

UNITED STATES NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

November 13, 1997

NOTE TO:

Documert Control Desk

FROM:

Sandra Figueroa, Licensing Assistant Division of Reactor Controls and Human Factors **Operating Licensing Branch**

OCTOBER 1997 GENERIC FUNDAMENTALS EXAMINATION (GFE) SUBJECT:

Enclosed please find the October, 1997 GFE examination and answer key to be placed in the PDR. If you have any questions I can be contacted at 415-1065.

Enclosure: As stated

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UNITED STATES NUCLEAR REGULATORY COMMISSION PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION OCTOBER 1997 - FORM A

September 12, 1997

Please Print	
Name:	
Facility:	
Docket No.:	
Start Time:	Stop Time:

INSTRUCTIONS TO APPLICANT

Answer all the test items using the answer sheet provided. Each item has equal point value. A score of at least 80% is required to pass this portion of the written licensing examination. All examination papers will be collected 3.0 hours after the examination starts. This examination applies to a typical pressurized water reactor (PWR) power plant.

SECTION	QUESTIONS	% OF TOTAL	SCORE
COMPONENTS	1 - 44		
REACTOR THEORY	45 - 72		Andrewski war i bili da kanana in grandani nananana na ana ana a
THERMODYNAMICS	73 - 100		
TOTALS	100		

All work done on this examination is my own. I have neither given nor received aid.

Applicant's Signature

RULES AND GUIDELINES FOR THE GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

- MOTE: The generic term "control rod" refers to the length of neutron absorber material that can be positioned by the operator to change core reactivity.
- 1. Print your name in the blank provided on the cover sheet of the examination.
- 2. Fill in the name of your facility.
- 3. Fill in your individual docket number.
- 4. Fill in your start and stop times at the appropriate time.
- 5. Two aids are provided for your use during the examination:
 - (1) An equations and conversions sheet contained within the examination copy, and
 - (2) Steam tables provided by your proctor.
- Place your answers on the answer sheet provided. Credit will only be given for answers properly marked on this sheet. Follow the instructions for filling out the answer sheet.
- 7. Scrap paper will be provided for calculations.
- Cheating on the examination will result in the automatic forfeiture of this examination. Cheating could also result in severe penalties.
- 9. Restroom trips are limited. Only **ONE** examinee may leave the room at a time. In order to avoid the appearance or possibility of cheating, avoid all contact with anyone outside of the examination room.
- 10. After you have completed the examination, sign the statement on the cover sheet indicating that the work is your own and you have not received or been given any assistance in completing the examination.
- 11. Turn in your examination materials, answer sheet on top, followed by the examination booklet, then examination aids steam table booklets, handouts and scrap paper used during the examination.
- 12. After turning in your examination materials, leave the examination area, as defined by the proctor. If after leaving you are found in the examination area while the examination is in progress, your examination may be forfeited.

GENERIC FUNDAMENTALS EXAMINATION EQUATIONS AND CONVERSIONS HANDOUT SHEET

EQUATIONS

$Q = \dot{m}c_{p}\Delta T$	$P = P_0 10^{SUR(t)}$
Q = mah	$P = P_0 e^{(t/t)}$
$Q = UA\Delta T$	$A = A_0 e^{-\lambda t}$
Q ~ min Gro	$CR_{S/D} = S/(1 - K_{eff})$
$\Delta T = m^2$	$CR_1(1 - K_{eff1}) = CR_2(1 - K_{eff2})$
al a man are	$1/M = CR_1/CR_x$
$K_{eff} = 1/(1 - p)$	$DRV \sim \phi_{tip}^2 / \phi_{svg}^2$
$p = (K_{eff} - 1)/K_{eff}$ SUR = 26.06/T	F = PA
Ā . o	$\dot{m} = \rho \lambda \nabla$
$\tau = \frac{p - p}{\lambda_{eff} p}$	$W_{Pump} = \dot{m} \Delta P \upsilon$
r' <u>B</u>	E = IR
$\rho = \frac{\tau}{\tau} + \frac{\rho}{1 + \lambda_{aff}\tau}$	Eff. = Net Work Out/Energy In
$' = 1 \times 10^{-4}$ seconds	$U(P_2 - P_1) + (\vec{v}_2^2 - \vec{v}_1^2) + g(z_2 - z_1) = 0$
$N_{eff} = 0.1 \text{ seconds}^{-1}$	2g _c g _c
	$g_c = 32.2 \ lbm-ft/lbf-sec^2$

CONVERSIONS

1	Mw	=	3.41 x 106 Btu/	hr 1	Curie	=	3.7 x 1	10 ¹⁰ dps
1	hp	=	2.54 x 103 Btu/	hr 1	kg	=	2.21 11	om
1	Btu	=	778 ft-1bf	1	galwacer	=	8.35 lb	om
°C		=	(5/9)(°F - 32)	1	ft ³ water	=	7.48 ga	ıl
°F		=	(9/5) (°C) + 32					

QUESTION:	1
TOPIC:	191001
KNOWLEDGE :	K1.02
QID:	P1504

Which one of the following is a difference between a typical relief valve and a typical safety valve?

- A. The actuator closing spring on a relief valve is in a compressed state whereas the actuator closing spring on a safety valve acts in tension.
- B. A relief valve gradually opens as pressure increases above the setpoint pressure whereas a safety valve fully opens at the setpoint pressure.
- C. Relief valves are capable of being gagged whereas safety valves are not.
- D. The blowdown of a relief valve is greater than the blowdown of a safety valve.

ANSWER: B.

QUESTION: 2 TOPIC: 191001 KNOWLEDGE: K1.07 QID: P503 (rev)

Which one of the following valves is used to control the direction of fluid flow and prevent backflow in a system?

A. Gate valve

- B. Relief valve
- C. Globe valve

D. Check valve

QUESTION:	3
TOPIC:	191001
KNOWLEDGE :	K1.08
QID:	P1405

Refer to the cutaway-view drawing of a valve (see figure below). Which one of the following describes the type of valve shown?

- A. Rising-stem gate valve
- B. Nonrising-stem gate valve
- C. Rising-stem globe valve
- D. Nonrising-stem globe valve

ANSWER: B.



QUESTION:	4	
TOPIC:	191001	
KNOWLEDGE :	K1.09	
QID:	P1104	(Rev)

Gate valves generally are not used to throttle fluid flow because:

- A. rapid changes in fluid direction through the valve cause a large unrecoverable system head loss.
- B. gate valves experience stem leakage when partially open.
- C. the turbulent flow created by a partially opened gate valve causes excessive seat and disk wear.
- D. the large size of the valve disk requires an oversized actuator to position the valve accurately.

ANSWER: C.

QUESTION:	5
TOPIC:	191002
KNOWLEDGE :	K1.02
QID:	P705

A steam flow measuring instrument uses density compensation and square root extraction to convert the differential pressure across the flow element to lbm/hr.

The purpose of square root extraction in this flow measuring instrument is to convert ______ to _____

A. volumetric flow rate; mass flow rate

B. volumetric flow rate; differential pressure

C. differential pressure; mass flow rate

D. differential pressure; volumetric flow rate

QUESTION:	6
TOPIC:	191002
KNOWLEDGE :	Y.1.04
QID:	P1608

Refer to the drawing of a horizontal pipe elbow (top view) in an operating water system (see figure below).

Three separate bellows differential pressure flow detectors are connected to taps A, B, C, and D as follows:

DETECTOR	1	TAPS		
AD	A	and	D	
BD	В	and	D	
CD	C	and	D	

Assuming zero head loss in this section of pipe, how will the detectors be affected if tap D ruptures?

A. All detectors will fail low.

B. All detectors will fail high.

C. Two detectors will fail low and one will fail high.

D. Two detectors will fail high and one will fail low.

ANSWER: A.



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QUESTION: 7 TOPIC: 1910C2 KNOWLEDGE: K1.05 QID: P908

Which one of the following flow measuring devices produces the largest unrecoverable head loss when used in an operating fluid system?

A. Orifice

B. Venturi

C. Pipe elbow

D. Flow nozzle

ANSWER: A.

QUESTION:	8
TOPIC:	191002
KNOWLEDGE :	K1.17
QID:	P1612

A reactor is shut down at 100 cps in the source/startup range when a loss of coolant accident occurs. Which one of the following describes excore source/startup range neutron level indication as homogeneous core voiding increases from 20% to 40%?

A. Increases because more neutron leakage is occurring

B. Decreases because less neutron leakage is occurring

C. Increases because K_{eff} is increasing

D. Decreases because Kett is decreasing

ANSWER: A.

QUESTION: 9 TOPIC: 191002 KNOWLEDGE: K1.06 QID: P608 (Rev)

Refer to the drawing of two tank differential pressure (D/P) level indicators (see figure below).

Two D/P level indicators are installed on a large water storage tank. Indicator 1 was calibrated at 100°F water temperature and indicator 2 was calibrated at 200°F water temperature.

Assuming both are on scale, which indicator will indicate the higher level?

A. Indicator 1 at all water temperatures

B. Indicator 2 at all water temperatures

C. Indicator 1 below 150°F, indicator 2 above 150°F

D. Indicator 2 below 150°F, indicator 1 above 1', F

ANSWER: B.



QUESTION:	10
TOPIC:	191002
KNOWLEDGE :	K1.08
QID:	NEW

Refer to the drawing of a tank with a differential pressure level detector (See figure below.).

The level detector was calibrated with reference leg and tank contents temperature at $70^{\circ}F$. An increase in ambient temperature causes the temperature of the reference leg and tank contents to increase to $110^{\circ}F$.

With the temperature of the reference leg and tank contents stable at 110°F, current level indication will be:

- A. higher than initial due to reference leg spill over.
- B. higher than initial due to expansion of tank contents.
- C. the same as initial due to offsetting density changes in the reference leg and tank contents.
- D. the same as initial due to the reference leg being connected to the upper portion of the tank.

ANSWER: A.



QUESTION:	11
TOPIC:	191002
KNOWLEDGE :	K1.12
QID:	P510 (Rev)

Refer to the drawing of a bellows-type pressure detector (see figure below).

A bellows-type pressure detector with its low-pressure side vented to containment atmosphere is being used to measure pressurizer pressure. A decrease in the associated pressure indication will be caused by either a containment pressure ____ or a ____

- A. increase; ruptured bellows
- B. increase; broken spring
- C. decrease; ruptured bellows
- D. decrease; broken spring

ANSWER: A.



QUESTION:	12
TOPIC:	191002
KNOWLEDGE :	K1.13
QID:	P1412 (Rev)

Refer to the drawing of a simple thermocouple circuit (see figure below).

Circuit temperature indicati n is currently 350°F. If an ambient temperature <u>decrease</u> lowers reference (cold) junction temperature by 10°F, the new temperature indication will be: (Assume measuring junction temperature remains constant.)

- A. 340°F.
- B. 350°F.
- C. 360°F.
- D. 370°F.

ANSWER: C.



PROOF: $T_{ind} = T_H - T_C$

If T_c decreases by 10°F, then T_{ind} increaser by 10°F. 350°F + 10°F = 360°F

QUESTION:	13
TOPIC:	191002
KNOWLEDGE :	K1.20
QID:	P1114

Which one of the following describes the source of ions collected in a proportional counter (BF, detector)?

- A. A fraction of the ions created by primary ionizations are collected. No secondary ionizations take place.
- B. Virtually all of the ions created by primary ionizations are collected. No secondary ionizations take place.
- C. Virtually all of the ions created by primary ionizations along with a fraction of the ions created by secondary ionizations are collected.
- D. Virtually all of the ions created by primary and socondary ionizations are collected.

ANSWER: D.

QUESTION:	14
TOPIC:	191002
KNOWLEDGE :	K1.19
QID:	NEW

An initial radiation survey is about to be performed in an area of unknown radiation field intensity. Which one of the following types of radiation monitoring instruments and settings should be used?

A. A Geiger Mueller survey meter selected to the low range
B. A Geiger Mueller survey meter selected to the high range
C. An ion chamber survey meter selected to the low range
D. An ion chamber survey meter selected to the high range
ANSWER: D.

QUESTION:	15
TOPIC:	191003
KNOWLEDGE :	K1.02
QID:	P218

An emergency diesel generator (D/G) is operating as the only power source connected to an emergency bus. The governor of the D/G <u>directly</u> senses D/G ______ and <u>directly</u> adjusts D/G flow to maintain a relatively constant D/G frequency.

A. spend; fuel

B. speed; air

C. load; fuel

D. load; air

ANSWER: A.

QUESTION:	16
TOPIC:	191003
KNOWLEDGE:	K1.05
QID:	P1618 (Rev)

An air-operated isolation valve requires 2,800 pounds-force (lbf) from its diaphragm actuator and 4 inches of stem travel for proper operation. The valve positioner can supply a nominal 117 psig of air pressure to the actuator.

What is the minimum surface alea of the actuator diaphragm required for proper valve operation?

A. 24 square inches

B. 48 squars inches

C. 94 square inches

D. 138 square inches

ANSWER: A. PROOF:

F = PA

$$A = \frac{F}{P} = \frac{2800 \ \#}{117 \ \#/in^2} = 24 \ in^2$$

QUESTION:	17
TOPIC:	191003
KNOWLEDGE :	K1.06
QID:	P2018

A diesel generator is supplying a bus with the governor operating in the isochronous mode. If a large electrical load on the bus trips, generator frequency will:

- A. initially increase, and then decrease and stabilize below the initial value.
- B. initially increase, and then decrease and stabilize at the initial value.
- C. initially increase, and then decrease and stabilize above the initial value.

D. remain constant during and after load change.

ANSWER: B. QUESTION: 18 TOPIC: 191003 KNOWLEDGE: K1.08 QID: P917

Which one of the following describes the response of a directacting derivative controller, operating in automatic, to an increase in the controlled parameter above the controller set point?

- A. The controller will develop an output signal that continues to increase until the controlled parameter equals the controller set point, at which time the output signal becomes constant.
- B. The controller will develop an output signal that will remain directly proportional to the difference between the controlled parameter and the controller set point.
- C. The controller will develop an output signal that continues to increase until the controlled parameter equals the controller set point, at which time the output signal becomes zero.
- D. The controller will develop an output signal that will remain directly proportional to the rate of change of the controlled parameter.

QUESTION:	19
TOPIC:	191003
KNOWLEDGE :	K1.11
QID:	P19

Why must an operator pay particular attention to auto/manual valve controllers placed in the manual mode?

- A. Manual valve controller operation can result in excessive valve cycling.
- B. Valve position will no longer automatically change in response to changes in system parameters.
- C. System parameters will no longer automatically change in response to changes in valve position.
- D. The valve can only be operated locally during manual controller operation.

ANSWER: B.

QUESTION:	20
TOPIC:	191004
KNOWLEDGE :	K1.07
QID:	P24

Shutting the discharge valve on an operating centrifugal pump will cause the motor amps to ______ and the pump discharge pressure to ______.

A. increase, increase

B. decrease, increase

C. increase, decrease

D. decrease, decrease

ANSWER: B.

QUESTION: 21 TOPIC: 191004 KNOWLEDGE: K1.04 QID: P1320 (Rev)

Refer to the drawing of a pump with a recirculation line (see figure below).

Valve "A" will open when pump:

A. discharge pressure reaches a high set point.

B. discharge pressure reaches a low set point.

C. flow rate reaches a high set point.

D. flow rate reaches a low set point.



QUESTION:	22	
TOPIC:	91004	
KNOWLEDGE:	K1.06	
QID:	P1221	(Rev

Refer to the drawing of a cooling water system (see figure below).

The available net positive suction head for the centrifugal pump will be decreased by:

A. increasing surge tank level by 5 percent.

B. throttling heat exchanger cooling water valve "B" more open.

C. throttling pump discharge valve "C" more closed.

D. increasing the heat loads on the cooling water system.



QUESTION:	23
TOPIC:	191004
KNOWLEDGE :	K1.09
QID:	NEW

A centrifugal pump is operating in parallel with a positive displacement pump in an open system. Each pump has the same design pressure.

If pump discharge pressure increases to the <u>maximum</u> design pressure of each pump, the centrifugal pump will be operating at ______ flow and the positive displacement pump will be operating at ______ flow.

- A. minimum; minimum
- B. minimum; rated
- C. rated; minimum
- D. rated; rated

ANSWER: B.

QUESTION:	24
TOPIC:	191004
KNOWLEDGE :	K1.15
QID:	P1421 (Rev)

A motor-driven centrifugal pump is operating in an open system with its discharge valve throttled to 50%. How will the pump be affected if the discharge valve is fully opened?

- A. Motor current decreases and total developed head decreases.
- B. Available net positive suction head (NFSH) decreases, and pump differential pressure decreases.
- C. Total developed head increases and available NPSH decreases.
- D. The potential for pump cavitation decreases, and pump differential pressure decreases.

ANSWER: B.

QUESTION :	25
TOPIC:	191004
KNOWLEDGE :	K1.12
QID:	P1721

Refer to the drawing of a centrifugal pump operating curve (see figure below).

Which point represents pump operation at runout conditions?

A. Point A

*

- B. Point B
- C. Point C
- D. Point D



QUESTION:	26
TOPIC:	191004
KNOWLEDGE :	K1.21
QID:	P1425

Which one of the following describes the proper location for a relier valve that will be used to prevent exceeding the design pressure of a positive displacement pump and associated piping?

- . On the pump suction piping upstream of the suction isolation valve
- B. On the pump suction piping downstream of the suction isolation valve
- C. On the pump discharge piping downstream of the discharge isolation valve
- D. On the pump discharge piping upstream of the discharge isolation valve

ANSWER: D.

QUESTION:	27
TOPIC:	191005
KNOWLEDGE :	K1.02
QID:	P528

Which one of the following will provide motor protection against electrical damage caused by gradual bearing degradation?

A. Thermal overload device

B. Overcurrent trip relay

C. Underfrequency relay

D. Undervoltage device

ANSWER: A.

QUESTION:	28
TOPIC:	191005
KNOWLEDGE :	K1.03
QID:	P1529 (Rev)

A diesel generator (D/G) is supplying an electrical bus in parallel with the grid. Assuming D/G terminal voltage and bus frequency do not change, if the D/G governor set point is increased from 60.0 Hz to 60.1 Hz, then D/G kVAR will ______ and D/G amps will _____.

A. remain the same; increase

3. remain the same; remain the same

L. increase; increase

D. increase; remain the same

ANSWER: A.

QUESTION:	29
TOPIC:	191005
KNOWLEDGE :	K1.04
QID:	P630 (Rev)

Which one of the following describes the motor current indications that would be observed during the start of a large ac motor-driven centrifugal pump with a closed discharge valve?

- A. Current immediately increases to the full-load value and then decreases to the no-load value over several seconds.
- B. Current immediately increases to the no-load value and then stabilizes.
- C. Current immediately increases to greater than the full-load value and then decreases to the no-load value after several seconds.
- D. Current immediately increases to greater than the full-load value and then decreases to the no-load value after several minutes.

QUESTION:	30
TOPIC:	191005
KNOWLEDGE :	K1.05
QID:	NEW

Two identical 4160 Vac induction motors are connected to identical centrifugal pumps being used to provide cooling water flow in separate systems in a power plant. Fich motor is rated at 1000 hp. The discharge valve for pump A is fully open and the discharge valve for pump B is fully shut.

If each motor is then started, the longest time period required to stabilize motor current will be experienced by motor ______ and the higher stable motor current will be experienced by motor _____.

A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: ...

QUESTION: 31 TOPIC: 191005 KNOWLEDGE: K1.06 QID: P1031

The number of starts for an electric motor in a given period of stars should be limited because overheating of the _______ can occur due to the _______ counter electromotive force produced at low rotor speeds.

A. windings; low

B. windings; high

C. commutator and/or slip rings; low

D. commutator and/or slip rings; high

ANSWER: A.

QUESTION:	32	
TOPIC:	191006	
KNOWLEDGE :	K1.07	
QID:	P1634	(Rev)

Refer to the drawing of a lube oil heat exchanger (see figure below).

Given the following existing conditions:

m _{oi.1}	=	1.8	x	104	1bm/hr
<i>m</i> water	=	3.3	x	101	lbm/hr
Cp oil	m	1.1	Bt	:u/1	bm-°F
Cp-watar	=	1.0	Bt	:u/1	bm-°F
T _{cw-in}	=	90°F	•		
T _{cw-out}	-	120°	F		
Toil-in		190°	F		
Toil-out	=	?			

Which one of the following is the temperature of the oil exiting the heat exchanger $(\rm T_{oil-out})$?

- A. 110°F
- B. 120°F
- C. 130°F
- D. 140°F



PROOF :

 $mc\Delta T = mc\Delta T$

 $\Delta T_{oil} = mc \Delta T/mc$

 $T_{oil-out} = T_{oil-in} - (mc \Delta T/mc)$

Toil-out

= 190 - (3.3)(1.0)(30)(1.8)(1.1)

 $= 140^{\circ} F$

QUESTION:	33
TOPIC:	191006
KNOWLEDGE :	K1.12
QID:	P32 (Rev)

Refer to the drawing of a lube oil heat exchanger (see figure below).

If deposits accumulate on the outside of the cooling water tubes, cooling water outlet temperature will ______ and oil outlet temperature will ______. (Assume oil and cooling water flow rates remain the same.)



QUESTION:	34
TOPIC:	191006
KNOWLEDGE :	K1.08
QID:	P1732

Which one of the following will reduce the rate of heat transfer between two liquids in a heat exchanger? (Assume single-phase conditions and a constant specific heat for both liquids.)

- A. The inlet temperatures of both liquids are decreased by 20°F.
- B. The inlet temperatures of both liquids are increased by 20°F.
- C. The inlet temperature of the hotter liquid is increased by 20°F.
- D. The inlet temperature of the colder liquid is increased by 20°F.

QUESTION:	35
TOPIC:	191007
KNOWLEDGE :	K1.01
QID:	P1736 (Rev)

A condensate demineralizer differential pressure (D/P) gauge indicates 4 psid at 50% flow rate. Which one of the following combinations of condensate flow and demineralizer D/P observed at various power levels indicates an <u>increase</u> in the accumulation of insoluble corrosion products in the demineralizer?

	<u>FLOW</u>	DEMINERALIZER D/P (PSID)
Α.	25%	1.0
B.	60%	6.0
C.	75%	9.0
D.	100%	15.0
ANSI	WER: B.	
PROC	OF:	
$F \propto$	N; H \propto N ²	
H_1/H	$_{2} = (F_{1}/F_{2})^{2}$	
H ₂ =	$H_1 (F_2/F_1)^2$	
@25%	flow, D/P	should be 1.0 psid
@60%	flow, D/P	should be 5.76 psid
@75%	flow, D/P	should be 9.0 psid
@100	% flow, D/H	should be 16.0 psid
Only	choice B e	exceeds the expected D/P.

QUESTION: 36 TOPIC: 191007 KNOWLEDGE: K1.03 QID: P936 (Rev)

To determine the demineralization factor for a demineralizer, the parameters that must be monitored are inlet and outlet _____.

A. pH

B. conductivity

C. suspended solids

D. pressure

ANSWER: B.

QUESTION:	37
TOPIC:	191007
KNOWLEDGE :	K1.14
QID:	P1335

The plant is operating at 70% stable power level when the temperature of reactor coolant letdown passing through a boron-saturated mixed bed ion exchanger is increased by 20°F.

As a result, the boron concentration in the effluent of the ion exchanger will ______ because the affinity of the ion exchanger for boron atoms has ______.

A. decrease; decreased

B. decrease; increased

C. increase; decreased

D. increase; increased

QUESTION:	38
TOPIC:	191008
KNOWLEDGE :	K1.04
QID:	P2041

Two identical 1000 Mw electrical generators are operating in parallel supplying the same electrical bus. The generator output breakers also provide identical protection for the generators. Generator A and B output indications are as follows:

Generator A	Generator B		
4160 Volts	4160 Volts		
60.2 Hertz	60.2 Hertz		
50 Mw	100 Mw		
25 MVAR (out)	50 MVAR (out)		

A malfunction causes the voltage regulator setpoint for generator B to slowly increase continuously toward a maximum of (400 volts. If no operator action is taken, which one of the following describes the current indications for generator A?

- A. Current will decrease continuously until the output breaker for generator B trips on reverse power.
- B. Current will decrease continuously until the output breaker for generator A trips on reverse power.
- C. Current will initially decrease, and then increase until the output breaker for generator B trips on overcurrent.
- D. Current will initially decrease, and then increase until the output breaker for generator A trips on overcurrent.

QUESTION: 39 TOPIC: 191008 KNOWLEDGE: K1.06 QID: P1739 (Rev)

Refer to the drawing of a valve motor control circuit (see figure below) for a valve that is currently fully open.

Which one of the following describes the valve response if the control switch is taken to the "Close" position for two seconds and then released?

A. The valve will not move.

B. The valve will close fully.

C. The valve will begin to close and then stop moving.

D. The valve will begin to close and then open fully.



QUESTION:	40
TOPIC:	191008
KNOWLEDGE :	K1.08
QID:	P1842 (Rev)

A main generator is being prepared for paralleling with the grid. Which one of the following indicates that the main generator and grid voltages are in phase?

- A. The voltage of the generator is equal to the voltage of the grid.
- B. The frequency of the generator is equal to the frequency of the grid.
- C. The synchroscope is turning slowly in the clockwise direction.

D. The synchroscope is passing through the 12 o'clock position.

ANSWER: D.

QUESTION:	41
TOPIC:	191008
KNOWLEDGE :	K1.08
QID:	P2040

A main generator is being prepared for paralleling with the grid. Which one of the following conditions will cause the main generator to immediately supply reactive power (MVAR) to the grid when the generator output breaker is closed?

- A. Generator voltage is 1% higher than grid voltage.
- B. Generator voltage is 1% lower than grid voltage.
- C. The synchroscope is turning slowly in the clockwise direction.
- D. The synchroscope is turning slowly in the counterclockwise direction.

ANSWER: A.

QUESTION:	42
TOPIC:	191008
KNOWLEDGE :	K1.11
QID:	P1932

While remotely investigating the condition of a normally-open motor control center (MCC) feeder breaker, an operator observes the following indications:

Green breaker position indicating light is out. Red breaker position indicating light is lit. MCC voltmeter indicates normal voltage. MCC ammeter indicates zero amperes.

Based on these indications, the operator should report that the circuit breaker is ______ and racked _____.

A. open; in

B. closed; in

C. open; to the test position

D. closed; to the test position

ANSWER: B.

QUESTION:	43
TOPIC:	191008
KNOWLEDGE :	K1.10
QID:	P943

What is an advantage of using high voltage electrical disconnects instead of circuit breakers to isolate main power transformers?

- A. Disconnects provide positive visual indication that the circuit is broken.
- B. Disconnects can be operated either locally or remotely.
- C. Disconnects are cheaper and provide the same protection as a breaker.
- D. Disconnects are capable of passing a higher current with less heating than a breaker.

ANSWER: A.

QUASTION:	44	
TOPIC:	191008	
KNOWLEDGE :	K1.08	
QID:	P2044	(Rev)

An isolated electrical bus is being supplied by generator A. Generator B is about to be connected to the same electrical bus. Generators A and B are both rated at 1000 Mw. Generator A and B output indications are as follows:

Generator A	Generator B	
4140 Volts	4160 Volts	
60.8 Hertz	60.2 Hertz	
25 Mw	0 Mw	
10 MVAR	0 MVAR	

When the output breaker for generator B is closed, which generator is more likely to trip on reverse power?

A. Generator A due to the lower initial voltage

B. Generator A due to the higher initial frequency

C. Generator B due to the higher initial voltage

D. Generator B due to the lower initial frequency

QUESTION: 45 TOPIC: 192001 KNOWLEDGE: K1.02 QID: P1245

As compared to a prompt neutron a delayed neutron, born from the same fission event, is more likely to:

A. leak out of the core.

B. be absorbed in the moderator.

C. be captured by a U-238 nucleus.

D. cause fission of a U-235 nucleus.

QUESTION:	46
TOPIC:	192002
FNOWLEDGE :	K1.13
QID:	P1446

A reactor at the beginning of core life has been shut down from 100% power and cooled down to 340°F over three days. During the cooldown, boron concentration was increased by 200 ppm.

Given the following absolute values of reactivities added during the shutdown and cooldown, assign a (+) or (-) as appropriate and choose the current value of shutdown margin.

Xenon	=	()	3.08	$\Delta K/K$
Boron	=	()	3.5%	$\Delta K/K$
Power defect	=	()	4.0%	∆K/K
Rods	=	()	7.0%	∆K/K
Cooldown	=	()	2.0%	ΔK/K

- A. -1.5% ΔK/K
- B. -2.5% ∆K/K
- C. -7.5% ΔK/K
- D. -9.5% AK/K
- ANSWER: A.
- PROOF :

Xenon	=	(+)	3.0%	$\Delta k/k$
Boron	-	(-)	3.5%	$\Delta k/k$
Power D	=	(+)	4.08	$\Delta k/k$
Rods	=	(-)	7.0%	$\Delta k/k$
Cooldown	=	(+)	2.0%	Ak/k
SDM	=	()	1.5%	Alc/k
QUESTION:	47			
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TOPIC:	192002			
KNOWLEDGE :	K1.14			
QID:	NEW			

A reactor is operating at 80% power when the operator adds 10 gallons of horic acid to the reactor coolant system (RCS). Over the next several minutes, the operator adjusts control rod position as necessary to maintain a constant reactor coolant average temperature.

When the plant stabilizes, shutdown margin will be ______ and axial power distribution will have shifted toward the ______ of the core.

A. the same; top

B. the same; bottom

C. larger; top

D. larger; bottom

QUESTION:	48
TOPIC:	192003
KNOWLEDGE :	K1.01
QID:	NEW

Two reactors are currently shut down with a reactor startup in progress. The two reactors are identical except that reactor A has a source neutron strength of 100 neutrons per second and reactor B source neutron strength is 200 neutrons per second. Control rods are stationary and Keff is 0.98 in both reactors. Core neutron level has reached equilibrium in both reactors.

Which one of the following lists the core neutron level (neutrons per second) in reactors A and B?

	Reactor A	Reactor B
Α.	5,000	10,000
в.	10,000	20,000
C.	10,000	40,000
D.	20,000	40,000
ANSW	VER: A.	
PROO	PF:	
CR _{S/D}	= S/(1-K)	
Reac	tor A	
CR _{3/D}	= 100/.02	
	= 5,000	
Reac	tor B	

 $CR_{S/D} = 200/.02$

= 10,000

QUESTION:	49
TOPIC:	192003
KNOWLEDGE :	K1.07
QID:	NEW

Which one of the following percentages of fuel undergoing fission in a reactor will result in the largest reactor core effective delayed neutron fraction?

	<u>U-235</u>	<u>U-238</u>	Pu-239
Α.	90%	78	3 %
в.	80%	6%	14%
C.	70%	78	23%
D.	50%	08	34%

ANSWER: A.

QUESTION:	50
TOPIC:	192004
KNOWLEDGE :	K1.03
QID:	P251

Under which one of the following condit are is a reactor core most likely to have a positive moderator temperature coefficient?

A. High coolant temperature at beginning-of-life

B. High coolant temperature at end-of-life

C. Low coolant temperature at beginning-of-life

D. Low coolant temperature at end-of-life

QUESTION:	51	
TOPIC:	192004	
KNOWLEDGE :	X1.05	
QID:	P1650 (Rev)

Which one of the following pairs of isotopes is responsible for the negative reactivity associated with a fuel temperature increase near the end of core life?

A. U-235 and Pu-239

B. U-235 and Pu-240

C. U-238 and Pu-239

D. U-238 and Pu-240

ANSWER: D.

QUESTION:	52
TOPIC:	192004
KNOWLEDGE :	K1.07
QID:	P1951

A reactor is operating at 70% power. Which one of the following will directly result in a <u>less negative</u> fuel temperature coefficient? (Consider only the effect of the change in each listed parameter.)

A. Increase in fuel temperature

B. Increase in moderator temperature

C. Increase in moderator voids

D. Increase in Pu-240 inventory in the core

ANSWER: A.

QUESTION: 53 TOPIC: 192004 KNOWLEDGE: K1.11 QID: P351

The amount of boric acid required to increase the coolant boron concentration by 50 ppm at BOL conditions (1200 ppm) is approximately ______ as the amount of boric acid required to increase boron concentration by 50 ppm at EOL (100 ppm).

A. the same

B. four times as large

C. eight times as large

D. twelve times as large

ANSWER: A.

QUESTION:	54
TOPIC:	192005
KNOWLEDGE :	K1.07
QID:	P2156 (Rev)

Which one of the following events will cause control rod worth to decrease?

- A. Fuel temperature decreases as the fuel pellets come into contact with the fuel clad.
- B. RCS boron concentration increases by 5 ppm at 80% power with no rod motion.
- C. Reactor power is decreased from 100% to 90% with no rod motion.
- D. Early in core life, the concentration of burnable poison decreases.

ANCWEP: B.

QUESTION:	55
TOPIC:	192005
KNOWLEDGE :	K1.05
QID:	P1471 (Rev)

The reactor is operating at steady state 70% power with the following conditions:

RCS boron concentration: 600 ppm Control rod position: 110 inches RCS average temperature: 575°F

Reactor power is increased to 100% over the next four hours. The 100% reactor power conditions are as follows:

RCS boron concentration: 590 ppm Control rod position: 130 inches RCS average temperature: 580°F

Given the following reactivity coefficient/worth values, and neglecting fission product poison reactivity changes, what is the differential control rod worth?

Power coefficient:-0.3% ΔK/K/%Moderator temperature coefficient:-0.2% ΔK/K/%FDifferential boron worth:-0.1% ΔK/K/ppm

A. 0.2% AK/K/inch

B. 0.25% ΔK/K/inch

C. 0.4% AK/K/inch

D. 0.5% AK/K/inch

ANSWER: C.

PROOF :

 $\rho_{PC} = 30 \times -0.3 = -9.0\% \Delta k/k$

 $\rho_{\rm B} = -10 \ {\rm x} \ -0.1 = +1 \ 0\% \ \Delta k/k$

 $\rho_{PC} + \rho_B = -9.0 + 1.0 = -8.0$ % $\Delta k/k$

 $CRW = \rho \text{ added/inches} = +8.0/20 = +0.4$ % $\Delta k/k/inch$

QUESTION:	56
TOPIC:	192005
KNOWLEDGE :	K1.10
QID:	P455

Which one of the following describes why most of the power is produced in the lower half of a core that has been operating at 100% power for several weeks at the beginning of core life?

- A. Xenon concentration is 'ower in the lower half of the core.
- B. The moderator to fuel ratio is lower in the lower half of the core.
- C. The fuel loading in the lower half of the core contains a higher U-235 enrichment.
- D. The moderator temperature coefficient of reactivity is adding less paga ive reactivity in the lower half of the core.

ANSWER: D.

Q'JESTION :	57
TOPIC:	192005
KNOWLEDGE :	K1.16
QID:	P1657 (Rev)

A reactor is operating at 85% power with all control rods fully withdrawn. Assuming reactor power does not change, which one of the following compares the effects of partially inserting (50%) a single center control rod to the effects of dropping (full insertion) the same control rod?

- A. A rarcially inserted rod causes a smaller change in axial power distribution.
- B. A partially inserted rod causes a smaller change in radial power distribution.
- C. A partially inserted rod causes a greater change in shutdown margin.
- D. A partially inserted rod causes a smaller charge in shutdown margin.

ANSWER: B.

QUESTION:	58
TOPIC:	192006
KNOWLEDGE :	K1.06
QID:	P2060

A reactor is initially operating at 50% power with equilibrium core xenon-135. Power is increased to 100% over a 2 hour period and average reactor coolant temperature is adjusted to 588°F using manual rod control. Rod control is left in Manual and no subsequent operator actions are taken.

Considering only the reactivity effects of core xenon-135 changes, which one of the following describes the average reactor coolant temperature 8 hours after the power change?

A. Greater than 588°F and decreasing slowly

B. Greater than 588°F and increasing slowly

C. Less than 588°F and decreasing slowly

D. Less than 588°F and increasing slowly

ANSWER: A.

QUESTION: 59 TOPIC: 192006 KNOWLEDGE: K1.07 QID: P1561

Which one of the following reactor prescram conditions requires the <u>least</u> amount of control rod withdrawal to attain reactor criticality during peak core xenon conditions after a reactor scram from equilibrium core xenon conditions?

A. Beginning of core life (BOL) and 100% power
B. End of core life (EOL) and 100% power
C. BOL and 20% power
D. EOL and 20% power
ANSWER: C.

QUESTION:	60
TOPIC:	192006
KNOWLEDGE :	K1.09
QID:	P561 (Rev)

A reactor is initially shut down with nc xenon in the core. The reactor is brought critical and 4 hours later power level is at the point of adding heat. The shift supervisor has directed that power be maintained constant at this level for 12 hours for testing.

To accomplish this, control rods will have to be:

- A. withdrawn periodically for the duration of the 12 hours.
- B. inserted periodically for the duration of the 12 hours.
- C. withdrawn periodically for 4 to 6 hours, then inserted periodically.
- D. inserted periodically for 4 to 6 hours, then withdrawn periodically.

ANSWER: A.

QUESTION:	61
TOPIC:	192006
KNOWLEDGE :	K1.11
QID:	P659 (Rev)

A reactor has been operating at steady-state 50% power for 12 hours following a one-hour power reduction from steady-state 100% power. Which one of the following describes the current core xenon-135 concentration?

A. Increasing toward a peak

B. Decreasing toward an upturn

C. Increasing toward equilibrium

D. Decreasing toward equilibrium

ANSWER: D.

QUESTION:	62
TOPIC:	192006
KNOWLEDGE :	K1.12
QID:	P1063 (Rev)

Eighteen hours after a reactor trip from 100% power, equilibrium xenon conditions, the amount of core xenon will

- A. lower than 100% equilibrium xenon, and will have added a net positive reactivity since the trip.
- B. lower than 100% equilibrium xenon, and will have added a net negative reactivity since the trip.
- C. higher than 100% equilibrium xenon, and will have added a net positive reactivity since the trip.
- D. higher than 100% equilibrium xenon, and will have added a net negative reactivity since the trip.

ANSWER: D.

QUESTION:	63
TOPIC:	192006
KNOWLEDGE :	K1.14
QID:	P1762

A reactor startup is being conducted and criticality has been achieved 15 hours after a reactor scram from long term operation at full power. After 1 additional hour, reactor power is stabilized at 10⁻⁴% power and all control rod motion is stopped.

Which one of the following describes the response of reactor power over the next 2 hours without any further operator actions?

- A. Power increases toward the point of adding heat due to the decay of Xe-135.
- B. Power increases toward the point of adding heat due to the decay of Sm-149.
- C. Power decreases toward the shutdown neutron level due to the buildup of Xe-135.
- D. Power decreases toward the shutdown neutron level due to the buildup of Sm-149.

ANSWER: A.

QUESTION:	64
TOPIC:	192007
KNOWLEDCE:	K1.05
QID:	P1964

Which one of the following compares the rate at which reactor power can be increased at the beginning of core life (BOL) to the end of core life (EOL)?

A. Faster at EOL due to faster changes in boron concentration

B. Faster at EOL due to greater control rod worth

C. Faster at BOL due to faster changes in boron concentration

D. Faster at BOL due to greater control rod worth

QUESTION:	65
TOPIC:	192008
KNOWLEDGE:	K1.04
QID:	P1972 (Rev)

During a reactor startup, source range indication is stable at 100 cps with K_{eff} at 0.95. After a number of rods have been withdrawn, source range indication stabilizes at 270 cps. Which one of the following is the new K_{eff} ?

A. 0.936

B. 0.972

C. 0.981

D. 0.990

ANSWER: C.

PROOF :

 $CR_1 (1-K_1) = CR_2 (1-K_2)$ $CR_2/CR_1 = (1-K_1)/(1-K_2)$ $270/100 = 0.05/1-K_2$ $1-K_2 = 0.05/2.7$ $K_2 = 1-0.0185$ $K_2 = 0.98148$

QUESTION:	66
TOPIC:	192008
KNOWLEDGE :	K1.07
QID:	P1666

An estimated critical rod position (ECP) has been calculated for a reactor startup to be performed 15 hours after a reactor trip that ended three months operation at 100% power.

Which one of the following conditions will result in criticality occurring at a lower than estimated critical rod position?

- A. Adjusting reactor coolant system boron concentration to 50 ppm higher than assumed for startup calculations
- B. I malfunction resulting in control rod speed being slower than normal speed
- C. Moving the time of startup from 15 hours to 12 hours following the trip
- D. Using a pretrip reactor power of 90% to determine power defect

ANSWER: D.

QUESTION: 67 TOPIC: 192008 KNOWLEDGE: K1.09 QID: P68 (Rev)

When a reactor is exactly critical, reactivity is:

A. infinity.

- B. undefined.
- C. 0.0 ΔK/K.

D. 1.0 AK/K.

CNESTION: 68 TOPIC: 192008 KNOWLEDGE: K1.10 QID: P1567

With a reactor on a constant period of 30 minutes, which one of the following power changes requires the <u>least</u> time to occur?

A. 1% power to 6% power

B. 10% power to 20% power

C. 20% power to 35% power

D. 40% power to 60% power

ANSWER: D.

PROOF: P.

$$= P_{e}e^{t/t}$$

tln $P_t/P_o = t$ ln 6/1(30) = 1.79(30) = t = 53.7 minutes ln 20/10(30) = .693(30) = t = 20.8 minutes ln 35/20(30) = .56(30) = t = 16.8 minutes ln 60/40(30) = .41(30) = t = 12.3 minutes

QUESTION:	69
TOPIC:	192008
KNOWLEDGE :	K1.14
QID:	P972 (Rev

A reactor is critical at the point of adding heat (POAH) when a small amount of <u>negative</u> reactivity is added to the core. If the same amount of <u>positive</u> reactivity is added to the core approximately 5 minutes later, reactor power will:

A. increase and stabilize at the POAH.

- B. quickly stabilize at a power level below the POAH.
- C. continue to decrease on a negative 80 second period until the shutdown equilibrium neutron level is reached.
- D. continue to decrease with an unknown period until the shutdown equilibrium neutron level is reached.

ANSWER: B.

QUESTION:	70
TOPIC:	192008
ENOWLEDGE :	K1.21
QID:	P1370

A reactor has been operating at 80% power for several weeks. A wartik steam line break occurs and 2% total steam flow is escaping. Turbine load and control rod position remain the same.

Assuming no operator or automatic actions, when the plant stabilizes, reactor power will be ______ and average reactor coolant temperature will be ______.

4. higher; higher

B. unchanged; higher

C. higher; lower

D. Unchanged; lower

QUESTION:	71
TOPIC:	192008
KNOWLEDGE :	K1.26
QID:	P370

After one month of operation at 100% reactor power, the fraction of thermal power being produced from the decay of fission products in the operating reactor is:

A. greater than 10%.

B. greater than 5% but less than 10%.

C. greater than 1% but less than 5%.

D. less than 1%.

ANSWER: B.

QUESTION:	72
TOPIC:	192008
KNOWLEDGE :	K1.27
QID:	P1672 (Rev)

A reactor is operating at 100% power near the end of core life. The greatest contribution to cor, heat production is being provided by the fission of:

A. U-235 and U-238.

B. U-235 and Pu-239.

C. U-238 and Pu-239.

D. U-238 and Pu-241.

ANSWER: B.

QUESTION:	73
TOPIC:	193001
KNOWLEDGE :	K1.01
QID:	P2073 (Rev)

Which one of the following is arranged from the highest pressure to the lowest pressure?

A. 2 psig, 12 inches Hg absolute, 8 psia

B. 2 psig, 18 inches Hg absolute, 8 psia

C. 12 psia, 20 inches Hg absolute, 2 psig

D. 12 psia, 30 inches Hg absolute, 2 psig

ANSWER: B.

PROOF :	Α.	is	equivalent	to	17	psia,	6	psia,	8	psia
	В.	is	equivalent	to	17	psia,	9	psia,	8	psia
	С.	is	equivalent	to	12	psia,	10	psia,		17 psia
	D.	is	equivalent	to	12	psia.	11	5 psia		17 psia

QUESTION: 74 TOPIC: 193003 KNOWLEDGE: K1.14 QID: P1674

A reactor trip occurred 10 minutes ago due to a loss of coolant accident. Emergency coolant injection is in progress and pressurizer level is increasing. Current pressurizer conditions are as follows:

Pressurizer	liquid temperature	=	540°F
Pressurizer	vapor temperature	=	607°F
Pressurizer	pressure	=	1410 psia
Pressurizer	level	=	60%

Given these conditions, the pressurizer liquid is ______ and the pressurizer vapor is ______

A. saturated; saturated

B. saturated; superheated

C. subcooled; saturated

D. subcooled; superheated

ANSWER: D.

QUESTION:	75
TOPIC:	193003
KNOWLEDGE:	K1.25
QID:	NEW

1 x 10⁶ lbm/hr saturated steam at 30% steam quality is leaving a main turbine and entering a condenser at 2.0 psia. Condensate is entering the hotwell at 118 degrees F.

Which one of the following is the approximate condenser heat transfer rate?

A. 3.1 x 10° Btu/hr

B. 5.8 x 10" Btu/hr

C. 7.2 x 10° Btu/hr

D. 9.9 x 10° Btu/hr

ANSWER: A.

PROOF :

From steam tables: Exhaust steam enthalpy is 1116.1 - (0.7)(1022.2) = 400.56 Btu/lbm From steam tables: Condensate enthalpy is 86 Btu/lbm Q = m-dot delta-h Q = (1,000,000 lbm/hr)(400.6 - 86 Btu/lbm)Q = 314,600,000 Btu/hr

QUESTION: 76 TOPIC: 193004 KNOWLEDGE: K1.11 QID: P1176 (Rev)

The thermodynamic cycle efficiency of a power plant will increase if:

A. the amount of condensate depression is decreased.

B. a high-pressure feed water heater is removed from service.

C. condenser vacuum decreases from 29 inches to 25 inches.

D. power is decreased from 100% to 25%.

ANSWER: A.

QUESTION:	77
TOPIC:	193004
KNOWLEDGE:	K1.15
QID:	P1277

A heatup and pressurization of the reactor coolant system (RCS) is in progress following a maintenance shutdown. RCS pressure is 800 psia with a steam bubble in the pressurizer. Pressurizer power-operated relief valve (PORV) tailpipe temperature has been steadily rising. Assume 97.5% quality saturated steam in the pressurizer vapor space, PORV downstream pressure is 30 psia, and PORV leakage is an ideal throttling process.

Which one of the following is the expected PORV tailpipe amperature if a PORV is leaking by?

A. 264°F

- B. 284°F
- C. 302°F
- D. 322°F

ANSWER: B.

QUESTION:	78
TOPIC:	193005
KNOWLEDGE :	K1.03
QID:	P277 (Rev)

If the moisture content of the steam supplied to a main turbine increases, turbine work will:

- A. decrease because the enthalpy of the steam being supplied to the turbine has decreased.
- B. decrease because moist steam results in more windage losses in the turbine.
- C. increase because the enthalpy of the steam being supplied to the turbine has increased.
- D. increase because moist steam results in less windage losses in the turbine.

ANSWER: A.

QUESTION:	79
TOPIC:	193006
KNOWLEDGE :	K1.04
QID:	P78 (Rev

Which one of the following operating practices minimizes the possibility of vater hammer?

- A. Change valve positions as rapidly as possible.
- B. Start centrifugal pumps with the discharge valve throttled.
- C. Start positive displacement pumps with the discharge valve closed.

D. Vent systems only after initiating system flow.

ANSWER: B.

QUESTION:	80
TOPIC:	193006
KNOWLEDGE :	K1.05
QID:	P1986

A 47 gpm leak has developed in a cooling water system that is operating at 150 psig. Which one of the following will be the leak rate when system pressure has decreased to 75 psig?

A. 23.5 gpm

B. 33.2 gpm

- C. 36.5 gpm
- D. 37.3 gpm

ANSWER: B.

PROOF: DP \propto f² DP₁/DP₂ = (f₁/f₂)² 1.414 = 47/f₂ f₂ = 47/1.414 f₂ = 33.2 gpm

QUESTION:	81
TOPIC:	193006
KNOWLEDGE :	K1.11
QID:	P1582

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Refer to the drawing of a cooling water system in which only pump A is operating and the pump discharge valve is currently 50% open (see figure below).

If pump A is cavitating, which one of the following will reduce or eliminate cavitation in pump A?

A. Starting pump B

B. Positioning the discharge valve to 75% open

C. Raising the water level in the surge tank by 2 feet

D. Decreasing heat exchanger service water flow rate by 10%



QUESTION:	82
TOPIC:	193006
KNOWLEDGE :	K1.15
QID:	NEW

Water at 90 degrees F and 50 psig is flowing through a 10-inch diameter pipe at 100 lbm/sec. The pipe then splits into two pipes, a 4-inch diameter pipe and an 8-inch diameter pipe. Disregarding any flow restrictions other than pipe size, which one of the following lists the approximate flow rates through the 4-inch and 8-inch diameter pipes?

	4-inch Pipe (lbm/sec)	8-inch Pipe (1bm/sec)
Α.	20	80
в.	25	75
с.	30	70
D.	33	67
ANSW	VER: A.	
PROO m = m1 + pA1v pv(A pv(8 pv(8 pv =	<pre>F: pAv m2 = 100 + pA2v = 100 1 +A2) = 100 0) = 100 100/80</pre>	
m1 = m1 = m1 =	pvA1 100/80 (16) 1600/80 ≈ 20	lbm/sec
m2 = m2 = m1 =	pvA2 100/80 (64) 6400/80 = 80	lbm/sec

QUESTION:	83
TOPIC:	193006
KNOWLEDGE :	K1.15
QID:	P1282

Two centrifugal pumps and two positive displacement pumps are able to be cross connected to provide flow in a system. Each pump will produce 100 gpm at 1000 psig discharge pressure and each pump has a design maximum pressure of 1500 psig.

If system pressure is 1200 psig, which one of the following will produce the greatest system flow rate?

A. Two positive displacement pumps in series

B. Two positive displacement pumps in parallel

C. Two centrifugal pumps in series

D. Two centrifugal pumps in parallel

ANSWER: B.

QUESTION:	84
TOPIC:	193007
KNOWLEDGE :	K1.01
QID:	NEW

Which one of the following describes a heat transfer process in which convection is the most significant heat transfer mechanism?

A. From the reactor fuel to the core barrel during core uncovery

- B. Through the tube walls in a steam generator during normal operation at 100% power
- C. From the reactor fuel to the steam generators during a station blackout
- D. From fuel pellet centerline to fuel clad during normal operation at 100% power

QUESTION:	85
TOPIC:	193007
KNOWLEDGE :	K1.06
QID:	P384

The power range nuclear instruments have been adjusted to 100% based on a calculated calorimetric (secondary heat balance). Which one of the following will result in actual reactor power being <u>less</u> than indicated reactor power?

- A. The feedwater temperature used in the calorimetric calculation is higher than actual feedwater temperature.
- B. The reactor coolant pump heat input term is omitted from the calorimetric calculation.
- C. The feedwater flow rate used in the calorimetric calculation is lower than actual feedwater flow rate.
- D. The steam pressure used in the calorimetric calculation is higher than actual steam pressure.

ANSWER: B.

QUESTION:	86
TOPIC:	193008
KNOWLEDGE :	K1.01
QID:	P1286

Refer to the drawing of a pool boiling curve (see figure below).

Which region of the curve contains the operating point at which the hottest locations of the reactor operate to transfer heat from the cladding to the coolant at 100% power?

- A. Region I
- B. Region II
- C. Region III
- D. Region IV

ANSWER: B.



QUESTION: 87 TOPIC: 193008 KNOWLEDGE: K1.03 QID: P487 (Rev)

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Which one of the following describes why the core heat transfer rate increases when nucleate boiling begins on the surface of a fuel rod?

- A. Steam has a greater thermal conductivity than water.
- B. The formation of steam bubbles increases coolant flow rate along the fuel rod.
- C. Radiative heat transfer begins to supplement convective heat transfer.
- D. Heat transfer by steam bubble formation is more effective than through a liquid film.

ANSWER: D.

QUESTION:	88
TOPIC:	193008
KNOWLEDGE :	K1.05
QID:	P1889 (Rev)

A plant is operating with the following initial conditions:

Reactor power is 55% in the middle of a fuel cycle.

Axial and radial power distributions are peaked in the center of the core.

Which one of the following will decrease the steady-state departure from nucleate boiling ratio?

- A. A reactor trip occurs and one control rod remains fully withdrawn from the core.
- B. A pressurizer malfunction increases reactor coolant system pressure by 20 psig.
- C. The operator increases reactor coolant boron concentration by 5 ppm with no rod motion.
- D. Core Xe-135 depletes in proportion to the axial and radial power distribution with no rod motion.

ANSWER: D.

QUESTION:	89
TOPIC:	193008
KNOWLEDGE :	K1.07
QID:	P1689 (Rev)

Refer to the drawing of a pool-boiling curve (see figure below).

The point at which heat flux stops increasing and the critical heat flux has been reached (point B), marks the beginning of:

- A. nucleate boiling.
- B. stable film boiling.

C. partial film boiling.

D. single-phase convection.



QUESTION:	90
TOPIC:	193008
KNOWLEDGE :	K1.10
QID:	P990

A reactor is operating at 100% steady-state power at the end of core life with all control rods fully withdrawn. At what axial location in a typical fuel assembly will the <u>minimum</u> departure from nucleate boiling ratio occur?

A. At the bottom of the fuel assembly

B. At the top of the fuel assembly

C. Between the bottom and the midplane of the fuel assembly

D. Between the midplane and the top of the fuel assembly

ANSWER: D.

QUESTION:	91
TOPIC:	193008
KNOWLEDGE :	K1.19
QID:	P1886 (Rev)

A reactor is producing 3400 MW of thermal output with a vessel ΔT of 60°F and a vessel mass flow rate of 1.1 x 10⁶ lbm/hr. If core ΔT is 63.6°F, what is core bypass flow rate? (Assume bypass flow ΔT equals 0°F.)

A. 5.66 x 10⁶ lbm/hr

B. 6.23 x 10⁶ lbm/hr

C. 5.66 x 107 lbm/hr

D. 6.23 x 107 lbm/hr

ANSWER: B.

PROOF :

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$$\dot{Q} = \dot{m} p \Delta T$$

$$\dot{m}_{c} c p \Delta T_{v} = \dot{m}_{c} c p \Delta T_{c} + \dot{m}_{b} c p \Delta T_{B}$$

$$\dot{m}_{t} = \dot{m}_{v} \frac{\Delta T_{v}}{\Delta T_{c}} = 1.1 \times 10^{8} \# / hr \left(\frac{60}{63.6}\right)$$

$$\dot{m}_{t} = 1.1(.9434) \times 10^{8} \# / hr = 1.038 \times 10^{8} \# / hr$$

$$\dot{m}_{v} = \dot{m}_{v} + \dot{m}_{b}$$

$$\dot{m}_{b} = \dot{m}_{v} - \dot{m}_{v}$$

$$= (1.1 - 1.038) \times 10^{8} \# / hr$$

$$= 0.0623 \times 10^{8} \# / hr$$

$$= 6.23 \times 10^{6} \# / hr$$

QUESTION:	92
TOPIC:	193008
KNOWLEDGE :	K1.23
QID:	P1591

A reactor had been operating at a constant power level for the last two weeks when a loss of all ac power occurred, thereby causing a scram and a loss of forced reactor coolant flow. Natural circulation reactor coolant flow developed and stabilized 30 minutes after the scram.

Which one of the following combinations of <u>initial</u> reactor power and <u>post-scram</u> steam generator pressure will result in the <u>highest</u> stable natural circulation flow rate 30 minutes after the scram?

	INITIAL REACTOR POWER	POST-SCRAM STEAM CENERATOR PRESSURE
١.	100%	1100 psia
3.	100%	1000 psia
:.	25%	1100 psia
).	25%	1000 psia

ANSWER: B.

QUESTION:	93
TOPIC:	193008
KNOWLEDGE :	K1.25
QID:	P793

A reactor coolant system natural circulation cooldown is in progress via the steam generator (S/G) atmospheric steam relief valves (operated in manual control). If high point voiding interrupts natural circulation, which one of the following will occur? (Assume feed flow rate, relief valve position, and decay heat level are constant.)

A. S/G level decreases and core exit thermocouple (CETC) indication increases.

B. S/G level decreases and CETC indication decreases.

C. S/G level increases and CETC indication increases.

D. S/G level increases and CETC indication decreases.

QUESTION:	94	
TOPIC:	193009	į
KNOWLEDGE:	K1.02	
QID:	P1195	

A reactor is operating at 80% power at the beginning of a fuel cycle. All control rods are fully withdrawn and in manual control. Moderator temperature coefficient is negative.

Which one of the following will decrease the axial peaking (or hot channel) factor? (Assume no subsequent operator action is taken and that turbine load and xenon distribution do not change unless stated.)

A. One bank of control rods is inserted 10%.

- B. One control rod fully inserts into the core.
- C. Turbine load/reactor power is reduced by 20%.
- D. Reactor coolant system boron concentration is reduced by 50 ppm.

ANSWER: C.

QUESTION: 95 TOPIC: 193010 KNOWLEDGE: K1.01 QID: P1896 (Rev)

Brittle fracture of the reactor vessel (RV) is <u>least</u> likely to occur during a ______ of the RV when RV temperature is ______ the reference temperature for nil-ductility transition (RT_{NDT}).

A. cooldown; above

- B. heatup; above
- C. cooldown; below

D. heatup; below

ANSWER: B.

QUESTION:	96	
TOPIC:	193009	1
KNOWLEDGE :	K1.07	
QID:	P1594	(Rev)

Refer to the drawing of a fuel rod and coolant flow channel at the beginning of core life (see figure below).

Given the following initial core parameters:

Reactor power	=	638
Tcoolant	-12	560°F
Tfuel centerline	з	2500°F

Which one of the following will be the fuel centerline temperature at the end of core life. If the total fuel-to-coolant thermal conductivity doubles? (Assume reactor power is constant.)

- A. 1080°F
- B. 1250°F
- C. 1530°F
- D. 1810°F



PROOF :

....

ΔT/2 :	=	(2500 - 560)/2	$T_{fc} = T_c + \Delta T$	=	560 + 970
	=	1940/2	Te	221	1530°F
	=	970°F	-10		

QUESTION: #7 TOPIC: 193010 KNOWLEDGE: K1.01 QID: P1296

Which one of the following increases the probability of brittle fracture of a pressure vessel wall?

- A. A high tempera 're rather than a low temperature
- B. A tensile stress rather than a compressive stress
- C. Performing a 100°F/hour heatup rather than a 100°F/hour cooldown
- D. Using materials fabricated from stainless steel rather than carbon steel

ANSWER: B.

QUESTION:	98
TOPIC:	193010
KNOWLEDGE :	K1.05
QID:	P2098 (Rev)

Two identical reactors have been in operation for the last 10 years. Reactor A has experienced 40 heatup/cooldown cycles and has an average power capacity of 50%. Reactor B has experienced 30 heatup/cooldown cycles and has an average power capacity of 60%.

Which reactor will have the highest reactor vessel nil-ductility transition temperature?

- A. Reactor A due to the greater number of heatup/cooldown cycles
- B. Reactor A due to the lower average power capacity
- C. Reactor B due to the fewer number of heatup/cooldown cycles

D. Reactor B due to the higher average power capacity

ANSWER: D.

QUESTION:	99
TOPIC:	193010
KNOWLEDGE :	K1.06
QID:	P99

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A plant is shut down with the reactor coolant system at 1200 psia and 350°F. Which one of the following would be most likely to cause pressurized thermal shock of the reactor vessel?

A. A rapid depressurization followed by a rapid heatup
B. A rapid depressurization followed by a rapid cooldown
C. A rapid cooldown followed by a rapid pressurization
D. A rapid heatup followed by a rapid pressurization
ANSWER: C.

QUESTION:	100
TOPIC:	193010
KNOWLEDGE :	K1.07
QID:	P1199

During cooldown, the thermal stress on the reactor vessel is: A. tensile across the entire wall.

B. compressive across the entire wall.

C. tensile at the inner wall, compressive at the outer wall.
D. compressive at the inner wall, tensile at the outer wall.
ANSWER: C.
A 10 100

OCTOBER 1997 NRC GENERIC FUNDAMENTALS EXAMINATION PRESSURIZED WATER REACTOR - ANSWER KEY

FOF	B	ANS	FOR	M B	ANS	FOI	RM B	ANS	FOF	RW B	ANS
1	29	B	26	54	D	51	79	D	76	45	A
2	30	D	27	55	A	52	80	A	77		B
3	31	B	28	56	A	53	81	A	78	6	A
4	32	C	29	57	C	54	82	B	79	7	B
5	33	D	30	58	A	55	83	C	80	8	B
6	34	A	31	59	A	56	84	D	81	9	C
7	35	A	32	60	D	57	85	B	82	10	A
8	36	A	33	61	D	58	86	A	83	11	B
9	37	B	34	62	D	59	87	C	84	12	C
10	38	A	35	63	B	60	88	A	85	13	B
11	39	A	36	64	B	61	89	D	86	14	B
12	40	C	37	65	C	62	90	D	87	15	D
13	41	D	38	66	C	63	91	A	88	16	DC
14	42	D	39	67	C	64	92	C	89	17	
15	43	A	40	68	D	65	93	C	90	18	D
16	44	A	41	69	A	66	94	D	91	19	B
17	45	B	42	70	B	67	95	C	92	20	B
18	46	D	43	71	A	68	96	D	93	21	C
19	47	B	44	72	D	69	97	B	94	22	C
20	48	B	45	73	D	70	98	C	95	23	B
21	49	D	46	74	A	71	99	B	96	24	C
22	50	D	47	75	C	72	100	B	97	25	B
23	51	B	48	76	A	73	1	B	98	26	D
24	52	B	49	77	A	74	2	D	99	27	C
25	53	C	50	78	С	75	3	P.	100	28	С

UNITED STATES NUCLEAR REGULATORY COMMISSION BOILING WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION OCTOBER 1997 - FORM A

September 17, 1997

Please Print	
Name:	
Facility:	
Docket No.: .	
Start Time:	Stop Time:

INSTRUCTIONS TO APPLICANT

Answer all the test items using the answer sheet provided. Each item has equal point value. A score of at least 80% is required to pass this portion of the written licensing examination. All examination papers will be collected 3.0 hours after the examination starts. This examination applies to a typical boiling water reactor (BWR) power plant.

SECTION	QUESTIONS	& OF TOTAL	SCORE
COMPONENTS	1 - 44		
REACTOR THEORY	45 - 72		
THERMODYNAMICS	73 - 100		
TOTALS	100		

All work done on this examination is my own. I have neither given nor received aid.

Applicant's Signature

EJLES AND GUIDELINES FOR THE GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

- 1. Print your name in the blank provided on the cover sheet of the examination.
- 2. Fill in the name of your facility.
- 3. Fill in your individual docket number.
- 4. Fill in your start and stop times at the appropriate time.
- 5. Two aids are provided for your use during the examination:
 - (1) An equations and conversions sheet contained within the examination copy, and
 - (2) Steam tables provided by your proctor.
- Place your answers on the sheet provided. Credit will only be given for answers properly marked on this sheet. Follow the instructions for filling out the answer sheet.
- 7. Scrap paper will be provided for calculations.
- Cheating on the examination will result in the automatic forfeiture of this examination. Cheating could also result in severe penalties.
- 9. Restroom trips are limited. Only **ONE** examinee may leave the room at a time. In order to avoid the appearance or possibility of cheating, avoid all contact with anyone outside of the examination room.
- 10. After you have completed the examination, sign the statement on the cover sheet indicating that the work is your own and you have not received or been given any assistance in completing the examination.
- 11. Turn in your examination materials, answer sheet on top, followed by the examination booklet, then examination aids steam table booklets, handouts and scrap paper used during the examination.
- 12. After turning in your examination materials, leave the examination area, as defined by the proctor. If after leaving you are found in the examination area while the examination is in procress, your examination may be forfeited.

GENERIC FUNDAMENTALS EXAMINATION EQUATIONS AND CONVERSIONS HANDOUT SHEET

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EQUATIONS

$Q = tt:C_p \Delta T$	$P = P_0 10^{SUR(t)}$
$Q = \dot{m} \Delta h$	$P = P_0 e^{(t/\tau)}$
$T \Delta A U = Q$	$A = A_0 e^{-\lambda t}$
$\dot{Q} \propto \dot{m}_{Nat Circ}^3$	$CR_{S/D} = S/(1 - K_{eff})$
AT a th ²	$CR_1(1 - K_{eff1}) = CR_2(1 - K_{eff2})$
AI - m _{Nat} Circ	$1/M = CR_1/CR_x$
$K_{eff} = 1/(1 - \rho)$	DRW $\propto \phi_{tin}^2/\phi_{ave}^2$
$\rho = (K_{eff} - 1) / K_{eff}$	Tup Tung
$SUR = 26.06 / \tau$	F = PA
β - ο	$\dot{m} = \rho A \ddot{v}$
$\tau = \frac{\mu}{\lambda_{eff} \rho}$	$W_{Pump} = \dot{m} \Delta P U$
ι· <u>β</u>	E = IR
$\rho = \frac{1}{\tau} + \frac{1}{1 + \lambda_{eff}\tau}$	Eff. = Net Work Out/Energy In
$l' = 1 \times 10^{-4}$ seconds	$U(P_2 - P_1) + (\vec{v}_2^2 - \vec{v}_1^2) + g(z_2 - z_1) = 0$
$\lambda_{eff} = 0.1 \text{ seconds}^{-1}$	2g _c g _c
	$g_{r} = 32.2$ lbm-ft/lbf-sec ²

CONVERSIONS

-	the set the site is	* ** ** *					
1	Mw	=	3.41 x 10 ⁶ Btu/hr	1	Curie	=	$3.7 \times 10^{10} \text{ dps}$
1	hp	=	2.54×10^3 Btu/hr	1	kg	=	2.21 lbm
1	Btu	=	778 ft-1bf	1	galwater	=	8.35 lbm
0	с	m	(5/9)(°F - 32)	1	ft ³ water	=	7.48 gal
0	F	=	$(9/5)(^{\circ}C) + 32$				

QUESTION:	1
TOPIC:	291001
KNOWLEDGE :	K1.01
QID:	B1701

A vertical safety valve has a compressed spring assembly that is applying 1200 lbf to the top of the valve disk in opposition to system pressure. System pressure is being exerted on the underside of the valve disk that is 3 inches in diameter.

Which one of the following is the approximate system pressure at which the safety valve will open? (Neglect the effect of atmospheric pressure.)

A. 44 psi

B. 64 psi

C. 128 psi

D. 170 psi

ANSWER:	D.		
PROOF :	F	32	PA
	P	=	F/A
	P	12	1200/3.14(1.5)2
	P	=	1200/7.07
	P	=	169.7 psi
QUESTION:		2	
TOPIC:		29	1001
KNOWLEDGE	:	K1	04
QID:		B1	.702

Which one of the following statements describes the flow rate characteristics of a typical gate or globe valve?

- A. The last 25% of valve stem movement in the open direction for a gate valve will produce a greater change in flow rate than the first 25% of valve stem movement.
- B. The last 25% of valve stem movement in the open direction for a globe valve will produce a greater change in flow rate than the first 25% of valve stem movement.
- C. A globe valve designed specifically for throttling flow must be operated in the first 25% of its range to control flow.
- D. The first 25% of valve stem movement in the open direction for a gate valve will produce a greater change in flow rate than the last 25% of valve stem movement.

ANSWER: D.

QUESTION: 3 TOPIC: 291001 KNOWLEDGE: K1.05 QID: B1404

Which one of the following is a generally accepted method for locally verifying that a manual valve is fully closed in a depressurized static piping system?

- A. Check a downstream flow gauge to be indicating zero flow
- B. Visually observe the valve rising-stem threading to be fully exposed
- C. Attempt to turn the valve handwheel in the close direction and verify no movement
- D. Compare an upstream and downstream pressure gauge to ensure zero differential pressure

ANSWER: C.

QUESTION:	4
TOPIC:	291001
KNOWLEDGE :	K1.07
QID:	B1102 (Rev)

Two common types of check valves used in power plants are:

A. globe and gate.

B. ball and plug.

C. swing and lift.

D. needle and angle.

ANSWER: C.

QUESTION:	5
TOPIC:	291001
KNOWLEDGE :	K1.02
QID:	B2005 (Rev)

When comparing the characteristics of gate valves and globe valves in an operating system, a globe valve generally has a ______ pressure drop when fully open, and is ______ commonly used for throttling system flow.

- 2. smaller; less
- B. larger; more
- C. smaller; more
- D. larger; less

ANSWER: B.

QUESTION:	6
TOPIC:	291002
KNOWLEDGE :	K1.01
QID:	B706 (Rev)

A cooling water system is operating at a steady-state flow rate of 700 gpm with 60 psid across the flow transmitter venturi. If cooling water flow rate is increased to 900 gpm, differential pressure across the flow transmitter venturi will be:

A. 68.0 psid.

- B. 77.1 psid.
- C. 99.2 psid.
- D. 127.5 psid.

ANSWER: C.

PROOF: $D/P = F^2$ $D/P_2 = D/P_1 (F_2/F_1)^2$ $= 60 (900/700)^2$ = 99.2

QUESTION:	7
TOPIC:	291002
KNOWLEDGE :	K1.04
QID:	B.07

Which one of the following will cause indicated flow rate to be <u>higher</u> than actual flow rate using a differential pressure flow detector and a calibrated orifice?

A. Debris becomes lodged in the orifice.

B. A leak develops in the high pressure sensing line

C. The orifice erodes over time.

D. The flow detector equalizing valve is inadvertently opened.

ANSWER: A.

QUESTION:	8
TOPIC:	291002
KNOWLEDGE :	K1.12
QID:	B611

Which one of the following parameters requires square root extraction when measured by differential pressure detectors?

A. Condenser vacuum

B. Reactor vessel level

C. Reactor vessel pressure

D. Recirculation pump flow rate

ANSWER: D.

QUESTION:	9
TOPIC:	291002
KNOWLEDGE :	K1.05
QID:	B1808 (Rev)

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Refer to the drawing of a pipe elbow used for flow measurement in a cooling water system (see figure below).

A differential pressure (D/P) flow detector is connected to instrument lines A and B.

If instrument line A develops a leak, indicated flow rate will ______ due to a ______ measured D/P.

- A. increase; larger
- B. increase; smaller
- C. decrease; larger
- D. decrease; smaller

ANSWER: D.



QUESTION:	10	
TOPIC:	291002	
KNOWLEDGE :	K1.08	
QID:	B1909	(Rev)

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

The level detector is being used in a level control system that is calibrated to maintain tank level at 80% at the current water temperature of 70°F. If water temperature gradually increases and stabilizes at 90°F, the level control system will cause <u>actual</u> tank' level to:

A. remain at 80%.

B. increase and stabilize above 80%.

C. oscillate around 80%.

D. decrease and stabilize below 80%.

ANSWER: B.



QUESTION:	11
TOPIC:	291002
KNOWLEDGE :	K1.08
QID:	NEW

Refer to the drawing of a tank with a differential pressure level detector (See figure below.).

The level detector was calibrated with reference leg and tank contents temperature at 70° F. An increase in ambient temperature causes the temperature of the reference leg and tank contents to increase to 110° F.

With the temperature of the reference leg and tank contents stable at 110°F, current level indication will be:

- A. higher than initial due to reference leg spill over.
- B. higher than initial due to expansion of tank contents.
- C. the same as initial due to offsetting density changes in the reference leg and tank contents.
- D. the same as initial due to the reference leg being connected to the upper portion of the tank.

ANSWER: A.



QUESTION:	12
TOPIC:	291002
KNOWLEDGE :	K1.19
QID:	B1214

The reactor scrammed due to a loss-of-coolant accident 1 hour ago. To verify adequate reactor vessel water level, the source range monitors (SRMs) are inserted. As the SRMs enter the core, count rate begins to increase and then stabilizes.

If the SRMs enter a voided section of the core, count rate will suddenly:

A. decrease due to decreased fast fission.

B. decrease due to increased neutron leakage.

C. increase due to increased neutron migration length.

D. increase due to decreased moderator neutron absorption.

ANSWER: B.

QUESTION:	13
TOPIC:	291002
KNOWLEDGE :	K1.24
QID:	NEW

An initial radiation survey is about to be performed in an area of unknown radiation field intensity. Which one of the following types of radiation monitoring instruments and settings should be used?

A. A Geiger Mueller survey meter selected to the low range
B. A Geiger Mueller survey meter selected to the high range
C. An ion chamber survey meter selected to the low range
D. An ion chamber survey meter selected to the high range
ANSWER: D.

QUESTION:	14
TOPIC:	291002
KNOWLEDGE :	K1.21
QID:	B2114

A gas-filled radiation detector operating in the proportional region is exposed to a constant gamma radiation field. If the applied voltage is increased but maintained within the proportional region, the rate of ion collection will:

- A. stay approximately the same because all of the primary ions were already being collected at the lower voltage.
- B. stay approximately the same because the detector is operating at saturated conditions.
- C. increase because fewer primary ions are recombining in the detector prior to reaching the electrodes.
- D. increase because more secondary ionizations are occurring in the detector.

ANSWER: D.

QUESTION:	15
TOPIC:	291003
KNOWLEDGE :	K1.03
QID:	B1317 (Rev)

Which one of the following controller types is designed to control the measured parameter at the controller set point?

A. Integral

B. Proportional

- C. On-Off
- D. Derivative

ANSWER: A.

QUESTION:	16	
TOPIC:	291003	
KNOWLEDGE :	K1.05	
QID:	B1416	(Rev)

Which one of the following describes a characteristic of pneumatic valve positioners?

- A. They can provide auto and manual demand signals to valve controllers and valve actuators.
- B. They can automatically increase or decrease air pressure to valve actuators to overcome sluggish valve response.
- C. They can either receive or supply air to/from valve controllers, depending on the direction of valve travel.
- D. They can increase air pressure to valve actuators above existing main air header pressure.

ANSWER: B.

QUESTION:	17
TOPIC:	291003
KNOWLEDGE :	K1.06
QID:	B1815

A diesel generator is supplying a bus with the governor operating in the isochronous mode. If a large electrical load is started on the generator bus, generator frequency will:

- A. remain constant during and after load start.
- B. initially decrease and then increase and stabilize below the initial value.
- C. initially decrease and then increase and stabilize at the initial value.
- D. initially decrease and then increase and stabilize above the initial value.

ANSWER: C.

QUESTION:	18
TOPIC:	291004
KNOWLEDGE :	K1.01
QID:	B1718

Starting a centrifugal pump with the discharge valve throttled (versus fully open) _____ the possibility of pump runout and _____ the possibility of pump cavitation.

A. increases; decreases

B. increases; increases

C. decreases; decreases

D. decreases; increases

ANSWER: C.

QUESTION:	19
TOPIC:	291004
KNOWLEDGE :	K1.07
QID:	B419 (Rev)

A centrifugal pump is circulating water at 150°F in a cooling water system. After several hours the water temperature has decreased to 100°F. Assuming system flow rate (gpm) is constant, pump motor amps will have _____ because _____ has increased.

A. increased; water density

B. increased; motor efficiency

C. decreased; water density

D. decreased; motor efficiency

ANSWER: A.

QUESTION:	20
TOPIC:	291004
KNOWLEDGE :	K1.06
QID:	B1918

Refer to the drawing of a cooling water system (see figure below).

The available net positive suction head for the centrifugal pump will be decreased by:

A. opening surge tank makeup valve "A" to raise tank level.

B. throttling heat exchanger cooling water valve "B" more cpen.

C. throttling pump discharge valve "C" more open.

D. reducing the heat loads on the cooling water system. ANSWER: C.



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QUESTION:	21
TOPIC:	291004
KNOWLEDGE :	K1.13/K1.19
QID:	B1725

Two identical centrifugal pumps (CPs) and two identical positive displacement pumps (PDPs) are able to take suction on a vented water storage tank and provide makeup water flow to a cooling water system. The pumps are capable of being cross-connected to provide multiple configurations. In single pump alignment, each pump will supply 100 gpm at a system pressure of 1000 psig.

Given the following information:

Centrifugal Pumps

Shutoff head: 1500 psig Maximum design pressile: 2000 psig

Positive Displacement Pumps

Maximum design pressure: 2000 psig

Which one of the following pump configurations will supply the <u>lowest</u> makeup flow rate to the system if system pressure is at 1700 psig?

A. Two CPs in parallel

B. Two CPs in series

C. One PDP and one CP in parallel

D. Cne PDP and one CP in series (CP supplying PDP)

ANSWER: A.

QUESTION:	22
TOPIC:	291004
KNOWLEDGE :	K1.11
QID:	B925

Refer to the drawing of a centrifugal pump operating curve (see figure below).

Which one of the following determines the general shape of the curve from point D to point B?

- A. Pump flow losses due to the decrease in available net positive " suction head as the system flow rate increases
- B. Pump flow losses due to back leakage through the clearances between the pump impeller and casing as the D/P across the pump increases
- C. The frictional and throttling losses in the piping system as the system flow rate increases
- D. The frictional losses between the pump impeller and its casing as the differential pressure (D/P) across the pump increases



ANSWER: C.

QUESTION:	23
TOPIC:	291004
KNOWLEDGE :	K1.06
QID:	B1120 (Rev)

A motor-driven centrifugal pump is operating in an open system. If the pump discharge valve is fully opened from a throttled position, available net positive suction head (NPSH) will ______ and required NPSH will ______.

A. increase; increase

B. increase; remain the same

C. decrease; increase

D. decrease; remain the same

ANSWER: C.

QUESTION:	2.4
TOPIC:	291004
KNOWLEDGE:	K1.18
QID:	B1125

Which one of the following describes the proper location for a relief value that will be used to prevent exceeding the design pressure of a positive displacement pump and associated piping?

- A. On the pump discharge piping upstream of the discharge isolation valve
- B. On the pump discharge piping downstream of the discharge isolation valve
- C. On the pump suction piping upstream of the suction isolation valv
- D. On the pump suction piping downstream of the suction isolation valve

ANSWER: A.

QUESTION: 25 TOPIC: 291004 KNOWLEDGE: K1.04 QID: B1219 (Rev)

Refer to the drawing of a pump with a recirculation line (see figure below).

Valve "A" will close when pump:

A. discharge pressure reaches a high set point.

B. discharge pressure reaches a low set point.

C. flow rate reaches a high set point.

D. flow rate reaches a low set point.

ANSWER: C.



QUESTION:	26
TOPIC:	291005
KNOWLEDGE :	K1.01
QID:	B1026

A motor-driven centrifugal pump exhibited indications of pump failure while being started. Which one of the following pairs of indications will occur if the pump failure is a sheared impeller shaft?

- A. Excessive duration of high starting current and motor breaker trips
- B. Excessive duration of high starting current and no change in system flow rate
- C. Lower than normal running current and motor breaker trips
- D. Lower than normal running current and no change in system flow rate

ANSWER: D.

QUESTION:	27
TOPIC:	291005
KNOWLEDGE :	K1.05
QID:	NEW

Two identical 4160 Vac induction motors are connectd to identical centrifugal pumps being used to provide cooling water flow in separate systems in a power plant. Each motor is rated at 1000 hp. The discharge valve for pump A is fully open and the discharge valve for pump B is fully shut.

If each motor is then started, the longest time period required to stabilize motor current will be experienced by motor ______ and the higher stable motor current will be experienced by motor

A. A; A
B. A; B
C. B; A
D. B; B
ANSWER: A.

QUESTION:	28
TOPIC:	291005
KNOWLEDGE :	K1.03
QID:	NEW

If the voltage supplied by an ac generator to an isolated electrical system is held constant while real load (kW) is increased, the current supplied by the generator will increase in direct proportion to the ______ of the change in real load. (Assume power factor does not change.)

- A. square root
- B. amount
- C. square
- D. cube

ANSWER: B.

QUESTION:	29
TOPIC:	291005
KNOWLEDGE:	K1.04
QID:	B326 (Rev)

A centrifugal pump is operating at 600 rpm with the following parameters:

Motor current = 100 amperes Pump head = 50 psid Fump flow rate = 880 gpm

Which one of the following will be the approximate value of pump head if pump speed is increased to 1200 rpm?

A. 71 rsid

- B. 100 psid
- C. 141 psid

D. 200 psid

ANSWER: D.

-

PROOF :

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H1/	H ₂	$= (S_1/S_2)^2$	
H ₂	=	$H_1 + (S_1/S_2)^2$	
H ₂	=	50 + 0.25	
H ₂	=	200 psid	

QUESTION: 30 TOPIC: 291005 KNOWLEDGE: K1.08 QID: B729

The main generator is operating on the grid with the following indications:

100 MWe 100 MVAR (VARs out) 2,800 amps

If main generator excitation is <u>increased</u> slightly, amps will and Mwe will

A. decrease; increase

B. decrease; remain the same

C. increase; increase

D. increase; remain the same

ANSWER: D.

QUESTION: 31 TOPIC: 291006 KNOWLEDGE: K1.03 QID: B631

The rate of heat transfer between two liquids in a heat exchanger will be <u>increased</u> if the: (Assume single-phase conditions and a constant specific heat capacity.)

A. flow rate of the colder liquid is decreased by 10%.

B. flow rate of the hotter liquid is increased by 10%.

C. temperature of both liquids is decreased by 20°F.

D. temperature of both liquids is increased by 20°F.

ANSWER: B.

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QUESTION: 32 TOPIC: 291006 KNOWLEDGE: K1.07 QID: B1231

Refer to the drawing of a water cleanup system (see figure below).

All values are identical and are initially 50% open. To lower the temperature at point 4, the operator should adjust value ______ in the ______ direction.

- A. A; open
- B. B; shut
- C. C; open
- D. D; shut

ANSWER: B.



QUESTION:	33
TOPIC:	291006
KNOWLEDGE :	K1.08
QID:	B2132 (Rev)

Refer to the drawing of a lube oil heat exchanger (see figure below).

The lube oil heat exchanger is in service with the following inlet temperatures:

Lube	oil	l inlet	tempe	erature:	130°F
Cooli	ng	water	inlet	temperature:	70°F

Assuming cooling water flow rate is greater than lube oil flow rate, which one of the following sets of heat exchanger outlet temperatures is possible? (Assume both fluids have the same c_p .)

	Lube Oil Outlet Temp	Cooling Wate Outlet Temp
A.	90°F	100°F
3.	90°F	110°F
2.	100°F	100°F
).	100°F	110°F

ANSWER :	Α.		



PROOF :

*

A. is the only option that shows a cooling water temp. increase that is smaller than the lube oil temp. decrease. This must be the case since cooling water flow rate is greater than lube oil flow rate.

QUESTION:	34
TOPIC:	291006
KNOWLEDGE :	K1.13
QID:	B1536

Which one of the following describes the state of water at 160 psig and 366°F?

A. Saturated liquid

B. Subcooled liquid

C. Superheated vapor

D. Mixture of saturated liquid and vapor

ANSWER: B.

PROOF: P_{sat} for 366°F is ~ 165 psia

 P_{water} is 160 psig + 15 = 175 psia

Pwater > Psat = subcooled

QUESTION:	35
TOPIC:	291006
KNOWLEDGE :	K1.18
QID:	B334 (Rev)

A plant is operating at 100% power when air inleakage results in the buildup of noncondensible gases in the main condenser. Which one of the following will occur as a result of this air inleakage?

A. Decreased condensate temperatu .

B. Decreased pressure in the main condenser

C. Decreased suction pressure at the condensate pumps

D. Decreased condenser cooling water outlet temperature

ANSWER: D.

QUESTION:	36
TOPIC:	291006
KNOWLEDGE :	K1.16
QID:	B1234

Refer to the drawing of a lube oil heat exchanger (see figure below).

If scaling occurs inside the cooling water tubes, cooling water outlet temperature will ______ and lube oil outlet temperature will ______. (Assume oil and cooling water flow rates remain the same.)

A. decrease; decrease

B. decrease; increase

C. increase; decrease

increase; increase

AUSWER: B.



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QUESTION:	37
TOPIC:	291007
KNOWLEDGE :	K1.05
QID:	B337 (Rev)

How does demineralizer differential pressure indicate the condition of the demineralizer resin bed?

- A. Low differential pressure indicates flow blockage in the demineralizer.
- B. Low differential pressure indicates that the demineralizer resin bed is exhausted.
- C. High differential pressure indicates flow blockage in the demineralizer.
- D. High differential pressure indicates that the demineralizer resin bed is exhausted.

ANSWER: C.

QUESTION:	38
TOPIC:	291007
KNOWLEDGE :	K1.07
QID:	B39 (Rev)

When a mixed-bed demineralizer resin is exhausted, the resin should be replaced or regenerated because:

- A. ions previously removed by the resin will be released into solution.
- B. the resin will fracture and possibly escape through the retention screens.
- C. particles previously filtered out of solution will be released.
- D. the resin will physically bond together, thereby causing a flow blockage.

ANSWER: A.

QUESTION: 39 TOPIC: 291007 KNOWLEDGE: K1.07 QID: B1039

A. hydroxide; negatively

B. hydroxide; positively

C. hydrogen; negatively

D. hydrogen; positively

ANSWER: A.

QUESTION:	40
TOPIC:	291008
KNOWLEDGE :	K1.02
QID:	B1144 (Rev)

Circuit breaker local overcurrent trip flag indicators, when actuated, indicate that:

- A. a breaker trip will occur unless current is reduced.
- B. a breaker overcurrent condition is responsible for a breaker trip.
- C. an overcurrent condition has cleared and the breaker can be closed.
- D. the associated circuit breaker has failed to trip open during an overcurrent condition.

ANSWER: B.

QUESTION:	41
TOPIC:	291008
KNOWLEDGE :	K1.03
QID:	B1044

Which one of the following describes a benefit of using charged springs (in lieu of a closing coil or solenoid operator) to close some large motor breakers?

- A. Springs produce faster breaker closing.
- B. Springs can be repaired or replaced without removing the breaker from service.
- C. Springs provide stored energy to allow local cycling of the breaker upon loss of control power.
- D. Springs will keep the breaker contacts firmly seated after closing to minimize arcing and prevent inadvertent opening.

ANSWER: C.

QUESTION:	42
TOPIC:	291008
KNOWLEDGE :	K1.05
QID:	B1041 (Rev)

Thermal overload devices will provide the first motor protection in the event of a/an:

A. locked rotor.

B. electrical short circuit.

C. gradual motor bearing damage.

D. sheared shaft.

ANSWER: C.

QUESTION:	43
TOPIC:	291008
KNOWLEDGE :	K1.08
QID:	B1143

A three-phase ac generator is being paralleled to the grid with the following conditions:

Generator frequency: 59.5 Hz Grid frequency: 59.8 Hz Generator voltage: 115.1 kV Grid voltage: 114.8 kV

When the generator output breaker is closed the generator will:

A. acquire real load and reactive load.

B. acquire real load and become a reactive load to the grid.
C. become a real load to the grid and acquire reactive load.
D. become a real load and a reactive load to the grid.
ANSWER: C.

QUESTION:	44
TOPIC:	291008
KNOWLEDGE :	K1.10
QID:	B1544 (Rev)

What is an advantage of using high voltage electrical disconnects instead of breakers to isolate main power transformers?

- A. Disconnects provide positive visual indication that the circuit is broken.
- B. Disconnects can be operated either locally or remotely.
- C. Disconnects are cheaper and provide the same automatic protection as a breaker.
- D. Disconnects are capable of passing a higher current with less heating than a breaker.

ANSWER: A.

QUESTION: 45 TOPIC: 292001 KNOWLEDGE: K1.02 QID: B1445 (Rev)

As compared to a prompt neutron, a delayed neutron, born from the same fission event, is more likely to:

A. leak out of the core.

B. be absorbed in a B-10 nucleus.

C. undergo resonance capture in a Pu-240 nucleus.

D. cause fission of a U-238 nucleus.

ANSWER: B.

QUESTION:	46
TOPIC:	292001
KNOWLEDGE:	K1.03
QID:	B945

Regarding a thermal neutron, the word "thermal" indicates that the neutron:

A. was born greater than 10⁻¹⁴ seconds after the fission event.

B. is a product of a thermal fission reaction.

C. was released by the decay of fission fragments.

D. is at the same energy level as the surrounding atoms.

ANSWER: D.

QUESTION:	47			
"DPIC:	292002			
KNOWLLDGE :	K1.09			
QID:	B1147			

The following are combinations of critical conditions that exist for the same reactor operating at 20% power at different times in core life. Which one of the following combinations indicates the largest amount of excess reactivity exists in the core?

	POS	TROL 1TIO	ROD N	REACTOR RECIR- CULATION FLOW
Α.	25%	rođ	density	25%
В.	25%	rod	density	50%
C.	50%	rod	density	25%
D.	50%	rod	density	50%
ANS QUE TOP KNC QID	WER: STION IC: WLEDO	C. N: GE:	48 292002 K1.14 B1748 (Rev)	

Sixteen hours ago, a reactor scrammed from 100% steady state power due to an instrument malfunction. All systems operated normally. Given the following absolute values of reactivities added since the scram, assign a (+) or (-) as appropriate and choose the current value of re reactivity.

Xenon	=	()	2.0% AK/K
Fuel temperature	=	()	3.0% AK/K
Control rods	=	()	12.0% AK/K
Voids	=	()	4.0% AK/K

A. -5.0% ΔK/K

B. -7.0% ∆K/K

C. -9.0% ∆K/K

D. -11.0% ΔK/K

ANSWER :	В.	
PROOF :	-2	+3.0
	-12	+4.0
	-14	+7.0

QUESTION:	49
TOPIC:	292603
KNOWLEDGE :	K1.01
QID:	NEW

Two reactors are currently shut down with a reactor startup in progress. The two reactors are identical except that reactor A has a source neutron strength of 100 neutrons per second and reactor B source neutron strength is 200 neutrons per second. Control rods are stationary and Keff is 0.98 in both reactors. Core neutron level has reached equilibrium in both reactors.

Which one of the following lists the core neutron level (neutrons per second) in reactors A and B?

	Reactor A	Reactor
Α.	5,000	10,000
в.	10,000	20,000
с.	10,000	40,000
D.	20,000	40,000
ANS	WER: A.	
PRO	OF :	
CRs	v _D = S/(1−K)	
Rea	ctor A	
CR ₈ /	_D = 100/.02	
	= 5,000	
Rea	ctor B	
CR	= 200/.02	

= 10,000
QUESTION:	50
TOPIC:	292003
KNOWLEDGE:	K1.04
QID:	NEW

Which one of the following percentages of fuel undergoing fission in a reactor will result in the largest rea tor core effective delayed neutron fraction?

	<u>U-235</u>	<u>U-238</u>	<u>Pu-239</u>
Α.	908	7%	38
в.	80%	6%	148
с.	70%	78	23%
D.	60%	68	348

ANSWER: A.

QUESTION:	51
TOPIC:	292003
KNOWLEDGE :	K1.06
QID:	B1250

Two reactors are identical in every way except that reactor A is at the end of core life and reactor B is at the beginning of core life. Both reactors are critical at 10⁻⁵% power.

If the same amount of positive reactivity is added to each reactor at the same time, the point of adding heat will be reached first by reactor ______ because it has a ______ delayed neutron fraction.

A. A; larger

B. B; larger

C. A; smaller

D. B; smaller

ANSWER: C.

QUESTION:	52
TOPIC:	292004
KNOWLEDGE :	K1.02
QID:	B742 (Rev)

Under which one of the following conditions is a reactor core most likely to have a positive moderator temperature coefficient?

A. Low coolant temperature at beginning-of-life

B. Low coolant temperature at end-of-life

C. High coolant temperature at beginning-of-life

D. High coolant temperature at end-of-life

ANSWER: B.

QUESTION:	53
TOPIC:	292004
KNOWLEDGE :	K1.04
QID:	B1553

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A reactor is operating at 70% power. Which one of the following will <u>directly</u> result in a less negative fuel temperature coefficient? (Consider only the effect of the change in each listed parameter.)

A. Increase in Pu-240 inventory in the core

B. Increase in moderator temperature

C. Increase in fuel temperature

D. Increase in void fraction

ANSWER: C.

QUESTION:	54
TOPIC:	292005
KNOWLEDGE :	K1.04
QID:	B755 (Rev)

A reactor is critical below the point of adding heat (POAH) during a reactor startup at the end of core life. Control rods are withdrawn for 20 seconds to establish a positive 30-second reactor period.

Reactor power will increase:

A. continuously until control rods are reinserted.

B. and stabilize at a value slightly below the POAH.

C. temporarily, then stabilize at the original value.

D. and stabilize at a value equal to the POAH.

QUESTION:	55
TOPIC:	292005
KNOWLEDGE :	K1.07
QID:	NEW

Which one of the following parameters typically has the greatest influence on the shape of a differential rod worth curve?

A. Core radial neutron flux distribution

B. Core axial neutron flux distribution

C. Core xenon distribution

D. Burnable poison distribution

ANSWER: B.

QUESTION:	56
TOPIC:	292005
KNOWLEDGE :	K1.09
QID:	B357

If the void fraction surrounding centrally located fuel bundles increases, the worth of the associated control rod(s) will:

- A. decrease, because more neutrons are able to travel from one fuel bundle to the next without being absorbed by the control rod.
- B. increase, because thermal neutrons will travel farther resulting in a larger fraction of thermal neutrons being absorbed by the control rod.
- C. decrease, because more neutrons are resonantly absorbed in the fuel as they are being thermalized resulting in fewer thermal neutrons to be absorbed by the control rod.
- D. increase, because control rod's are epithermal neutron absorbers and neutrons remain at higher energies longer due to the longer slowing down length.

ANSWER: C.

QUESTION:	57
TOPIC:	292005
KNOWLEDGE :	K1.12
QID:	B656

During reactor power operations, the axial neutron flux shape is affected most by withdrawal of ______ control rods and the radial neutron flux shape is affected most by withdrawal of ______ control rods.

A. shallow; shallow

B. deep; shallow

C. shallow; deep

D. deep; deep

ANSWER: C

QUESTION:	58
TOPIC:	292006
KNOWLEDGE :	K1.62
QID:	B55

Which one of the following lists the proper order of substances from the <u>largest</u> to the <u>smallest</u> microscopic cross sections for absorption of thermal neutrons?

A. Gadolinium, U-235, Xe-135, U-238

B. Gadolinium, Xe-135, U-235, U-238

C. Xe-135, U-235, gadolinium, U-238

D. Xe-135, gadolinium, U-235, U-238

QUESTION:	59
TOPIC:	292006
KNOWLEDGE :	K1.04
QID:	B1759 (Rev)

Which one of the following describes the change in core xenon-135 concentration immediately following a power increase from 50% equilibrium conditions?

- A. Initially decreases due to the increased rate of xenon-135 radioactive decay.
- B. Initially decreases due to the increased absorption of thermal neutrons by xenon-135.
- C. Initially increases due to the increased xenon-135 production from fission.
- D. Initially increases due to the increased iodine-135 production from fission.

ANSWER: B.

QUESTION:	60
TOPIC:	292006
KNOWLEDGE :	K1.07
QID:	B1561

Which one of the following reactor startup conditions requires the least amount of control rod withdrawal to attain reactor criticality during peak core xenon-135 conditions after a reactor scram from equilibrium core xenon-135 conditions?

A. Scram from 20% power at beginning of core life (BOL)

B. Scram from 20% power at end of core life (EOL)

C. Scram from 100% power at BOL

D. Scram from 100% power at EOL

ANSWER: A.

QUESTION:	61
TOPIC:	292006
KNOWLEDGE :	K1.10
QID:	B1461

A reactor has been operating at 100% power for two months when a reactor scram occurs. Four hours later, the reactor is critical and stable at 10% power.

Which one of the following operator actions is required to maintain reactor power at 10% over the next 24 hours?

A. Add positive reactivity during the entire period

B. Add negative reactivity during the entire period

C. Add positive reactivity, then negative reactivity

D. Add negative reactivity, then positive reactivity ANSWER: C.

QUESTION:	62
TOPIC:	292006
KNOWLEDGE :	K1.12
QID:	B2159 (Rev)

Twenty-four hours after a reactor scram from a long-term, steadystate, 100% power run, the core xenon-135 concentration will be approximately:

A. the same as at the time of the scram and decreasing.

B. the same as at the time of the scram and increasing.

C. 50% lower than at the time of the scram and decreasing.

D. 50% higher than at the time of the scram and increasing.

ANSWER: A.

QUESTION:	63
TOPIC:	292006
KNOWLEDGE :	K1.14
QID:	B62 (Rev)

A reactor is operating at 80% power following a power reduction from 100% over a one-hour period. To keep reactor power at 80% over the next three hours, the operator must _____ control rods or _____ recirculation flow rate.

A. insert; increase

B. insert; 'ecrease

C. withdraw; increase

D. withdraw; decrease

ANSWER: C.

QUESTION:	64
TOPIC:	292008
KNOWLEDGE :	K1.03
QID:	B1766

A reactor startup is in progress with a current K_{eff} of 0.95 and a current equilibrium source range count rate of 150 cps. Which one of the following equilibrium count rates will occur when K_{eff} becomes 0.98?

- A. 210 cps
- B. 245 cps

C. 300 cps

D. 375 cps

ANSWER: D.

PROOF :

 $CR_2/CR_1 = (1 - K_1)/(1 - K_2)$

 $CR_2 = (.05/.02) 150$

= 375

QUESTION: 65 TOPIC: 292007 KNOWLEDGE: K1.03 QID: B1163

Refer to the drawing of K_{eff} versus core age (see figure below). The decrease in K_{eff} from point 1 to point 2 is primarily caused by:

- A. depletion of fuel.
- B. burnout of burnable poisons.
- C. initial heat-up of the reactor.
- D. buildup of fission product poisons.



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QUESTION:	66
TOPIC:	292008
KNOWLEDGE :	K1.04
QID:	B67 (Rev)

As a reactor approaches criticality during a reactor startup it takes longer to reach an equilibrium neutron count rate after each control rod withdrawal due to the increased:

- A. length of time required to complete a neutron generation.
- B. number of neutron generations required to reach a stable neutron level.
- C. length of time from neutron birth to absorption.
- D. fraction of delayed neutrons being produced as criticality is approached.

ANSWER: B.

QUESTION:	67
TOPIC:	292008
KNOWLEDGE :	K1.08
QID:	B1069

A reactor is critical just below the point of adding heat (POAH) at a temperature of 160°F. Which one of the following will result in reactor power increasing and stabilizing at the POAH? (Assume a negative moderator temperature coefficient.)

A. Reactor recirculation flow increases 10%.

B. Reactor coolant temperature increases 3°F.

C. A single control rod moves in one notch.

D. Core xenon-135 concentration decreases.

QUESTION:	68
TOPIC:	292008
KNOWLEDGE :	K1.12
QID:	B133 (Rev)

A reactor startup is in progress and criticality has just been achieved. After recording critical rod height, the operator withdraws control rods for 20 seconds to establish a positive 30second reactor period. One minute later (prior to the point of adding heat) the operator inserts the same control rods for 25 seconds.

During the insertion, the reactor period will become:

- A. infinity during the entire period of control rod insertion.
- B. negative after the control rods pass through the critical rod height.
- C. negative just as the control rods pass through the critical rod height.
- D. negative before the control rods pass through the critical rod height.

ANSWER: D.

QUESTION: 69 TOPIC: 292008 KNOWLEDGE: K1.15 QID: B469

A reactor is stable at the point of adding heat (POAH) with the reactor coolant at 160°F during the reactor heat-up and pressurization phase of a reactor startup. Control rods are withdrawn a few notches to raise reactor power and establish a heat-up rate.

If no further control rod withdrawal occurs, reactor power will: (Assume no voiding occ_rs.)

A. remain stable until voiding begins to occur.

B. increase until the control rods are reinserted.

C. decrease and stabilize at a subcritical power level.

D. decrease and stabilize at the POAH.

QUESTION: 70 TOPIC: 292008 KNOWLEDGE: K1.18 QID: B1371 (Rev)

With a reactor on a constant period, which one of the following power changes requires the shortest time to occur?

A. 1% power to 4% power

B. 5% power to 15% power

C. 20% power to 35% power

D. 40% power to 60% power

ANSWER: D.

QUESTION:	71
TOPIC:	292008
KNOWLEDGE :	K1.22
QID:	B971

A plant is operating at 85% power when a failure of the steam pressure control system opens the turbine control valves to admit 10% more steam flow to the main turbine. No operator actions occur and no protective system actuations occur.

How will reactor power respond? (Assume the valves remain in the failed position.)

A. Increase until reactor power matches the new steam demand

B. Increase continuously and exceed reactor protection set points

- C. Decrease and stabilize at a lower power level and steaming rate
- D. Decrease and stabilize at a critical power level below the point of adding heat

ANSWER: C.

QUESTION:	72
TOPIC:	292008
KNOWLEDGE :	K1.30
QID:	B131 (Rev)

A reactor has been operating at 100% power for several weeks when a reactor scram occurs. How much time will be required for core heat production to decrease to 1% following the scram?

A. 1 to 8 days

. .

B. 1 to 8 hours

C. 1 to 8 minutes

D. 1 to 8 seconds

ANSWER: B.

QUESTION:	73
TOPIC:	293001
KNOWLEDGE :	K1.03
QID:	B1174

Refer to the drawing of four identical tank differential pressure level detectors (see figure below).

The tanks are identical and are presently at 2 psig overpressure and the same constant water level and a temperature of 60°F. They are surrounded by atmospheric pressure. All level detectors have been calibrated and are producing the same level indication. A leak in the top of each tank causes a complete loss of overpressure in both tanks.

Which level detector(s) will produce the lowest level indication?

A. 1

B. 2

C. 1 and 4

D. 2 and 3



QUESTION:	74
TOPIC:	293003
KNOWLEDGE :	K1.09
QID:	B1574

Consider a steam-water mixture with a current quality of 79%. If pressure remains constant and heat is added to the mixture, the temperature of the mixture will ______ and the quality of the mixture will ______. (Assume the mixture remains saturated.)

A. remain the same; increase

B. remain the same; remain the same

C. increase; increase

D. increase; remain the same

ANSWER: A.

QUESTION:	75
TG>IC:	293003
KNOWLEDGE :	K1.23
QID:	NEW

1.0 x 10⁶ lbm/hr saturated steam at 30% steam quality is leaving a main turbine and entering a condenser at 2.0 psia. Condensate is entering the hotwell at 118 degrees F. Which one of the following is the approximate condenser heat transfer rate?

A. 3.1 x 10° Btu/hr

B. 5.8 x 10° Btu/hr

C. 7.2 x 10⁸ Btu/hr

D. 9.9 x 10" Btu/hr

ANSWER: A.

PROOF :

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From steam tables: Exhaust steam enthalpy is 1116.1 - (0.7)(1022.2) = 400.56 Btu/lbm
From steam tables: Condensate enthalpy is 86 Btu/lbm
Q = m-dot delta-h
Q = (1.000,000 \text{ lbm/hr})(400.6 - 86 \text{ Btu/lbm})
Q = 314,600,000 Btu/hr
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QUESTION: 76 TOPIC: 293004 KNOWLELGE: K1.04 QID: B376

Refer to the drawing of a steam-jet air ejector (see figure below).

In the figure of an operating steam jet air ejector, steam flowing from D to E undergoes a pressure _____ and a velocity

- A. decrease; decrease
- B. decrease; increase
- C. increase; increase
- D. increase: decrease



QUESTION:	17
TOPIC:	293004
KNOWLEDGE :	K1.12
QID:	B1876 (Rev)

Condensate depression is the process of:

A. removing condensate from turbine exhaust steam.

B. spraying condensate into turbine exhaust steam.

C. heating turbine exhaust steam above its saturation temperature.

D. cooling turbine exhaust steam below its saturation temperature. ANSWER: D.

QUESTION:	78
TOPIC:	293005
KNOWLEDGE :	K1.05
QID:	B278

Which one of the following is the most probable location for superheated steam in a boiling water reactor steam cycle that uses moisture separator reheaters?

A. The inlet of the high pressure turbine
B. The inlet of the low pressure turbines
C. The outlet of the high pressure turbine
D. The outlet of the low pressure turbines
ANSWER: B.

QUESTION:	79
TOPIC:	191004
KNOWLEDGE :	K1.14
QID:	B1878 (Rev)

Refer to the drawing of four sets of centrifugal pump operating curves (see figure below). Each set of curves shows the results of a change in pump/system operating conditions.

Two identical constant-speed centrifugal pumps are operating in parallel in an open system when one pump trips.

Which set of operating curves depicts the "before" and "after" conditions described above?

A. 1.

B. 2.

C. 3.

D. 4.

ANSWER: A.



QUESTION:	80
TOPIC:	293006
KNOWLEDGE :	K1.19
QID:	B1181

A plant is operating at full power when a 200 gpm reactor coolant leak occurs, which results in a reactor scram and initiation of emergency coolant injection. Reactor vessel pressure stabilizes at 900 psia and all injection pumps are operating with all pump miniflow paths isolated. The shutoff heads for the pumps are as follows:

High pressure coolant injection (HPCI) pumps: 1200 psia Low pressure coolant injection (LPCI) pumps: 200 psia

Which pumps must be stopped quickly and why?

A. HPCI pumps to avoid pump overheating caused by high flow
B. HPCI pumps to avoid motor overheating caused by high flow
C. LPCI pumps to avoid pump overheating caused by low flow
A. LPCI pumps to avoid motor overheating caused by low flow

QUESTION:	81
TOPIC:	293006
KNOWLEDGE:	K1.29
QID:	NEW

Water at 90 degrees F and 50 psig is flowing through a 10-inch diameter pipe at 100 lbm/sec. The pipe then splits into two pipes, a 4-inch diameter pipe and an 8-inch diameter pipe. Disregarding any flow restrictions other than pipe size, which one of the following lists the approximate flow rates through the 4-inch and 8-inch diameter pipes?

	4-inch Pipe (1bm/sec)	8-inch Pipe (1bm/sec)
Α.	20	80
в.	25	75
с.	30	70
D.	33	67
ANSW	ER: A.	
PROO m = m1 + pA1v pv(A pv(8 pv(8 pv =	F: ρAv m2 = 100 $+ \rho A2v = 100$ 1 + A2) = 100 0) = 100 100/80	
m1 = m1 = m1 =	pvA1 100/80 (16) 1600/80 = 20	lbm/sec
m2 = m2 = m1 =	pvA2 100/80 (64) 6400/80 = 80	lbm/sec

QUESTION:	82
TOPIC:	223007
KNOWLEDGE:	K1.01
QID:	NEW

Which one of the following describes a heat transfer process in which convection is the most significant heat transfer mechanism?

- A. From the reactor fuel to the core barrel during core uncovery
- B. Through the tube walls in a main condenser during normal operation at 100% power
- C. From the reactor fiel to the steam outlet of the reactor vessel during a station blackout
- D. From fuel pellet centerline to fuel clad during normal operation at 100% power

ANSWER: C.

QUESTION:	83
TOPIC:	293007
KNOWLEDGE :	K1.02
QID:	B1682

The buildup of fission gases in a fuel rod causes thermal conductivity of the fuel pellets to ______ and thermal conductivity of the fill gas to ______. (Consider only the direct effect of the fission gases.)

A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

ANSWER: A.

QUESTION:	84	
TOPIC:	293007	
KNOWLEDGE :	K1.13	
QID:	B2183	(Rev)

The power range nuclear instruments have been adjusted to 100% based on a calculated heat balance. Which one of the following will result in indicated reactor power being <u>lower</u> than actual reactor power?

- A. The feedwater temperature used in the heat balance calculation was 20°F higher than actual feedwater temperature.
- B. The reactor recirculation pump heat input term used in the heat balance was 11/8 lower than actual.
- C. The steam and feedwater flow rates used in the heat balance calculation were 10% higher than actual flow rates.
- D. The operator miscalculated the enthalpy of the steam exiting the reactor vessel to be 10 Btu/lkm higher than actual.

ANSWER: A.

QUESTION: 85

DELETED.

QUESTION:	86
TOPIC:	293008
KNOWLEDGE :	K1.01
QID:	B1183

Refer to the drawing of a pool boiling curve (see figure below).

In which region(s) of the curve does the reactor normally operate to transfer heat from the fuel cladding to the coolant at 100% power?

- A. Region I only
- B. Regions I and II
- C. Region II only
- D. Regions II and III

ANSWER: B.



QUESTION: 87 TOPIC: 293008 KNOWLEDGE: K1.08 QID: B287 (Rev)

The maximum convective heat transfer coefficient exists just prior to the beginning of:

A. bulk boiling.

B. departure from nucleate boiling.

C. subcooled nucleate boiling.

D. saturated nucleate boiling.

ANSWER: B.

QUESTION:	88
TOPIC:	293008
KNOWLEDGE:	K1.09
QID:	B987 (Rev)

Which one of the following describes the conditions in a fuel channel that is experiencing transition boiling?

A. Complete steam blanketing of the fuel rod surface

B. Alternate wetting and drying of the fuel rod surface

C. Steam bubbles form and collapse on the fuel rod surface

D. Steam bubbles form on the fuel rod surface and are swept away by subcooled bulk coolant

ANSWER: B.

QUESTION:	89
TOPIC:	293008
KNOWLEDGE :	K1.17
QID:	B1588

A reactor is operating at steady state 90% power. Which one of the following will cause the two-phase coolant flowing upward in a fuel channel to become closer to the onset of transition boiling? (Assume reactor power does not change unless stated.)

A. Reactor pressure increases.

B. Recirculation flow increases.

C. Feedwater temperature decreases.

D. Associated bundle power decreases.

ANSWER: A.

QUESTION:	90					
TOPIC:	293008					
KNOWLEDGE :	K1.21					
QID:	B1689					

Given the following conditions:

10 lbm mixture of vapor and liquid Steam quality = 30% Pressure = 1,000 psia

Which one of the following approximates the void fraction?

A. 10.18

B. 11.3%

C. 88.7%

D. 89.9%

ANSWER: D.

PROOF: Voic Fraction = Volume Steam

Volume Steam + Volume Water

- $= \frac{.3(.44596)}{.3(.44596) + .7(.02159)}$
- = <u>.133788</u> .133788 + .015113

•

*

= .8985 = 89.9%

QUESTION:	91
TOPIC:	293008
KNOWLEDGE :	K1.30
QID:	B1790

Two reactors, A and B, are operating at rated power with neutron flux radially peaked in the center of each core. Reactors A and B are identical except that reactor A has core orificing and reactor B does not. Both reactors have the same control rod pattern and density.

Compared to the center fuel bundle in reactor A, the center fuel bundle in reactor B will have the ______ critical power and the ______ coolant flow rate.

A. lowest; lowest

B. lowest; highest

C. highest; lowest

D. highest; highest

ANSWER: A.

QUESTION:	92
TOPIC:	293009
KNOWLEDGE :	K1.11
QID:	B1793 (Rev)

Which one of the following describes the basis for the 2200°F maximum fuel clad temperature limit?

- A. 2200°F is approximately 500°F below the fuel clad melting temperature.
- B. The rate of the zircaloy-steam reaction becomes significant at temperatures above 2200°F.
- C. If fuel clad temperature reaches 2200°F, the onset of transition boiling is imminent.
- D. The differential expansion between the fuel pellets and the fuel clad becomes excessive above 2200°F.

ANSWER: B.

QUESTION:	93
TOPIC:	293009
KNOWLEDGE :	K1.07
QID:	B295

Operating a reactor below the linear heat generation rate thermal limit prevents:

- A. cracking of the fuel cladding due to high stress from fuel pellet expansion.
- B. melting of the fuel cladding due to cladding temperature exceeding 2200°F during an anticipated transient without a scram.
- C. cracking of the fuel cladding due to a lack of cooling caused by departure from nucleate boiling.
- D. melting of the fuel cladding due to a lack of cooling following a loss of coolant accident.

ANSWER: A

QUESTION:	94
TOPIC:	293009
KNOWLEDGE :	K1.01
QID:	B1092

In a reactor operating at full power, the fuel bundle with the highest power always has the:

A. greatest critical power ratio.

B. greatest radial peaking factor.

C. smallest linear heat generation rate.

D. smallest maximum average planar linear heat generation rate.

ANSWER: B.

QUESTION: 95 TOPIC: 293009 KNOWLEDGE: K1.16 QID: B495

Refer to the drawing of a fuel rod and coolant flow channel at the beginning of core life (see figure below).

Given the following initial core parameters:

Reactor	power	=		1	0	0	8
Tcoolant		=		5	0	0	°F
Tfuel center	line	=	2	5	0	0	°F

What would the fuel centerline temperature be if, over core life, the total fuel-to-coolant thermal conductivity were doubled? (Assume reactor power is constant.)

- A. 1250°F
- B. 1300°F
- C. 1400°F
- D. 1500°F

ANSWER. D.



PROOF :

 $T_{CL} = T_{coolant} + \Delta T$ $\Delta T/2 = (2500 - 500)/2$ = 2000/2 = 1000 $\therefore T_{CL} = 500 + 1000$

= 1500°F

QUESTION:	96
TOPIC:	293009
KNOWLEDGE :	K1.26
QID:	B1396

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How is critical power affected when the axial power distribution in a fuel bundle shifts from bottom-peaked to top-peaked?

- A. Critical power increases to a new, higher value.
- B. Critical power increases temporarily, then returns to its initial value.
- C. Critical power decreases to a new, lower value.
- D. Critical power decreases temporarily, then returns to its initial value.

ANSWER: C.

QUESTION:	97	
TOPIC:	293009	
KNOWLEDGE :	K1.30	
QID:	B2193	(Rev)

A step increase in reactor power results in a fuel rod surface temperature increase from 570°F to 590°F at steady state conditions. The fuel thermal time constant is 6 seconds.

Which one of the following is the approximate fuel rod surface temperature 6 seconds after the power change?

A. 574°F

B. 577°F

C. 580°F

D. 583°F

ANSWER: D.

PROOF :

 $T_f = T_i + 0.632(T_f - T_i)$ $T_f = 570 + 12.64$

 $T_t = 570 + 0.632(590 - 570)$ $T_t = 582.64$

QUESTION: 98 TOPIC: 293009 KNOWLEDGE: K1.43 QID: B1298 (Rev)

If reactor feedwater temperature suddenly increases by 10°F during operation at 75% power, critical power will ______ and bundle power will ______. (Assume the reactor does not scram.)

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

ANSWER: D.

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QUESTION:	99 .
TOPIC:	293010
KNOWLEDGE:	K1.02
QID:	B1500 (Rev)

The nil-ductility transition temperature is that temperature:

A. below which vessel failure is imminent.

B. above which vessel failure is imminent.

C. below which the probability of brittle fracture significantly increases.

D. above which the probability of brittle fracture significantly increases.

ANSWER: C.

QUESTION: 100 TOPIC: 293010 KNOWLEDGE: K1.04 QID: B899 (Rev)

A heatup stress applied to the reactor vessel is:

A. tensile at the inner wall and compressive at the outer wall.

B. tensile across the entire wall.

C. compressive at the inner wall and tensile at the outer wall.

D. compressive across the entire wall.

ANSWER: C.

6. . . .

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OCTOBER 1997 NRC GENERIC FUNDAMENTALS EXAMINATION BOILING WATER REACTOR - ANSWER KEY

FC	DRM B	ANS	FORI	B	ANS	FOI	RM B	ANS	FOR A	M B	ANS
1	29	D	26	54	D	51	79	C	76	4	D
2	30	D	27	55	A	52	80	B	77	5	D
34	31	C	28	56	B	53	81	C	`8	6	B
	32	C	79	57	D	54	82	D	79	7	A
5	33	B	30	58	D	55	83	B	80	8	C
6	34	C	31	59	B	56	84	C	81	9	A
78	35	A	32	60	B	57	85	C	82	10	C
	36	D	33	61	A	58	86	D	83	11	A
9	37	D	34	62	B	59	87	B	84	12	A
10	38	B	35	63	D	60	88	A	85	13	C/D
11	39	A	36	64	B	61	89	C	86	1.4	B
12	40	B	37	65	C	62	90	A	87	15	B
13	41	D	38	66	A	63	91	C	88	16	B
14	42	D	39	67	A	64	92	D	89	17	A
15	43	A	40	68	B	65	93	D	90	18	D
16	44	B	41	69	C	66	94	B	91	19	A
17	45	C	42	70	C	67	95	D	92	20	B
18	46	C	43	71	C	68	96	D	93	21	A
19	47	A	44	72	A	69	97	D	94	22	B
20	48	C	45	73	B	70	98	D	95	23	D
21	49	A	46	74	D	71	99	C	96	24	C
22	50	C	47	75	C	72	100	B	97	25	D
23	51	C	48	76	B	73	1	D	98	26	D
24	52	A	49	77	A	74	2	A	99	27	C
25	53	С	50	78	A	75	3	A	100	28	С