

APPENDIX A
TEST ITEM DEVELOPMENT FORM

TEST ITEM DEVELOPMENT FORM

(Test Item Reference Number)

SIGNATURE

DATE

Developed by:

Test Item Format:

Short Answer _____

Reviewed by (SME):

Multiple Choice _____

Essay _____

Other _____

Reviewed by (IT):

Approved by:

Purpose of test item (i.e., objectives tested, areas covered, content tested): _____

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Reference to course material (which lecture/lesson plan, what references, page numbers):

Test item statement (provide complete test item with point values): _____

Test item response (model answer and grading criteria, including partial credit): _____

Alternate acceptable answers: _____

APPENDIX B
ACTION VERBS

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ACTION VERBS

TABLE 1. Action verbs versus level for the cognitive domain.

Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
define	convert	apply	analyze	arrange	appraise
describe	defend	associate	appraise	assemble	assess
identify	describe	build changes	break down	categorize	choose
label	diagram	calculate	classify	collect	compare
list	discuss	choose	compute	combine	conclude
locate	distinguish	appropriate	conclude	compile	contrast
match	estimate	procedures	contrast	compose	criticize
memorize	expand	collect	criticize	construct	critique
name	explain	information	debate	create	decide
outline	express	compute	determine	design	describe
recall	extend	construct	diagram	develop	develop
recite	generalize	demonstrate	differentiate	devise	criteria
recognize	given examples,	discover	discern	explain	discriminate
record	identify	dramatize	discover	forecast	estimate
relate	illustrate	employ	discriminate	form	evaluate
repeat	infer	find solutions	distinguish	formulate	explain
reproduce	interpret	illustrate	examine	generalize	interpret
state	locate	interpret	experiment	generate	judge
select	measure	locate	generalize	hypothesize	justify
tell	outline	manipulate	identify	manage	make
	paraphrase	modify	illustrate	modify	judgement
	predict	operate	infer	organize	measure
	recognize	perform	inspect	plan	rate
	reconstruct	practice	inventory	predict	revise
	report	put in	locate	prepare	score
	restate	operation	note	produce	select
	review	relate	organize	propose	summarize
	rewrite	repair	outline	rearrange	support
	summarize	schedule	point out	reconstruct	
	translate	shop	question	relate	
		show	relate	reorganize	
		sketch	select	revise	
		solve	separate	rewrite	
		translate	solve	set up	
		write	subdivide	structure	
			test	summarize	
				tell	
				theorize	
				write	

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ACTION VERBS

TABLE 2. Action verbs versus level for the affective domain.

Awareness	Reinforcement	Promotion	Defense
ask accept accumulate attends to be aware of choose combine control describe differentiate follow reads receive recognize reply responds select separate set apart share	acclaim adhere applaud approve augment commend comply conform discuss follow obeys play practice praise volunteer	accepts adhere advocate alter argue assist encourage follow help initiate justify model prefers propose subsidize select support	abstract act argue arrest avoid balance debate defend define discriminate display formulate influence intervene manage organize prevent resist resolve

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ACTION VERBS

TABLE 3. Action verbs for the psychomotor domain.

The Psychomotor Domain				
acknowledge	compare	heat	override	shutdown
activate	complete	heat up	perform	sketch
actuate	compute	hoist	plot	splice
add	connect	hold	position	spray
adjust	control	identify	prepare	start
align	cool	immerse	pressurize	start up
alternate	correct	increase	prime	steer
analyze	construct	inform	print	stop
apply	cut	inspect	pull	store
assemble	couple	install	pump	switch
assess	decrease	insert	push	supply
assist	deenergize	isolate	purge	synchronize
backwash	depress	investigate	rack in/out	tagout
balance	deselect	jog	raise	test
begin	detect	letdown	reactivate	throttle
bleed	dilute	lineup	read	titrate
block	direct	load	rebuild	trace
boil	disassemble	locate	recirculate	track
borate	disconnect	lock	record	transfer
build	display	lower	regulate	transmit
bypass	dispose	lubricate	release	transport
calculate	dissolve	maintain	remove	trip
calibrate	don	maneuver	repair	tune
call	draft	manipulate	replace	turn
center	draw	measure	return	type
change	energize	mix	rinse	unlatch
charge	enter	monitor	run	unload
check	establish	move	sample	unlock
choose	estimate	neutralize	scan	uncouple
circulate	exit	observe	secure	vent
clean	feed	obtain	select	warm
clear	fix	open	sequence	warmup
close	flush	operate	service	weigh
code	formulate	organize	sharpen	weld
collect	guide	overhaul	shut	withdraw
				zero

APPENDIX C
TEST ITEM EXAMPLES

APPENDIX C

TEST ITEM EXAMPLES

C.1 Short-Answer Test Item Examples

Satisfactory:

Test item:

Define the following terms:

- (a) Minimum critical power ratio (MCPR)
- (b) Rod density
- (c) Maximum fraction limiting power density (MFLPD).

Answer:

- (a) MCPR is the smallest critical power ratio that exists in the core.
- (b) Rod density is the number of control rod notches inserted as a fraction of the total number of notches.
- (c) MFLPD is the largest value of fraction limiting power density that exists in the core.

Unsatisfactory:

Test item:

Select the words from the list provided to complete the simplified descriptions. Place the letter corresponding to each answer in the blanks. Each correct response is worth two (2) points.

- (a) The _____ critical power ratio (MCPR) is the smallest CPR that exists in the core.

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- (b) Rod density is the number of control rod notches _____ as a fraction of the total number of control rod notches. One hundred percent rod density is achieved when all rods are _____.
- (c) The _____ fraction of limiting power density is the _____ value of FLPD that exists in the core.

Word List:

- (a) Maximum (c) Smallest (e) Inserted
(b) Minimum (d) Largest (f) Withdrawn

Answer:

- (a) 2
(b) 5,5
(c) 1,4.

Comment:

- Since the alternatives are provided, this is actually a matching test item.
- Completion test items should not be used if the intent is to test complex knowledge.
- The answer choices are identified by numbers not letters (does not match instructions).
- The word list includes synonymous distractors (e.g., maximum versus largest, smallest versus minimum).
- The acronym MCPR identifies the correct answer as beginning with "M."

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Satisfactory:

Test item:

Procedure AOP-2-1909, 'Inability to Shut Down with Control Rods,' states that when certain conditions are present, the shift supervisor is required to use the standby liquid control system to shut down the reactor.

List the four conditions identified in Procedure AOP-2-1909 that must be considered by the shift supervisor in determining the need to shut down the reactor using the standby liquid control system. (4 points)

Answer:

- (a) Five (5) or more adjacent control rods are not inserted past the 06 position.
- (b) Thirty (30) or more total control rods are not inserted past the 06 position.
- (c) Reactor pressure vessel level cannot be maintained.
- (d) Suppression pool water temperature cannot be maintained below 110°F.

Unsatisfactory:

Test item:

Procedure AOP-2-1909, 'Inability to Shut down with Control Rods,' states that '...if at any time, either condition b(1) or b(2) exists, and cannot be shut down and, either (a.1) or (a.2), and if it is obvious that within the reactor, in the judgment of the shift supervisor (or in his absence, a licensed operator), a hazard exists to the environs, personnel or the plant, use the standby liquid control system per AOP-2-1400....' (4 points)

- (a) List conditions (a.1) and (a.2).

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(b) List conditions b(1) and b(2).

Answer:

(a.1) RPV level cannot be maintained. (1.5 points)

(a.2) Suppression pool water temperature cannot be maintained below 110°F.
(1.5 points)

b(1) Five (5) or more adjacent control rods not inserted below the 06 position.
(0.5 points)

b(2) Thirty (30) or more total control rods not inserted below the 06 position.
(0.5 points)

Comment:

- Response blanks should occur at or near the end of a test item after sufficient information has been provided to establish exactly what the problem is and what frame of reference should be used to arrive at the solution.
- Response blank labels are unnecessarily complicated b(1), b(2), (a.1), (a.2), versus 1, 2, 3, and 4.
- If blanks are used, they should either be of sufficient size to write in the answers, or a separate location should be provided for the answers.
- There is no apparent reason for assigning different values to the four responses, and the trainee will not be aware of the differential weighing.

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C.2 Matching Test Item Examples

Satisfactory:

Test item:

Select the answers needed to complete each sentence. Write the letter of each answer in the blank provided.

In the containment air return system, both fans are actuated upon the _____ actuation signal but are delayed starting for _____ minutes. They continuously draw air from the dome of the containment vessel and from the following pocketed spaces _____, _____, _____, and _____. (6 points)

- | | |
|------------------------------------|-----------------------------------|
| (a) High pressurizer pressure | (g) Accumulator spaces |
| (b) Containment high-high pressure | (h) Lower containment compartment |
| (c) Two | (i) Cable penetration area |
| (d) 10 | (j) Steam generator enclosures |
| (e) 60 | (k) Pressurizer enclosure |
| (f) Instrument room | (l) Upper containment. |

Answer:

(b), (d), (f), (g), (i), and (k).

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Unsatisfactory:

Test item:

In the containment air return system, both fans are actuated upon a _____ actuation signal but are delayed starting for _____ minutes. They continuously draw air from the dome of the containment vessel and from the following pocketed spaces _____, _____, _____, and _____. (6 points)

- | | |
|-----------------------------------|------------------------------------|
| (a) One hour | (g) Ten minutes |
| (b) Instrument room | (h) Containment high-high pressure |
| (c) HPZ | (i) Cable penetration area |
| (d) Accumulator spaces | (j) S/G enclosures |
| (e) One minute | (k) Pressurizer enclosure |
| (f) Lower containment compartment | (l) Upper containment compartment |

Answer:

(h), (g), (b), (d), (j), and (k).

Comment:

- Directions are implied but not given.
- Abbreviations are used when complete terms should be specified. (HPZ, S/G).
- Distractors are not logically grouped (i.e., by signal, time, and spaces).

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- Answers are not appropriate for blanks (i.e., ten minutes).
- Number of points available has not been stated.
- Blanks are not same size.
- Avoid specific determiners before blanks, like "a" or "an."

Test item:

Subatomic particles have certain properties. Match the names of the following particles with their properties by writing the letter representing the particle next to its properties: (10 points)

<u>PARTICLES</u>	<u>PROPERTIES</u>
(a)—Alpha	___1. Very small mass, one negative charge
(b)—Electron	___2. Very small mass, one positive charge
(c)—Meson	___3. Mass 1 unit, no charge
(d)—Neutrino	___4. Mass 1 unit, one positive charge
(e)—Neutron	___5. Mass 4 units, two positive charges.
(f)—Positron	
(g)—Proton	

Answer:

1 (b), 2 (f), 3 (e), 4 (g), and 5 (a) (2 points for each answer)

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C.3 Multiple-Choice Test Item Examples

Satisfactory:

Test item:

After a long refueling outage, a reactor startup is performed, and criticality is achieved in the source range. How would you hold reactor power level constant (in the source range) for 8 hours while surveillances are conducted? (2 points)

- (a) Adjust rods
- (b) Adjust boron concentration
- (c) Adjust reactor coolant system temperature
- (d) No adjustments required.

Answer: (a).

Unsatisfactory:

Test item:

During a cold S/U, a long refueling outage, with power level below the point of adding heat, you are asked to hold the reactor power level steady for several hours while surveillances are being conducted. During this period of time you may be doing any of the following to hold power constant. Pick the best answers:

- (a) Withdrawing rod slowly
- (b) Inserting rods slowly
- (c) Diluting boron slowly

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(d) Borating slowly

(e) Holding rods and boron at a constant level.

Explain your answer.

Answer: (a) and (b).

Comment:

- The stem suggests more than one response.
- There should be one clear best or correct response.
- An essay test item is mixed with a multiple-choice test item.
- The conditions in the stem are not precise; confusion exists as to the best answers.
- Acronyms such as S/U should be avoided.
- Available points are not stated.

Test item:

Why are reactivity adjustments required to hold the reactor power level constant (in the source range)? (2 points)

- (a) To compensate for doppler feedback
- (b) To compensate for the condition that K_{eff} cannot be exactly one
- (c) To compensate for power coefficients

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- (d) No adjustments required, the inherent power coefficients will maintain the reactor at constant power.

Answer: (b).

C.4 Essay Test Item Examples

Satisfactory:

Test item:

Assume the reactor is at 100% power. For each of the following reactor protective system trips, state (a) the sensed parameter, (b) the limiting safety system setting (LSSS), and (c) the protection provided.

- (1) High power level trip (3 points)
- (2) Low reactor coolant flow trip (3 points)
- (3) Steam generator differential pressure trip (3 points)

Answer:

- (1) (a) Neutron flux (thermal backup) is sensed.
(b) LSSS @ 100% is 107% of rated power.
(c) Prevents clad damage due to reactivity excursions too rapid to be detected by pressure/temperature trips.

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- (2) (a) Reactor coolant system (RCS) differential pressure across each steam generator (SG) is sensed.
- (b) LSSS @ 100% is 95% of max flow.
- (c) Protects the core against departure from nucleate boiling (DNB).
- (3) (a) Secondary differential pressure across each SG is sensed.
- (b) LSSS @ 100% is 135 psid.
- (c) Protects against departure from nucleate boiling (DNB) and high linear heat rate.

Unsatisfactory:

Test item:

For each of the reactor protective system trips listed below, state the sensed parameter, the limiting safety system setting, and what each trip protects against. Only the LSSS that would apply at 100% power is required. (3.5 points)

- (a) High power level (1.0)
- (b) Low reactor coolant flow (1.0)
- (c) Steam generator differential pressure (1.0)
- (d) Containment high pressure (sensed parameter is NOT required). (0.5)

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Answer:

- (a) Neutron flux (thermal backup) is sensed (0.3)

LSSS @ 100% is 107% of rated power (0.2)

Prevents clad damage due to reactivity excursions too rapid to be detected by pressure/temperature trips (0.5)

- (b) RCS differential pressure across each SG is sensed (0.3)

LSSS @ 100% is 95% of max flow (0.2)

Protects against DNB (0.5)

- (c) Secondary differential pressure across each SG is sensed (0.3)

LSSS @ 100% 135 psid (0.2)

Protects the core against DNB (0.5)

- (d) LSSS @ 100% is 5 psig (0.1)

Assures reactor is tripped whenever SG is sensed (0.4)

Reference: FCS TS 1.3, p. 1-7 to 1-10.

Comment:

- The developer has assigned different values to responses (i.e., state the sensed parameter, limiting safety system setting, and what each trip protects against).
- Abbreviations are used instead of complete wording.

APPENDIX D
EXAM TEST ITEM REVIEW CHECKLIST

EXAM TEST ITEM REVIEW CHECKLIST

The following checklist presents points that should be incorporated when constructing test items from the learning objectives for the written examination.

D.1 General Guidance

- Does the concept being measured have a direct, important relationship to the ability to perform the job?
- Does the test item match the learning objective? Does each test item measure one specific concept and reflect the actions, conditions, and standards of the objective being tested?
- Is the test item clear, concise, and easy to read? Does the test item contain only information relevant to the problem posed? Could it be stated more simply and still provide the necessary information? Can it be reworded or split up into more than one test item?
- Does the test item provide all necessary information, conditions, and assumptions needed for a fully correct response?
- Is the test item written at the highest appropriate level of knowledge or ability for the job position of the trainee being tested?
- Is the test item grammatically correct?
- Is the test item free of tricky wording and clues to the correct answer?
- Is the test item free of unnecessary difficulty or irrelevancy?
- Is the reading level appropriate for the target audience?

EXAM TEST ITEM REVIEW CHECKLIST

- Is the test item limited to one concept or topic?
- Are directions completing individual test items necessary for clarity? Do they repeat standard instructions provided to trainees at outset of testing?
- Does the test item have face validity?
- Are key points underlined?
- Is each test item separate and independent of all other test items?
- Are all parts of the test item on the same page?
- Are all required material, drawings, and accompanying test items clearly identified?
Can the trainee easily locate them?
- Is there sufficient space provided for answers?
- Are the less difficult test items at the beginning of each section?
- Have your test items been reviewed by others?

EXAM TEST ITEM REVIEW CHECKLIST

D.2 Point Values

- Point values are specified for whole test items and all subordinate parts (if more than one response is required).
- Values are assigned relative to other test items in terms of:
 - significance of successful performance of associated objective to task performance
 - learning difficulty and cognitive level
 - number of responses required
 - difficulty of problem.
- Specific values are assigned for parts of short-answer and essay test items.
- Test items which test the same objective have comparable point values.

D.3 Short-Answer Test Items

- Is there one, short, definitely correct answer for each test item?
- Does the scoring key follow directly from the test item?
- Are clues to the answer avoided?
- Is the required degree of precision specified? For test items requiring computation, specify the degree of precision expected. Try to make the answer turn out to be whole numbers.
- Are the test item statements simple and direct without extensive qualification?

EXAM TEST ITEM REVIEW CHECKLIST

- Are the test item blanks the same length regardless of the number of words to be entered?
- Does the test item wording avoid grammatical clues to the correct response such as "a" or "an" before the blank?
- Limit the space allocated for each answer to encourage a single word or short phrase.
- For fill-in-the-blank test items, arrange the blanks to be of equal but adequate length.
- For fill-in-the-blank test items, do not omit words that are interdependent.
- For fill-in-the-blank test items, do not make sentences unrecognizable by leaving too many blanks.
- For a completion table, do not have more than six items in one column.
- For a completion diagram, include only necessary features and ensure that components are clearly referenced.
- Compose a detailed model answer, identifying important statements, steps, or parts, and allocate points for each test item subpart.

D.4 Multiple-Choice Test Items

- Does the test item have one focused topic, making it something other than a collection of true/false test items? Does the stem clearly express a single problem in a direct manner followed by response?
- Does the test item provide sufficient information to provide a basis for formulating the response?

- Is the test item or problem defined in the stem?
- Are tricky or irrelevant test items avoided?
- Are the answer options homogeneous, highly plausible, and comparable length?
- Are "none of the above" and "all of the above" avoided?
- Is one response clearly the correct or best answer accompanied by three or four distractors?
- Is each test item stated positively, unless the intent is to test knowledge of what not to do?
- Is the test item free of "specific determiners" (e.g., logical or grammatical inconsistencies, incorrect answers which are consistently different, verbal associations between the stem and the answer options)?
- Are common misconceptions used as distractors?
- Are the answer options of the test items ordered sequentially?
- Is the test item free of trivial distractors? Does the stem include irrelevant, trivial detail or instructive information?
- Are the references, attachments, and data included in the stem or identified following the stem? The drawings accompanying the stem may proceed, be to the right of, or below responses or distractors as space permits.
- Are the correct responses varied from test item to test item in a random fashion?
- Are there equivalent and/or synonymous options that rule out both options for a trainee who recognizes the equivalence.

EXAM TEST ITEM REVIEW CHECKLIST

D.5 True or False (Multiple-Choice) Test Items

- Does the test item address only one idea or concept in a declarative statement?
- Is the test item either completely true or completely false?
- Is the test item too long or overly complex with qualifying statements?
- Is the test item free of absolute and indefinite terms such as always and sometimes and does it contain no double negatives?
- Are false statements plausible and not false because of trivial detail?

D.6 Matching Test Items

- Are tricky or irrelevant test items avoided?
- Is there a clearly correct answer or answers to the test item?
- Are clues to the answer avoided (e.g., grammatical clues, response patterns)?
- Do the directions clearly tell the trainees the basis on which to make the match and how to indicate their answers?
- Do the directions tell whether responses can be used more than once?
- Is each response a plausible answer for each premise?
- Are there more responses than premises if each response can only be used once?
- Are the responses arranged on one page in a logical order?

EXAM TEST ITEM REVIEW CHECKLIST

- Is the test item arranged so that the trainees can mark their answers easily?

D.7 Essay-Format Test Items

- Is the test item clearly and concisely worded WITHOUT AMBIGUITY?
- Does the test item illicit the correct response and no other responses? Does it clearly place bounds on the required response?
- Are point values, expected time to respond, expectations for exact answers or estimates clearly identified?
- Is enough information supplied to allow the knowledgeable trainee to correctly respond?
- Is the test item free of negative statements?
- Is the sample answer constructed to minimize subjectivity in grading? Are all significant requirements clearly identified, each with specific point values? Are alternate acceptable responses also included with the sample answer, where appropriate?

D.8 Drawing or Labeling Test Items

- Are clear instructions provided concerning what is to be drawn, labeled, or sketched?
- Are clean, readable illustrations provided with parts to be labeled specifically identified?
- Does the test item require only one type of response per diagram?

EXAM TEST ITEM REVIEW CHECKLIST

- Are spaces provided for answers that require labeling a given drawing?
- Does the test item provide sufficient space for the required drawing/sketch?
- Are the points allocated for all parts of the drawing/sketch?