 + 1 = \$1$ -- fair.
111	Charts & Tables	Data tables let you look up and compare values directly; watch headers for units and categories.	Read the question BEFORE the table so you know which column matters.	A table of temperatures by city lets you answer "which city was warmest in July?" by scanning one column.
112	Interpreting Statistics	Samples represent the whole population only if random; a biased sample distorts conclusions.	Ask "who was surveyed and how?" before trusting any statistic in a problem.	A poll of website visitors only reflects website visitors -- not all citizens.
113	Percentage Change	Percent change = $(\text{new} - \text{original}) \div \text{original} \times 100$. A decrease gives a negative result.	Decide the ORIGINAL first -- it's the denominator in every percent-change calculation.	

A price rises from \$50 to \$60: $(60-50)/50 \times 100 = 20\%$ increase.

114

Simple Interest

$I = \text{principal} \times \text{rate} \times \text{time}$. Rate must be in decimal form; time in years.

Convert the annual rate: $6\% = 0.06$, then multiply -- don't add the percent sign into math.

\$2,000 at 4% for 3 years: $I = 2000 \times 0.04 \times 3 = \$240$.

Part 8: Science -- Life Science (20 Concepts)

Biology content: cells, genetics, ecosystems, and the human body -- the largest science domain.

#

Term

Key Facts

Strategy Tip

Example

115

The Scientific Method

Observe -> question -> hypothesis -> test (experiment) -> analyze -> conclude. A controlled experiment changes ONE variable at a time.

Identify the independent variable (what's changed) and dependent variable (what's measured) in every experiment passage.

Testing fertilizer: fertilizer amount is independent; plant height is dependent; water and light are controlled.

116

Cells: Basic Unit of Life

All living things are made of cells. Prokaryotes (bacteria) lack a nucleus; eukaryotes (plants, animals, fungi) have one.

The nucleus = control center -- its presence or absence is the prokaryote/eukaryote split.

A bacterium with no nucleus is prokaryotic; a human muscle cell with a nucleus is eukaryotic.

117

Cell Organelles

Mitochondria produce energy (ATP); ribosomes build proteins; the nucleus holds DNA; the cell membrane controls what enters/exits.

Match organelle to job: energy = mitochondria, protein = ribosome, control = nucleus.

A cell needing more energy makes more

mitochondria -- that's why muscle cells are packed with them.

118

Photosynthesis

Plants use sunlight, water, and carbon dioxide to make glucose and oxygen: $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{light} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$.

Photosynthesis takes in CO_2 and gives off O_2 -- the opposite of cellular respiration.

A leafy plant placed in sunlight produces bubbles of oxygen -- evidence of photosynthesis.

119

Cellular Respiration

Cells break down glucose with oxygen to release energy: $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy (ATP)}$.

Respiration releases the energy photosynthesis stored; the two equations mirror each other.

After exercise, breathing hard delivers extra oxygen so muscles can respire and make more ATP.

120

DNA & Genes

DNA carries hereditary information in genes; genes code for traits; DNA is a double helix made of nucleotides (A-T, C-G base pairs).

A always pairs with T, C with G -- use pairing rules to complete a DNA strand.

Strand A-T-C-G pairs with T-A-G-C on the complementary strand.

121

Chromosomes & Meiosis

Chromosomes are packaged DNA; body cells have 46 (23 pairs); egg and sperm (gametes) have 23 via meiosis.

Meiosis halves the chromosome number so fertilization restores 46.

A human sperm (23) + egg (23) = zygote with 46 chromosomes.

122

Inheritance: Dominant & Recessive

A dominant allele (A) masks a recessive one (a); an organism with Aa shows the dominant trait. Two recessive alleles (aa) show the recessive trait.

A Punnett square maps allele combinations: AA, Aa, aA, aa -- 3:1 phenotype ratio for a monohybrid cross.

Crossing Aa × Aa: 25% AA, 50% Aa, 25% aa -- 75% show the dominant trait.

123

Mutations

Changes in DNA sequence; may be harmful, helpful, or neutral. Only mutations in gametes pass to offspring.

Context decides whether a mutation is an advantage -- environment matters.

A mutation for thicker fur is neutral in a mild climate but helpful in a cold one.

124

Natural Selection & Evolution

Individuals with helpful traits survive and reproduce more, passing those traits on -- the population changes over generations.

"Survival of the fittest" means most reproductively successful, NOT strongest.

Antibiotic-resistant bacteria survive treatment and multiply -- the population becomes resistant.

125

Ecosystems & Food Chains

Producers (plants) → primary consumers (herbivores) → secondary consumers (carnivores) → decomposers. Energy decreases at each level.

About 10% of energy transfers between trophic levels -- this caps food chain length.

A food chain: grass → rabbit → fox. If grass traps 10,000 J, the fox receives about 100 J.

126

Food Webs vs. Chains

A food web is many interconnected chains; removing one species (a keystone species) can collapse the web.

Webs, not chains, show real ecosystems -- answer questions about "what happens if X disappears" by tracing all links.

Removing wolves lets deer overpopulate, depleting plants and harming other consumers.

127

Biomes & Habitats

Large communities defined by climate: tropical rainforest (hot/wet), desert (dry),

tundra (cold), grassland, taiga.

Climate (temperature + rainfall) determines the biome; name the climate to name the biome.

Cacti and reptiles live in deserts -- low rainfall defines the community.

128

Cycles: Water, Carbon, Nitrogen

Matter cycles: evaporation/precipitation (water), photosynthesis/respiration (carbon), nitrogen fixation by bacteria (nitrogen).

Matter cycles; ENERGY flows one way -- matter is never created or destroyed.

Nitrogen gas in air becomes usable by plants only after bacteria fix it into ammonia.

129

Human Body Systems

Digestive (breakdown), circulatory (transport), respiratory (gas exchange), nervous (control), skeletal/muscular (support/movement), excretory (waste).

Match system to function: transport = circulatory, control = nervous, gas exchange = respiratory.

Oxygen enters blood in the lungs (respiratory), and the heart pumps it around the body (circulatory).

130

Homeostasis

The body's ability to maintain stable internal conditions: body temperature, blood sugar, pH.

Feedback loops correct deviations -- sweating cools you when too hot.

After a big meal, insulin lowers high blood sugar back to normal range.

131

Immune System

Defends against pathogens: white blood cells, antibodies, and memory cells. Vaccines train immunity without causing disease.

Antibodies are specific -- each one matches a particular pathogen, like a key to a lock.

A flu vaccine exposes the body to a weakened virus so memory cells respond quickly to a real infection.

132

Ecology: Populations & Limits

Populations grow until limited by resources,

predation, or disease -- carrying capacity is the sustainable maximum.

Logistic growth levels off at carrying capacity; exponential growth cannot last.

A deer population grows rapidly then plateaus as food becomes scarce -- the plateau is carrying capacity.

133

Classification of Life

Domain -> Kingdom -> Phylum -> Class -> Order -> Family -> Genus -> Species (DKPCOFGS).

"King Philip Came Over For Good Soup" helps order -- species is the most specific.

Humans: Homo sapiens -- Homo is the genus, sapiens the species.

134

Viruses vs. Bacteria

Bacteria are living cells that reproduce on their own; viruses are non-living particles that hijack host cells. Antibiotics kill bacteria, not viruses.

Antibiotics are useless against colds/flu (viral) -- that's why "just take antibiotics" fails.

Strep throat (bacterial) responds to antibiotics; the common cold (viral) does not.

Part 9: Science -- Physical Science (18 Concepts)

Chemistry and physics: matter, energy, forces, and motion.

#	Term	Key Facts	Strategy Tip	Example
135	States of Matter	Solid (fixed shape/volume), liquid (fixed volume, takes container's shape), gas (fills any container). Changes: melting, freezing, evaporation, condensation.	Phase changes are physical, not chemical -- the substance's identity stays the same.	Ice (solid) melts into water (liquid); both are H ₂ O -- a physical change.
136	Atoms & Elements	Atoms = protons (+), neutrons (0), electrons (?). The atomic number = protons; elements are single-atom substances on the periodic		

table.

Atomic number identifies the element -- change protons and you change the element.

Carbon has 6 protons; an atom with 8 protons is oxygen, not carbon.

137

Molecules & Compounds

Molecules are atoms bonded together (O₂); compounds are molecules of different elements (H₂O, CO₂).

The chemical formula tells which and how many atoms: CO₂ = 1 carbon + 2 oxygen.

Water (H₂O) has two hydrogen and one oxygen atom per molecule.

138

Chemical vs. Physical Changes

Chemical changes create new substances (rusting, burning, digesting); physical changes alter form only (cutting, melting, dissolving).

New substance + irreversible = chemical; same substance, new shape = physical.

Rust on iron is a chemical change (iron oxide); melting butter is physical.

139

The Periodic Table

Organized by atomic number; columns (groups) share properties; rows are periods. Metals on the left, nonmetals on the right.

Group number often predicts valence electrons -- group 1 elements react similarly.

Sodium (Na) and potassium (K), both group 1, are soft reactive metals.

140

Chemical Reactions & Equations

Reactants -> products. Mass is conserved: atoms are rearranged, never created or destroyed.

Balance equations by counting atoms on both sides -- coefficients adjust counts.

2H₂ + O₂ -> 2H₂O: 4 H and 2 O on each side -- balanced.

141

Acids & Bases

Acids taste sour, pH < 7 (stomach acid, lemon juice); bases are slippery, pH > 7 (soap, bleach); pH 7 is neutral.

pH scale: lower = more acidic,

higher = more basic; each step is 10× stronger.

Lemon juice (pH ~2) is far more acidic than coffee (pH ~5).

142

Solutions & Mixtures

A solution is a uniform mixture (salt water); a suspension separates over time. Solute dissolves into solvent.

"Like dissolves like" -- water (polar) dissolves salt and sugar easily.

Sugar is the solute, water the solvent in a glass of sweet tea.

143

Density

Density = mass ÷ volume (g/cm³). Objects denser than water sink; less dense float.

Re-express as $D = m/V$ and solve for any unknown; water's density is 1 g/cm³.

A 20 g object with 5 cm³ volume has density 4 g/cm³ -- it sinks in water.

144

Force, Mass & Acceleration

Newton's Second Law: $F = ma$. Force in newtons, mass in kg, acceleration in m/s².

Push harder (more force) or lighten the object (less mass) both increase acceleration.

A 10 kg cart accelerated at 2 m/s² needs $F = 10 \times 2 = 20$ N.

145

Newton's First & Third Laws

First: objects keep moving (or stay still) unless a force acts. Third: every action has an equal and opposite reaction.

Inertia = resistance to change in motion; seat belts exist because of it.

A rocket pushes gas down (action); the gas pushes the rocket up (reaction).

146

Gravity

Every mass attracts every other mass; force rises with mass and drops with distance. Near Earth, $g \approx 9.8$ m/s².

Weight = mass × gravity; mass stays the same everywhere, weight changes.

A 10 kg object weighs about 98 N on Earth but only ~16 N on the Moon.

147

Energy: Kinetic & Potential

Kinetic = energy of motion ($KE = \frac{1}{2}mv^2$).
 Potential = stored energy: gravitational (mgh) or elastic.

As an object falls, potential converts to kinetic; total mechanical energy is conserved (ignoring friction).

A roller coaster at the highest point has maximum potential energy; at the bottom, maximum kinetic.

148

Work & Power

Work = force $\times$ distance (J). Power = work $\div$ time (W). No motion = no work.

Work is only done when an object MOVES in the force's direction.

Lifting a 50 N box 2 m does 100 J of work; doing it in 5 s = 20 W of power.

149

Simple Machines

Levers, pulleys, wedges, screws, wheels, and inclined planes trade force for distance (mechanical advantage).

Mechanical advantage > 1 means less force needed but more distance traveled.

A ramp (inclined plane) lets you lift a heavy crate with less force over a longer path.

150

Electricity Basics

Current (amps) flows through circuits; voltage (volts) pushes it; resistance (ohms) opposes it. Ohm's Law: $V = IR$.

Series circuits share current; parallel circuits share voltage.

A 12 V battery through a 4 Ω resistor: $I = V/R = 12/4 = 3$ A.

151

Magnetism & Electromagnetism

Opposite poles attract, like poles repel; moving charges create magnetic fields (electromagnets).

An electromagnet's strength increases with more coils or more current.

Wrapping wire around a nail and running current makes a magnet that drops the nail when unplugged.

152

Waves: Sound & Light

Waves transfer energy. Sound needs a medium (air); light travels through vacuum.

Frequency = pitch; amplitude = loudness/brightness.

Higher frequency = higher pitch (sound) and more energy (light).

A violin's high note vibrates faster (higher frequency) than a bass note.

Part 10: Science -- Earth & Space Science (16 Concepts)

Geology, weather, the solar system, and how Earth changes.

#	Term	Key Facts	Strategy Tip	Example
153	Earth's Layers	Crust (thin outer shell), mantle (thick, hot rock), outer core (liquid iron/nickel), inner core (solid).	The crust is a thin shell -- Earth is mostly mantle and core, like an egg with a thin shell.	Earthquakes release energy from faults in the crust; volcanoes come from molten rock in the mantle.
154	Plate Tectonics	Earth's crust is broken into moving plates; they collide (mountains), separate (rift valleys), or slide past each other (faults/earthquakes).	The plate BOUNDARY is where the action happens: convergent = collision, divergent = separation, transform = slide.	The Himalayas formed where the Indian plate collides with the Eurasian plate (convergent boundary).
155	Earthquakes & Faults	Sudden movement along faults releases seismic waves; magnitude measures energy released (Richter/moment magnitude scale).	Each whole-number step up = about 10× stronger shaking and 32× more energy.	A magnitude 6 earthquake releases far more energy than a magnitude 5 -- about 32×.
156	Volcanoes	Erupt when magma reaches the surface; common at plate boundaries and hot spots. Viscous magma -> explosive; runny ->		

gentle flows.

Convergent boundaries produce explosive volcanoes (thick, gas-rich magma); hot spots like Hawaii produce gentler flows.

Mount St. Helens (convergent boundary) erupted explosively; Hawaiian volcanoes flow steadily.

157

Weathering & Erosion

Weathering breaks rock down (chemical: acid rain, rust; physical: ice, roots, temperature); erosion moves the pieces (water, wind, ice).

Weathering = breaking in place; erosion = carrying away.

A river carves a canyon: ice wedging cracks the rock (weathering), and flowing water carries the debris downstream (erosion).

158

The Rock Cycle

Igneous (cooled magma/lava), sedimentary (compacted layers), metamorphic (heat/pressure). Any rock type can become any other.

The rock type tells the PROCESS: melted = igneous, layered = sedimentary, squeezed = metamorphic.

Limestone (sedimentary) buries and compacts; heat and pressure transform it into marble (metamorphic).

159

Fossils & the Geologic Time Scale

Fossils preserve past life in sedimentary rock; older layers sit below younger ones (superposition).

If a question asks relative age, the deepest layer is OLDEST unless folded or overturned.

A trilobite fossil in a deep rock layer is older than a dinosaur fossil in a shallower one.

160

The Water Cycle

Evaporation -> condensation -> precipitation -> collection, plus runoff and groundwater. Heat from the sun drives the cycle.

The same water molecule keeps cycling -- water is never lost, just relocated.

Ocean water evaporates, forms clouds, rains on mountains, and rivers carry it back to the ocean.

161

Weather vs. Climate

Weather = conditions right now (hours/days); climate = average conditions over decades.

"Climate is what you expect; weather is what you get."

A snowy week in Miami is weather; Miami's hot, humid average conditions are climate.

162

Atmosphere & Air Pressure

The atmosphere layers: troposphere (weather), stratosphere (ozone), mesosphere, thermosphere. Air pressure drops with altitude.

Most weather happens in the troposphere, the lowest layer.

Planes fly in the stratosphere above weather; skydivers fall through the troposphere.

163

Storms & Fronts

Cold front (cold air pushes in, sudden storms), warm front (warm air rides over, steady rain), high pressure (clear), low pressure (stormy).

Low pressure + rising air = clouds and storms; high pressure = sinking air and clear skies.

A line of thunderstorms forms as a cold front sweeps through, dropping temperatures behind it.

164

The Solar System

Sun at center; rocky planets (Mercury, Venus, Earth, Mars), gas giants (Jupiter, Saturn, Uranus, Neptune); asteroids between Mars and Jupiter; comets orbit the sun.

Inner planets are rocky and small; outer planets are large and gassy -- "My Very Educated Mother Just Served Us Noodles."

Mars is rocky like Earth; Jupiter's massive size makes it a gas giant -- no solid surface.

165

Earth's Motions: Rotation & Revolution

Rotation (spin on axis) = 24 hours = day/night cycle. Revolution (orbit around the sun) = 365.25 days = year and seasons.

Axial tilt (23.5°) causes the seasons -- not distance from the sun.

When the Northern Hemisphere tilts

toward the sun, it's summer there -- even though Earth is actually farthest from the sun in July.

166	The Moon & Tides	The moon's gravity pulls ocean water, creating high and low tides; the sun adds to the effect (spring tides at full/new moon).	Spring tides (highest) happen at full AND new moon; neap tides (lowest) at quarter moons.	Twice a day, coastal water rises (high tide) as the moon passes overhead and on the opposite side.
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167	Stars & Galaxies	Stars are massive balls of gas fusing hydrogen; our sun is a star. The Milky Way is a spiral galaxy of billions of stars.	A star's color indicates temperature: blue = hottest, red = coolest.	The sun is a medium-yellow star; blue stars are much hotter and burn out faster.
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168	Natural Resources & Conservation	Renewable (sun, wind, water) vs. nonrenewable (fossil fuels, minerals). Conservation reduces use and waste.	Renewable ? unlimited -- even solar needs maintenance; the label describes replenishment speed.	Wind power is renewable; coal is nonrenewable because it takes millions of years to form.
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Part 11: Social Studies -- History (18 Concepts)

U.S. and world history: causes, effects, and the people who shaped events.

#	Term	Key Facts	Strategy Tip	Example
169	Primary vs. Secondary Sources	Primary = made at the time by witnesses (letters, diaries, photos, laws). Secondary = later analysis (textbooks, biographies).	"First-hand evidence from the era" = primary; "written about the era later" = secondary.	The Declaration of Independence is a primary source; a history textbook chapter

about it is secondary.

170

Chronology &
Timelines

Events are ordered by time; timelines show sequence and duration at a glance.

Anchor major dates (1776, 1861, 1929, 1941) to navigate any timeline question.

Place in order: Revolutionary War (1775-83), Civil War (1861-65), WWI (1914-18), Great Depression (1929).

171

Cause & Effect in
History

Historical change has causes (underlying conditions) and effects (consequences); look for multiple causes, not one.

Ask "what conditions made this possible?" -- the deepest cause is often economic or political.

The Great Depression's causes included the 1929 stock crash, bank failures, and declining demand; its effect was the New Deal.

172

Colonial America &
Independence

13 colonies grew with self-government; unfair taxes (Stamp Act, Tea Act) and no representation triggered the Revolution; independence in 1776.

Connect the slogan "no taxation without representation" to the push for self-rule.

The Boston Tea Party protested the Tea Act; the Revolution followed from escalating colonial resistance.

173

The Constitution &
Federalism

Ratified 1788: creates the federal government, separates powers among three branches, and shares power with states (federalism).

Federalism = the federal/state power split -- the 10th Amendment reserves unlisted powers to states.

The federal government handles defense; states run schools and roads -- a federalist split.

174

The Bill of Rights

First ten amendments: speech, religion,

press, assembly, petition (1st); bear arms (2nd); no unreasonable search (4th); rights in criminal cases (5th-8th); reserved powers (10th).

Match amendment to right: 1 = speech/religion, 4 = search, 5 = fair trial.

A court throws out evidence from an illegal search -- that's 4th Amendment protection.

175

Westward Expansion

1803 Louisiana Purchase; Lewis & Clark expedition; Manifest Destiny pushed settlers west; railroads and the Gold Rush followed.

Manifest Destiny = the belief that U.S. expansion across the continent was inevitable and justified.

The Homestead Act (1862) gave land to settlers, accelerating westward settlement after the Civil War.

176

The Civil War

1861-65: North (Union) vs. South (Confederacy) over slavery and states' rights; Lincoln's Emancipation Proclamation (1863); Union victory ended slavery.

The deeper cause: slavery; the trigger: secession after Lincoln's election.

The 13th Amendment (1865) abolished slavery, a direct outcome of the Union's victory.

177

Reconstruction & Jim Crow

After the Civil War, the South was rebuilt and Black Americans gained rights (14th/15th Amendments), then segregation (Jim Crow) eroded them.

The 13th freed, 14th guaranteed equal protection, 15th gave Black men the vote -- then Jim Crow laws undermined all three.

Jim Crow "separate but equal" laws were upheld in Plessy v. Ferguson (1896), legalizing segregation.

178

Industrial Revolution

1800s: factories, railroads, steel, and oil transformed the economy; mass immigration supplied labor; labor unions formed for better conditions.

New technology + cheap labor +

urbanization = industrialization;
unions were its response.

The Bessemer process made cheap steel,
fueling skyscrapers, bridges, and
railroads.

179

World War I

1914-18: alliances and the assassination of
Archduke Franz Ferdinand triggered war;
the U.S. joined in 1917; ended with the
Treaty of Versailles.

U.S. entry (1917) was prompted by
unrestricted submarine warfare and
the Zimmerman telegram.

The Treaty of Versailles's harsh terms on
Germany set the stage for WWII.

180

The Great Depression
& New Deal

1929 stock market crash -> bank failures,
unemployment; FDR's New Deal created
relief programs (Social Security, WPA,
FDIC).

The New Deal = government
programs to relieve, recover, and
reform -- the safety-net state's
origin.

Social Security (1935) still provides
retirement income -- a New Deal legacy.

181

World War II

1939-45: Axis (Germany, Italy, Japan) vs.
Allies (U.S., Britain, USSR). Pearl Harbor
(1941) brought the U.S. in; atomic bombs
ended the Pacific war.

Sequence the turning points:
D-Day (1944), VE Day (May 1945),
VJ Day (Aug 1945).

The Japanese attack on Pearl Harbor on
Dec 7, 1941, brought the U.S. into the
war.

182

The Cold War

1947-91: U.S. vs. USSR rivalry without
direct war; nuclear deterrence, NATO vs.
Warsaw Pact, Berlin Wall, Korean/Vietnam
Wars.

"Cold" = no direct U.S.-USSR
combat -- they fought through
proxies and ideology.

The Cuban Missile Crisis (1962) brought
the superpowers closest to nuclear war.

183

Civil Rights Movement

1950s-60s: nonviolent protests (Montgomery bus boycott, March on Washington) won the 1964 Civil Rights Act and 1965 Voting Rights Act.

Key figures and events: MLK's "I Have a Dream," Brown v. Board (1954) ending school segregation.

Brown v. Board of Education overturned "separate but equal" schools; the 1964 Act banned discrimination.

184

Ancient Civilizations

Mesopotamian writing (cuneiform) and law (Hammurabi); Egyptian pyramids and pharaohs; Greek democracy and philosophy; Roman law and roads.

Match civilization to contribution: Rome = law, Greece = democracy, Egypt = architecture, Mesopotamia = writing.

Roman roads and aqueducts connected the empire; the Twelve Tables were Rome's written laws.

185

World Religions & Trade

Major religions (Christianity, Islam, Judaism, Hinduism, Buddhism) shaped cultures; the Silk Road and later ocean routes connected world trade.

Trade routes spread goods AND ideas -- religion, technology, and disease traveled with merchants.

The Silk Road carried silk from China westward and brought Buddhism eastward.

186

The Age of Exploration & Colonization

European powers (Spain, Portugal, Britain, France, Netherlands) explored and colonized the Americas, Africa, and Asia; the Columbian Exchange swapped crops, animals, and diseases.

The Columbian Exchange went both ways: potatoes/tomatoes came to Europe; horses/wheat went to the Americas -- and disease devastated native peoples.

European explorers brought smallpox to the Americas, causing massive population loss; they took maize and potatoes back to Europe.

How the U.S. government works: branches, rights, and citizenship.

#	Term	Key Facts	Strategy Tip	Example
187	The Three Branches	Legislative (Congress: makes laws), Executive (President: enforces laws), Judicial (Supreme Court: interprets laws).	"Legislature legislates, executive executes, judiciary judges" -- keep the verb matched to the branch.	Congress passes a law; the President signs/enforces it; the Supreme Court reviews whether it's constitutional.
188	Checks and Balances	Each branch limits the others: veto (executive over legislative), override (legislative over executive), judicial review (judicial over both).	The veto is balanced by a 2/3 Congressional override -- every check has a counter-check.	The President vetoes a bill; Congress overrides with a 2/3 vote; the Court strikes it down if unconstitutional.
189	Congress	Bicameral: House of Representatives (435, by population, 2-year terms) + Senate (100, 2 per state, 6-year terms).	The Senate represents STATES equally; the House represents POPULATION.	California has 52 House seats but the same 2 Senate seats as Wyoming.
190	The Presidency	President = head of state + head of government + commander-in-chief; 4-year term, max 2 terms (22nd Amendment).	The President's "power of the purse" is limited -- Congress appropriates money.	The President negotiates treaties, but the Senate must ratify them -- a check on executive power.
191	The Supreme Court	Nine justices, lifetime appointments; judicial		

review (*Marbury v. Madison*, 1803) lets the Court strike down unconstitutional laws.

Judicial review is NOT in the Constitution -- the Court claimed it in *Marbury v. Madison*.

The Court ruled school segregation unconstitutional in *Brown v. Board* (1954) using judicial review.

192

The Amendment Process

Proposed by 2/3 of both houses (or a convention), ratified by 3/4 of states. The Constitution has 27 amendments.

The bar is deliberately high -- amendments are rare because supermajorities are hard.

The 26th Amendment (voting age 18) took only months; the Equal Rights Amendment never got 3/4.

193

Citizenship & Naturalization

Birthright (born in the U.S. or to U.S. citizens) or naturalization: apply, meet residency/character/English/civics requirements, and take the oath.

The naturalization test covers civics and English -- the last step is the oath of allegiance.

A green-card holder living in the U.S. for 5+ years applies, passes the civics test, and takes the oath to become a citizen.

194

Voting & Elections

U.S. citizens 18+ vote; elections choose representatives at federal, state, and local levels; the Electoral College elects the President.

The popular vote elects Congress; the Electoral College (538 votes, 270 to win) elects the President.

A candidate wins the presidency with 270+ electoral votes even if another wins the nationwide popular vote.

195

Political Parties

Parties organize around shared platforms, nominate candidates, and mobilize voters; the U.S. has a two-party system (Democrats, Republicans).

A party's PLATFORM is its set of positions; third parties exist but rarely win federal races.

A platform may promise tax reform and healthcare changes; both major parties court the same voters with different plans.

196

Federal, State & Local
GovernmentFederal handles national
defense/currency/foreign policy; states
handle education/licensing/roads; local
handles police/fire/zoning.Match the level to the job: armies =
federal, driver's licenses = state,
sidewalks = local.The federal government prints money; a
state issues nursing licenses; a city runs
its fire department.

197

Rights &
Responsibilities of CitizensRights: vote, free speech, fair trial.
Responsibilities: jury duty, taxes, obeying
law, civic participation.Rights are what the government
can't do to you; responsibilities are
what you owe the community.Serving on a jury when called is a
responsibility; speaking freely at a town
meeting exercises a right.

198

Democracy & the Rule
of LawDemocracy = government by the people
(direct or representative); the rule of law
means everyone, including leaders, is
bound by the law."Government of laws, not of men"
-- no one is above the law, not
even the President.Even a sitting President can be sued for
private conduct -- an application of the
rule of law.

199

The Electoral College

Each state gets electors = House seats +
Senate seats (538 total); winner needs 270;
most states give all electors to the
popular-vote winner.California (52+2=54) has the most
electors; the Electoral College is
why swing states matter.In 2016 a candidate lost the popular vote
but won 304 electoral votes -- enough to
become President.

200

Interest Groups &
MediaInterest groups lobby for policy; media
informs and shapes public opinion; both are
protected by the 1st Amendment.Follow the money/agenda: an
interest group's ad and a news

report serve different purposes.

The NRA lobbies for gun-rights laws; a newspaper's editorial endorses a candidate -- both use the 1st Amendment.

Part 13: Social Studies -- Economics & Geography (14 Concepts)

Personal finance, markets, and the human/physical world.

#	Term	Key Facts	Strategy Tip	Example
201	Scarcity & Opportunity Cost	Resources are limited (scarcity); every choice gives up the next-best alternative (opportunity cost).	"What did I give up?" answers every opportunity-cost question -- it's the best foregone option, not all options.	Choosing a \$12 pizza over a \$20 book: the book is the opportunity cost of the pizza.
202	Supply and Demand	Demand rises when price falls; supply rises when price rises. The equilibrium price balances both.	Shortage = price too low (demand exceeds supply); surplus = price too high (supply exceeds demand).	A new console launches at a low price -> shortages -> price rises until demand falls to meet supply.
203	Market Structures	Perfect competition (many sellers, identical goods), monopoly (one seller), oligopoly (few sellers), monopolistic competition (many, differentiated).	Number of sellers is the key: one = monopoly, few = oligopoly, many = competition.	A local utility holding the only water service is a monopoly; three airlines dominate a route -- an oligopoly.
204	The Circular Flow	Households supply labor and buy goods; firms hire labor and sell goods; money flows one way while goods/services and resources flow the other.		

Households = providers of labor
AND consumers of goods; firms
are the opposite.

A worker's paycheck flows from firm to
household, then back to firms when the
worker shops.

205

GDP & Economic
Growth

GDP = total value of final goods/services
produced in a country in a year; growth =
rising real GDP.

GDP counts only FINAL goods --
not the value of parts resold in an
assembled product.

If a bakery buys flour for \$2 and sells
bread for \$5, GDP counts the \$5 bread,
not \$2 + \$5.

206

Inflation & Purchasing
Power

Inflation = a general rise in prices; each
dollar buys less (falling purchasing power).

Inflation hurts savers on fixed
incomes and helps borrowers -- the
dollar's value falls.

An item that cost \$100 last year costs
\$104 this year at 4% inflation -- your \$100
buys less.

207

Unemployment Types

Frictional (between jobs), structural (skills
no longer needed), cyclical (economic
downturn).

Cyclical unemployment follows the
business cycle -- recessions cause
it; frictional is temporary and
normal.

A factory closes in a recession (cyclical); a
typist whose job is automated needs
retraining (structural).

208

Fiscal & Monetary
Policy

Fiscal = government taxes/spending
(Congress, President). Monetary = money
supply/interest rates (Federal Reserve).

Fiscal = Congress's lever;
monetary = the Fed's lever. Don't
swap them.

To fight a recession, Congress cuts taxes
(fiscal) while the Fed lowers interest rates
(monetary).

209

The Federal Reserve

The U.S. central bank: sets interest rates, controls the money supply, regulates banks; aims for stable prices and full employment.

The Fed fights inflation by RAISING rates (borrowing gets costlier) and boosts growth by LOWERING them.

To cool inflation, the Fed raises the federal funds rate, making mortgages and loans more expensive.

210

Taxes & Budgets

Types: income, payroll, sales, property, corporate. A budget deficit = spending > revenue; surplus = revenue > spending.

Progressive taxes take a larger share from higher incomes; sales taxes hit everyone at the same rate.

The federal income tax is progressive; a 7% state sales tax is the same for rich and poor shoppers.

211

Personal Finance Basics

Budgeting (track income vs. expenses), saving (emergency fund), credit (borrow responsibly, build score), interest: earn it saving, pay it borrowing.

Compound interest works for savers (earning) and against borrowers (paying) -- start saving early.

A \$1,000 deposit at 5% compounds to \$1,050 after year one, \$1,102.50 after year two -- interest on interest.

212

Global Trade & Comparative Advantage

Countries export what they produce at relatively lower cost and import the rest; tariffs tax imports; trade deficits = imports > exports.

Comparative advantage = doing what you're relatively BEST at, then trading -- everyone gains.

A country good at both coffee and cars exports coffee and imports cars if its coffee edge is larger.

213

Geography: Maps & Tools

Latitude (parallels, horizontal), longitude (meridians, vertical), scale, legend, compass rose; GIS layers data.

Latitude = "flatitude" (flat lines run east-west); longitude lines run pole

to pole.

Coordinates 40°N, 74°W (latitude, longitude) locate New York City on a map.

214	Human-Environment Interaction	People adapt to, depend on, and modify their environment (dams, irrigation, mining); consequences can be positive or negative.	Read the question: "adapt" = change behavior, "modify" = change the environment.	People in Arizona build canals to bring water (adaptation to aridity) that modifies the landscape.
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Part 14: Final Review & Test-Day Strategy (14 Concepts)

How to lock in readiness: study plans, essay timing, format choice, and the check-in rules that decide test day.

#	Term	Key Facts	Strategy Tip	Example
215	The Official Study Companion	ETS publishes a free HiSET Study Companion per subtest with content outlines and sample questions at hiset.org.	Read the Study Companion BEFORE drilling -- it defines exactly what can be asked.	A candidate checks the Math Study Companion and finds data analysis listed -- and adds it to the week's practice.
216	The HiSET Formula Sheet	The Math subtest provides the formula sheet with area, volume, and geometric formulas -- you don't memorize them, you learn to USE them.	Practice with the sheet open so test-day lookup is automatic -- never solve blind.	Need the area of a trapezoid? The formula sheet's version matches the test's notation -- no recall needed.
217	Calculator Use & Policy	A calculator is permitted for the Mathematics subtest. Bring an approved model or use the on-screen one; other subtests ban calculators.	Learn the on-screen calculator	

before test day so you're not fumbling for basic operations.

During the 90-minute Math subtest, a candidate uses the calculator only for messy arithmetic -- not for logic problems.

218

Study Plan: Weakest Subtest First

Target the subtest farthest below 8 first: it gates the credential, and it has the most room to improve.

Spend 50% of study time on the weakest subtest, 30% on the second, 20% on review.

With Math at 5 and Reading at 11, a candidate schedules Math first and gives it the majority of prep hours.

219

Practice-Test Protocols

Take full-length practice tests under real timing with no breaks, then review EVERY wrong answer to find the pattern.

Track mistake types (careless, content, time) -- fix the biggest category first.

A candidate sees 60% of errors are careless and starts re-reading questions twice before answering.

220

Essay Timed Practice

Write the essay in 45 minutes or less: 5 plan, 30 write, 10 proofread. Practice to a timer before test day.

A full essay beats a polished half -- always finish with a conclusion.

A timed practice ends with intro, two body paragraphs, and a conclusion at 43 minutes -- ready for test conditions.

221

Choosing Computer or Paper

Computer offers on-screen tools and typed essay; paper offers handwritten essay and physical scratch work. Match the format to your strengths.

If your handwriting is fast and legible and you dislike typing, paper is a reasonable choice.

A candidate who types 60 wpm chooses computer for the Writing subtest; another with slow typing picks paper.

222

ID & Check-In Rules

Bring a valid, current government-issued

photo ID matching your registration name EXACTLY; arrive 30 minutes early.

A name mismatch or expired ID means no test and a forfeited fee -- fix both before booking.

The registration says "Robert J. Smith" and the driver's license says the same -- check-in passes without a hitch.

223

Prohibited Items

Phones, smart watches, headphones, notes, and calculators (outside Math) are banned from the testing room at test centers and during remote proctoring.

Leave everything except ID in the car or a locker; remote proctors scan the room on camera.

A candidate removes a smart watch before entering -- one buzz would forfeit the subtest.

224

Scheduling the Battery

Subtests can be taken in any order and combination. Doing all five in one day takes ~7.5 hours and is generally NOT recommended.

Pair two subtests per visit (e.g., Math + Science) over three sessions for better stamina.

A candidate books Math on Saturday, Science + Social Studies the next Saturday, and Reading + Writing the week after.

225

Using Free Retakes Wisely

Each subtest purchase includes two free retakes within 12 months. Don't burn one on a near-pass -- prep harder first.

If you scored a 6 or 7, the content is close -- a focused two-week review usually crosses the line.

A candidate scores 7 on Science, reviews the missed categories for two weeks, and passes on the first free retake.

226

Test-Day Mentality

Sleep 7+ hours, eat beforehand, arrive early, and treat every question with full effort -- unscored pretest items hide among the scored ones.

Don't dwell on a hard question; flag it, move on, and return if time allows -- every question counts equally.

Mid-Science, a candidate skips a tough physics item, answers the rest, then returns with 8 minutes left and solves it.

227	After You Pass: The Credential	Passing earns a state-issued high school equivalency credential and transcript -- recognized by employers, colleges, and apprenticeships.	Order extra transcripts for applications; employers verify the credential like a diploma.	A graduate sends the credential to an employer, a community college, and a union apprenticeship -- one credential, three doors opened.
228	Re-taking the Whole Battery	If a subtest is failed multiple times, review your state's retesting rules -- some states limit attempts per year; the free retakes cover the first two retests per purchase.	Retake only the failed subtest -- passed subtest scores remain valid, so never redo a passing one.	A candidate passed Reading, Writing, and Social Studies, then failed Math twice -- they retake ONLY Math.