TOPIC: 192003
KNOWLEDGE: K1.01 [2.7/2.8]
QID: P347 (B350)

Which one of the following is a characteristic of subcritical multiplication?

A. The subcritical neutron level is directly proportional to the neutron source strength.

B. Doubling the indicated count rate by reactivity additions will reduce the margin to criticality by approximately one quarter.

C. For equal reactivity additions, it takes less time for the new equilibrium source range count rate to be reached as K_{eff} approaches unity.

D. An incremental withdrawal of any given control rod will produce an equivalent equilibrium count rate increase, whether K_{eff} is 0.88 or 0.92.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.01 [2.7/2.8]
QID: P1848 (B1170)

A nuclear power plant has been operating at 100 percent power for two months when a reactor trip occurs. Two months after the reactor trip, with all control rods still fully inserted, a stable count rate of 20 cps is indicated on the source range nuclear instruments.

The majority of the source range detector output is being caused by the interaction of __________ with the detector.

A. intrinsic source neutrons

B. fission gammas from previous power operation

C. fission neutrons from subcritical multiplication

D. delayed fission neutrons from previous power operation

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.01 [2.7/2.8]
QID: P7687 (B7687)

The total neutron flux in a shutdown reactor is constant at 5.0 x 10^3 n/cm^2-sec. If non-fission neutron sources are supplying a constant flux of 1.0 x 10^2 n/cm^2-sec, what is K_{eff}?

A. 0.98

B. 0.96

C. 0.94

D. Cannot be determined without additional information.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.05 [2.7/2.8]
QID: P548

Reactor power was increased from 1.0 x 10^{-9} percent to 1.0 x 10^{-6} percent in 6 minutes. The average startup rate was ___________ decades per minute.

A. 0.5

B. 1.3

C. 2.0

D. 5.2

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.05 [2.7/2.8]
QID: P648

Reactor power increases from 1.0 x 10^{-8} percent to 5.0 x 10^{-7} percent in two minutes. What was the average startup rate during the power increase?

A. 0.95 dpm

B. 0.90 dpm

C. 0.85 dpm

D. 0.82 dpm

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.05 [2.7/2.8]
QID: P2349

During a reactor startup, reactor power increases from 1.0 x 10^{-8} percent to 2.0 x 10^{-8} percent in two minutes. What was the average reactor period during the power increase?

A. 173 seconds

B. 235 seconds

C. 300 seconds

D. 399 seconds

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.05 [2.7/2.8]
QID: P2648

During a reactor startup, reactor power increases from 3.0 x 10^{-6} percent to 5.0 x 10^{-6} percent in two minutes. What was the average reactor period during the power increase?

A. 357 seconds

B. 235 seconds

C. 155 seconds

D. 61 seconds

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P47 (B451)

A small amount of positive reactivity is added to a reactor that is critical in the source range. The amount of reactivity added is much less than the effective delayed neutron fraction.

Which one of the following will have the most significant effect on the magnitude of the stable reactor period achieved for this reactivity addition while the reactor is in the source range?

A. Prompt neutron lifetime

B. Fuel temperature coefficient

C. Moderator temperature coefficient

D. Effective delayed neutron precursor decay constant

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P126

A nuclear power plant is operating at steady-state 50 percent power in the middle of a fuel cycle. Which one of the following will initially produce a positive startup rate?

A. Main turbine runback.

B. Unintentional boration.

C. Increase in main turbine load.

D. Closure of a letdown isolation valve.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P248

The magnitude of the stable startup rate achieved for a given positive reactivity addition to a critical reactor is dependent on the __________ and __________.

A. prompt neutron lifetime; axial neutron flux distribution

B. prompt neutron lifetime; effective delayed neutron fraction

C. effective delayed neutron precursor decay constant; effective delayed neutron fraction

D. effective delayed neutron precursor decay constant; axial neutron flux distribution

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P2748 (B2751)

A reactor is critical at 1.0 x 10^{-8} percent power during a reactor startup. $\bar{\beta}_{eff}$ for this reactor is 0.0072. Which one of the following is the approximate amount of positive reactivity that must be added to the core by control rod withdrawal to attain a stable startup rate of 1.0 dpm?

A. 0.2 %ΔK/K

B. 0.5 %ΔK/K

C. 1.0 %ΔK/K

D. 2.0 %ΔK/K

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P3148 (B3151)

A reactor is being started for the first time following a refueling outage. Reactor Engineering has determined that during the upcoming fuel cycle, $\bar{\beta}_{eff}$ will range from a maximum of 0.007 to a minimum of 0.005.

Once the reactor becomes critical, control rods are withdrawn to increase reactivity by 0.1 %ΔK/K. Assuming <u>no</u> other reactivity additions, what will the stable reactor period be for this reactor until the point of adding heat is reached?

A. 20 seconds

B. 40 seconds

C. 60 seconds

D. 80 seconds

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P3548 (B3551)

Reactors A and B are identical except that the reactors are operating at different times in core life. The reactor A effective delayed neutron fraction is 0.007, and the reactor B effective delayed neutron fraction is 0.005. Both reactors are currently subcritical with neutron flux level stable in the source range.

Given:

Reactor A K_{eff} = 0.999
Reactor B K_{eff} = 0.998

If positive 0.003 $\Delta K/K$ is suddenly added to each reactor, how will the resulting stable startup rates (SUR) compare? (Consider only the reactor response while power is below the point of adding heat.)

A. Reactor A stable period will be shorter.

B. Reactor B stable period will be shorter.

C. Reactors A and B will have the same stable SUR because both reactors will remain subcritical.

D. Reactors A and B will have the same stable SUR because both reactors received the same amount of positive reactivity.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P6825 (B6825)

Given the following stable initial conditions for a reactor:

Power level = 1.0×10^{-8} percent
K_{eff} = 0.999
Core $\bar{\beta}_{eff}$ = 0.006

What will the stable reactor period be following an addition of positive 0.15 %ΔK/K reactivity to the reactor? (Assume the stable reactor period occurs before the reactor reaches the point of adding heat.)

A. 30 seconds

B. 50 seconds

C. 80 seconds

D. 110 seconds

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P7225

Given the following stable initial conditions for a reactor:

Power level = 1.0×10^{-8} percent
K_{eff} = 0.999
Core $\bar{\beta}_{eff}$ = 0.006

What will the stable startup rate be following an addition of positive 0.2 %ΔK/K reactivity to the reactor? (Assume the stable startup rate occurs before the reactor reaches the point of adding heat.)

A. 0.24 dpm

B. 0.33 dpm

C. 0.52 dpm

D. 1.30 dpm

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.06 [3.2/3.3]
QID: P7607

A nuclear power plant has just completed a refueling outage and a reactor startup is in progress. Reactor engineers have determined that during the upcoming fuel cycle, $\bar{\beta}_{eff}$ will range from a minimum of 0.0052 to a maximum of 0.0064.

After the reactor becomes critical, control rods are withdrawn further to increase reactivity by an additional 0.1 %ΔK/K. Assuming <u>no</u> other reactivity changes occur, what will the approximate stable startup rate be for this reactor until the point of adding heat is reached?

A. 1.0 dpm

B. 0.6 dpm

C. 0.5 dpm

D. 0.3 dpm

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P48 (B1950)

During a fuel cycle, plutonium isotopes are produced with delayed neutron fractions that are __________ than the delayed neutron fractions for uranium isotopes, thereby causing reactor power transients to be __________ near the end of a fuel cycle.

A. larger; slower

B. larger; faster

C. smaller; slower

D. smaller; faster

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P129

Following a reactor trip, when does the startup rate initially stabilize at –1/3 dpm?

A. When decay gamma heating starts adding negative reactivity.

B. When the long-lived delayed neutron precursors have decayed away.

C. When the installed neutron source contribution to the total neutron flux becomes significant.

D. When the short-lived delayed neutron precursors have decayed away.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P249

Delayed neutrons contribute more to reactor stability than prompt neutrons because they __________ the average neutron generation time and are born at a __________ kinetic energy.

A. increase; lower

B. increase; higher

C. decrease; lower

D. decrease; higher

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P348 (B2450)

Which one of the following statements describes the effect of changes in the delayed neutron fraction from the beginning of a fuel cycle (BOC) to the end of a fuel cycle (EOC)?

A. A given reactivity addition to a shutdown reactor at EOC yields a larger change in shutdown margin (SDM) than at BOC.

B. A given reactivity addition to a shutdown reactor at EOC yields a smaller change in SDM than at BOC.

C. A given reactivity addition to an operating reactor at EOC results in a higher startup rate (SUR) than at BOC.

D. A given reactivity addition to an operating reactor at EOC results in a lower SUR than at BOC.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P1149 (B2651)

Delayed neutrons are important for reactor control because...

A. they are produced with a higher average kinetic energy than prompt neutrons.

B. they prevent the moderator temperature coefficient from becoming positive.

C. they are the largest fraction of the neutrons produced from fission.

D. they greatly extend the average lifetime of each neutron generation.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P1248 (B1349)

Two reactors are identical except that reactor A is near the end of a fuel cycle and reactor B is near the beginning of a fuel cycle. Both reactors are operating at 100 percent power when a reactor trip occurs at the same time on each reactor.

If <u>no</u> operator action is taken and the reactor systems for both reactors respond identically to the trip, reactor A will attain a negative __________ second stable period; and reactor B will attain a negative __________ second stable period.

A. 80; 56

B. 80; 80

C. 56; 56

D. 56; 80

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P1548 (B1250)

Two reactors are identical except that reactor A is near the end of a fuel cycle and reactor B is near the beginning of a fuel cycle. Both reactors are critical at 1.0 x 10^{-5} percent 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 __________ effective delayed neutron fraction.

A. A; smaller

B. A; larger

C. B; smaller

D. B; larger

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P1649 (B1649)

Two reactors are identical except that reactor A is near the end of core life and reactor B is near the beginning of core life. Both reactors are operating at 100 percent power when a reactor trip occurs at the same time on each reactor.

If no operator action is taken and the reactor systems for both reactors respond identically to the trip, a power level of 1.0 x 10^{-5} percent will be reached first by reactor __________ because it has the __________ effective delayed neutron fraction.

A. A; larger

B. B; larger

C. A; smaller

D. B; smaller

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P1749 (B1751)

Which one of the following is the reason that delayed neutrons are so effective at controlling the rate of reactor power changes?

A. Delayed neutrons make up a large fraction of the fission neutrons compared to prompt neutrons.

B. Delayed neutrons have a long mean generation time compared to prompt neutrons.

C. Delayed neutrons produce a large amount of fast fission compared to prompt neutrons.

D. Delayed neutrons are born with high kinetic energy compared to prompt neutrons.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P2249 (B2250)

Which one of the following distributions of fission percentages occurring in a reactor will result in the largest effective delayed neutron fraction?

	U-235	U-238	Pu-239
A.	90%	7%	3%
B.	80%	6%	14%
C.	70%	7%	23%
D.	60%	6%	34%

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P2348 (B2349)

Which one of the following distributions of fission percentages occurring in a reactor will result in the smallest effective delayed neutron fraction?

	U-235	U-238	Pu-239
A.	90%	7%	3%
B.	80%	6%	14%
C.	70%	7%	23%
D.	60%	6%	34%

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P2849 (B2850)

Two reactors are identical except that reactor A is near the beginning of core life and reactor B is near the end of core life. Both reactors are critical at 10^{-5} percent 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 __________ effective delayed neutron fraction.

A. A; smaller

B. A; larger

C. B; smaller

D. B; larger

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P2948 (B2950)

A nuclear power plant is operating at steady-state 50 percent power when a control rod is ejected from the core. Which one of the following distributions of fission percentages in the core would result in the highest startup rate? (Assume the reactivity worth of the ejected control rod is the same for each distribution.)

	U-235	U-238	Pu-239
A.	90%	8%	2%
B.	80%	7%	13%
C.	70%	7%	23%
D.	60%	8%	32%

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P3248 (B3249)

Two reactors are identical except that reactor A is near the end of core life and reactor B is near the beginning of core life. Both reactors are operating at 100 percent power when a reactor trip occurs at the same time on each reactor. No operator action is taken and the reactor systems for both reactors respond identically to the trip.

Ten minutes after the trip, the greater thermal neutron flux will exist in reactor __________ because it has a __________ effective delayed neutron fraction.

A. A; larger

B. B; larger

C. A; smaller

D. B; smaller

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P3648 (B3650)

Two reactors are identical except that reactor A is near the beginning of core life and reactor B is near the end of core life. Both reactors are operating at 100 percent power when a reactor trip occurs at the same time on each reactor. No operator action is taken and the reactor systems for both reactors respond identically to the trip.

Ten minutes after the trip, the greater thermal neutron flux will exist in reactor __________ because it has a __________ effective delayed neutron fraction.

A. A; larger

B. B; larger

C. A; smaller

D. B; smaller

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P3748 (B3749)

A step positive reactivity addition of 0.001 ΔK/K is made to a reactor with a stable neutron flux and an initial K_{eff} of 0.99. Consider the following two cases:

Case 1: The reactor is near the beginning of a fuel cycle.
Case 2: The reactor is near the end of a fuel cycle.

Assume the initial neutron flux is the same for each case.

Which one of the following correctly compares the prompt jump in neutron flux levels and the final stable neutron flux levels for the two cases?

A. The prompt jump will be greater for case 1, but the final stable neutron flux level will be the same for both cases.

B. The prompt jump will be greater for case 2, but the final stable neutron flux level will be the same for both cases.

C. The prompt jump will be the same for both cases, but the final stable neutron flux level will be greater for case 1.

D. The prompt jump will be the same for both cases, but the final stable neutron flux level will be greater for case 2.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P3849

A reactor is critical in the source range during the initial reactor startup immediately following a refueling outage. The effective delayed neutron fraction is 0.0062. The operator adds positive reactivity to establish a stable 0.5 dpm startup rate.

If the reactor had been near the end of a fuel cycle with an effective delayed neutron fraction of 0.005, what would the approximate stable startup rate be after the addition of the same amount of positive reactivity?

A. 0.55 dpm

B. 0.65 dpm

C. 0.75 dpm

D. 0.85 dpm

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P4425 (B4425)

The following data is given for the fuel in an operating reactor:

Nuclide	Delayed Neutron Fraction	Fraction of Total Fuel Composition	Fraction of Total Fission Rate
U-235	0.0065	0.03	0.73
U-238	0.0148	0.96	0.07
Pu-239	0.0021	0.01	0.20

What is the delayed neutron fraction for this reactor?

A. 0.0052

B. 0.0054

C. 0.0062

D. 0.0068

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P5425 (B5425)

The following data is given for the fuel in an operating reactor:

Nuclide	Delayed Neutron Fraction	Fraction of Total Fuel Composition	Fraction of Total Fission Rate
U-235	0.0065	0.023	0.63
U-238	0.0148	0.965	0.07
Pu-239	0.0021	0.012	0.30

What is the delayed neutron fraction for this reactor?

A. 0.0052

B. 0.0058

C. 0.0072

D. 0.0078

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P5525 (B5525)

Which characteristic of delayed neutrons is primarily responsible for enhancing the stability of a reactor following a reactivity change?

A. They are born at a lower average energy than prompt neutrons.

B. They are more likely to experience resonance absorption than prompt neutrons.

C. They comprise a smaller fraction of the total neutron flux than prompt neutrons.

D. They require more time to be produced following a fission event than prompt neutrons.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P5725 (B5725)

For an operating reactor, the effective delayed neutron fraction may differ from the delayed neutron fraction because, compared to prompt neutrons, delayed neutrons...

A. are less likely to leak out of the reactor core, and are less likely to cause fast fission.

B. are less likely to cause fast fission, and require more time to complete a neutron generation.

C. require more time to complete a neutron generation, and spend less time in the resonance absorption energy region.

D. spend less time in the resonance absorption energy region, and are less likely to leak out of the reactor core.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P5825 (B5825)

Given the following data for a reactor:

- The average delayed neutron fraction is 0.0068.
- The effective delayed neutron fraction is 0.0065.

The above data indicates that this reactor is operating near the __________ of a fuel cycle; and a typical delayed neutron is __________ likely than a typical prompt neutron to cause another fission in this reactor.

A. beginning; less

B. beginning; more

C. end; less

D. end; more

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P5925 (B5925)

A reactor is initially critical at a stable power level below the point of adding heat (POAH) and remains below the POAH for the following two cases:

Case 1: An operator adds positive 1.0×10^{-4} $\Delta K/K$ reactivity to the reactor.
Case 2: An operator adds negative 1.0×10^{-4} $\Delta K/K$ reactivity to the reactor.

The time required for reactor power to change by a factor of 10 will be greater in case __________ because delayed neutrons are more effective at slowing reactor power changes when reactor power is __________.

A. 1; increasing

B. 1; decreasing

C. 2; increasing

D. 2; decreasing

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P6225 (B6225)

Two identical reactors, A and B, are critical at 1.0 x 10^{-8} percent power near the beginning of a fuel cycle. Simultaneously, positive 0.001 ΔK/K is added to reactor A, and negative 0.001 ΔK/K is added to reactor B. One minute later, which reactor, if any, will have the shorter period and why?

A. Reactor A, because delayed neutrons are less effective at slowing down power changes when the fission rate is increasing.

B. Reactor B, because delayed neutrons are less effective at slowing down power changes when the fission rate is decreasing.

C. The periods in both reactors will be the same because their effective delayed neutron fractions are the same.

D. The periods in both reactors will be the same because the absolute values of the reactivity additions are the same.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P6325 (B6325)

The following data is given for the fuel in an operating reactor just prior to a refueling shutdown.

Nuclide	Delayed Neutron Fraction	Fraction of Total Fission Rate
U-235	0.0065	0.64
U-238	0.0148	0.07
Pu-239	0.0021	0.29

During the refueling, one-third of the fuel assemblies were offloaded and replaced with new fuel assemblies consisting of uranium having an average U-235 enrichment of 3.5 percent by weight.

Which one of the following describes how the above data will change as a result of completing the refueling outage?

A. The delayed neutron fraction for U-235 will decrease.

B. The delayed neutron fraction for Pu-239 will decrease.

C. The fraction of the total fission rate attributed to U-235 will increase.

D. The fraction of the total fission rate attributed to Pu-239 will increase.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P6525 (B6525)

Which one of the following is the major cause for the change in the delayed neutron fraction from the beginning to the end of a fuel cycle?

A. Burnup of the burnable poisons.

B. Changes in the fuel composition.

C. Buildup of fission product poisons.

D. Shift in the core axial power distribution.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P7025 (B7025)

Given the following data for the fuel in an operating reactor:

Nuclide	Delayed Neutron Fraction	Cross Section for Thermal Fission	Fraction of Total Fission Rate
U-235	0.0065	531 barns	0.58
U-238	0.0148	< 1 barn	0.06
Pu-239	0.0021	743 barns	0.32
Pu-241	0.0049	1009 barns	0.04

What is the delayed neutron fraction for this reactor?

A. 0.0044

B. 0.0055

C. 0.0063

D. 0.0071

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P7325 (B7325)

A nuclear reactor is operating at steady-state 100 percent power in the middle of a fuel cycle. Which one of the following changes would cause the core effective delayed neutron fraction to increase?

A. The fast nonleakage factor increases.

B. The fast nonleakage factor decreases.

C. The thermal utilization factor increases.

D. The thermal utilization factor decreases.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P7617 (B7617)

Given the following data for a reactor:

- The average delayed neutron fraction is 0.0052.
- The effective delayed neutron fraction is 0.0054.

The above data indicates that the reactor is operating near the __________ of a fuel cycle, and that a typical delayed neutron is __________ likely than a typical prompt neutron to cause another fission in this reactor.

A. beginning; less

B. beginning; more

C. end; less

D. end; more

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P7697 (B7697)

A reactor core has a delayed neutron importance factor of 1.02. If the average delayed neutron fraction in the core is 0.0057, the effective delayed neutron fraction is...

A. equal to 0.0057.

B. less than 0.0057.

C. greater than 0.0057.

D. unpredictable without additional information.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.07 [3.0/3.0]
QID: P7707 (B7707)

Which one of the following is the primary reason that delayed neutrons are more effective than prompt neutrons at controlling the rate of reactor power changes?

A. Delayed neutrons have a longer mean generation time than prompt neutrons.

B. Delayed neutrons produce a larger amount of core fissions than prompt neutrons.

C. Delayed neutrons make up a larger fraction of fission neutrons than prompt neutrons.

D. Delayed neutrons are born with a lower average kinetic energy than prompt neutrons.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.08 [2.8/2.9]
QID: P549 (B3351)

Which one of the following describes a condition in which a reactor is <u>prompt</u> critical?

A. A very long reactor period makes reactor control very sluggish and unresponsive.

B. Fissions are occurring so rapidly that the effective delayed neutron fraction approaches zero.

C. Any increase in reactor power requires a reactivity addition equal to the fraction of prompt neutrons in the core.

D. The net positive reactivity in the core is greater than or equal to the magnitude of the effective delayed neutron fraction.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.08 [2.8/2.9]
QID: P748

A critical reactor will become <u>prompt</u> critical when the reactivity is equal to the...

A. shutdown margin.

B. effective delayed neutron fraction.

C. effective decay constant.

D. worth of the most reactive rod.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.08 [2.8/2.9]
QID: P949

A reactor is operating at 75 percent power with the following conditions:

Power defect	=	-0.0157 Δ/K/K
Shutdown margin	=	0.0241 Δ/K/K
Effective delayed neutron fraction	=	0.0058
Effective prompt neutron fraction	=	0.9942

How much positive reactivity must be added to make the reactor prompt critical?

A. 0.0157 ΔK/K

B. 0.0241 ΔK/K

C. 0.0058 ΔK/K

D. 0.9942 ΔK/K

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.08 [2.8/2.9]
QID: P1449

A reactor with a xenon-free core is critical several decades below the point of adding heat (POAH). The operator continuously withdraws control rods until a positive 0.5 dpm startup rate (SUR) is reached and then stops control rod motion.

When rod motion is stopped, the SUR will immediately... (Ignore any reactivity effects from fission product poisons.)

A. stabilize at 0.5 dpm until power reaches the POAH.

B. decrease, and then stabilize at a value less than 0.5 dpm until power reaches the POAH.

C. stabilize at 0.5 dpm, and then slowly and continuously decrease until power reaches the POAH.

D. decrease, and then continue to slowly decrease until power reaches the POAH.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.08 [2.8/2.9]
QID: P1948 (B1150)

Positive reactivity is continuously added to a critical reactor. Which one of the following values of K_{eff} will first result in a prompt critical reactor?

A. 1.0001

B. 1.001

C. 1.01

D. 1.1

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.08 [2.8/2.9]
QID: P2049

A reactor initially has a stable positive 1.0 dpm startup rate with no control rod motion several decades below the point of adding heat (POAH). Control rods are inserted until a positive 0.5 dpm startup rate is attained and then stopped.

When rod insertion is stopped, startup rate will immediately...

A. stabilize at 0.5 dpm until power reaches the POAH.

B. increase, and then stabilize at a value greater than 0.5 dpm until power reaches the POAH.

C. continuously decrease until startup rate becomes zero when power reaches the POAH.

D. increase, and then slowly and continuously decrease until startup rate becomes zero when power reaches the POAH.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.08 [2.8/2.9]
QID: P2549 (B2550)

A reactor was stable at 80 percent power when the operator withdrew a control rod continuously for 2 seconds. Which one of the following affects the amount of "prompt jump" increase in reactor power for the control rod withdrawal?

A. The total control rod worth

B. The differential control rod worth

C. The duration of control rod withdrawal

D. The magnitude of the fuel temperature coefficient

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.08 [2.8/2.9]
QID: P2949 (B2951)

A reactor is operating at steady-state 75 percent power with the following conditions:

Power defect	=	-0.0185 $\Delta K/K$
Shutdown margin	=	-0.0227 $\Delta K/K$
Effective delayed neutron fraction	=	0.0061
Effective prompt neutron fraction	=	0.9939

How much positive reactivity must be added to make the reactor <u>prompt</u> critical?

A. 0.0061 $\Delta K/K$

B. 0.0185 $\Delta K/K$

C. 0.0227 $\Delta K/K$

D. 0.9939 $\Delta K/K$

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.08 [2.8/2.9]
QID: P3249 (B3250)

Refer to the partially labeled reactor response curve shown below for a reactor that was initially stable in the source range. Both axes have linear scales. A small amount of positive reactivity was added at time = 0 sec.

The response curve shows __________ versus time for a reactor that was initially __________.

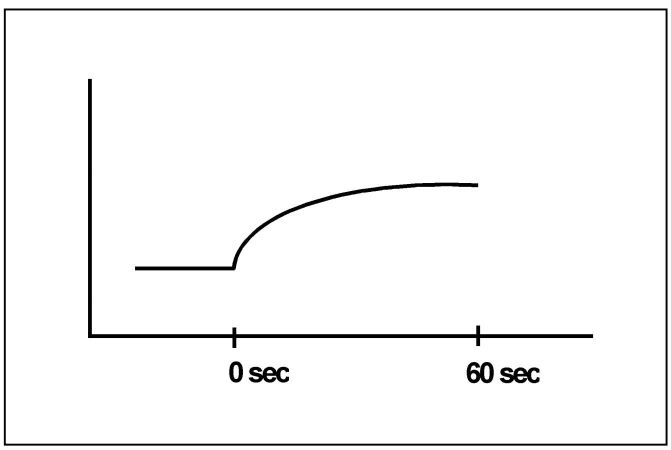
A. startup rate; subcritical

B. startup rate; critical

C. reactor fission rate; subcritical

D. reactor fission rate; critical

[redacted]



TOPIC: 192003
KNOWLEDGE: K1.08 [2.8/2.9]
QID: P3449 (B3450)

Two reactors are critical at the same power level well below the point of adding heat. The reactors are identical except that reactor A is near the beginning of a fuel cycle (BOC) and reactor B is near the end of a fuel cycle (EOC).

If a step addition of positive 0.001 $\Delta K/K$ is added to each reactor, the size of the prompt jump in power level observed in reactor B (EOC) will be __________ than in reactor A (BOC); and the stable startup rate observed in reactor B (EOC) will be __________ than in reactor A (BOC). (Assume the power level in each reactor remains below the point of adding heat.)

A. smaller; smaller

B. smaller; larger

C. larger; smaller

D. larger; larger

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.08 [2.8/2.9]
QID: P3649 (B3651)

Refer to the partially labeled reactor response curve shown below for a reactor that was initially subcritical in the source range and remained below the point of adding heat. A small amount of positive reactivity was added at time = 0 sec.

The response curve shows __________ versus time for a reactor that is currently (at time = 60 sec) __________.

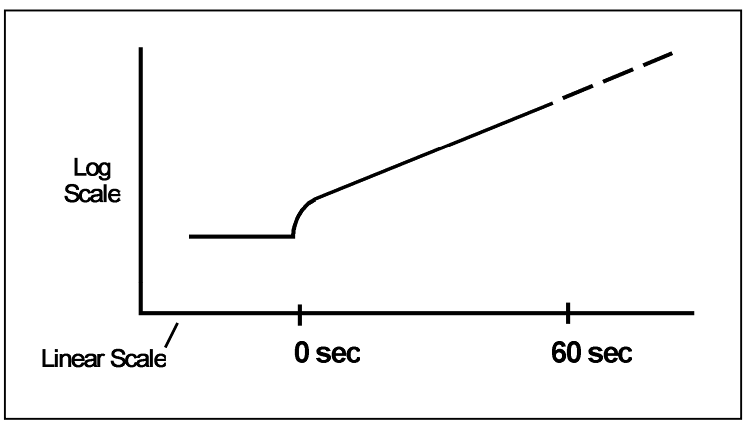
A. startup rate; exactly critical

B. startup rate; supercritical

C. reactor fission rate; exactly critical

D. reactor fission rate; supercritical

[redacted]



TOPIC: 192003
KNOWLEDGE: K1.08 [2.8/2.9]
QID: P3749 (B3750)

A reactor is operating at equilibrium 75 percent power with the following conditions:

Total power defect	=	-0.0176 ΔK/K
Shutdown margin	=	-0.0234 ΔK/K
Effective delayed neutron fraction	=	0.0067
Effective prompt neutron fraction	=	0.9933

How much positive reactivity must be added to make the reactor prompt critical?

A. 0.0067 ΔK/K

B. 0.0176 ΔK/K

C. 0.0234 ΔK/K

D. 0.9933 ΔK/K

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.11 [2.7/2.8]
QID: P49

Which one of the following is a characteristic of a neutron source installed in a reactor?

A. Maintains the production of neutrons high enough to allow the reactor to achieve criticality.

B. Provides a means to allow reactivity changes to occur in a subcritical reactor.

C. Generates a sufficient neutron population to start the fission process and initiate subcritical multiplication.

D. Provides a neutron level that is detectable on the source range nuclear instrumentation.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.11 [2.7/2.8]
QID: P349

Neutron sources are installed in a reactor for which one of the following reasons?

A. To decrease the amount of fuel load required for criticality.

B. To compensate for neutrons being absorbed by burnable poisons.

C. To augment the shutdown neutron flux to allow detection on nuclear instrumentation.

D. To provide sufficient neutron flux to achieve criticality during a reactor startup following a long-term shutdown.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.11 [2.7/2.8]
QID: P1249

Which one of the following neutron reactions yields the highest neutron production rate immediately following a reactor trip from extended power operations during the tenth fuel cycle? (Ignore any contribution from an installed neutron source.)

A. Alpha-neutron reactions

B. Beta-neutron reactions

C. Photo-neutron reactions

D. Spontaneous fission

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.11 [2.7/2.8]
QID: P1549 (B1549)

Which one of the following neutron sources undergoes the most significant source strength reduction during the hour immediately following a reactor trip from steady-state 100 percent power?

A. Spontaneous fission reactions

B. Photo-neutron reactions

C. Alpha-neutron reactions

D. Transuranic isotope decay

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.11 [2.7/2.8]
QID: P2149 (B2150)

Which one of the following is the neutron source that produces the greatest neutron flux for the first few days following a reactor trip from extended high power operations?

A. Spontaneous neutron emission from control rods.

B. Photo-neutron reactions in the moderator.

C. Spontaneous fission in the fuel.

D. Alpha-neutron reactions in the fuel.

[redacted]

TOPIC: 192003
KNOWLEDGE: K1.11 [2.7/2.8]
QID: P3149 (B967)

Which one of the following describes the purpose of a neutron source that is installed in a reactor during refueling for the third fuel cycle?

A. Ensures shutdown neutron level is large enough to be detected by nuclear instrumentation.

B. Provides additional excess reactivity to increase the length of the fuel cycle.

C. Amplifies the electrical noise fluctuations observed in source range instrumentation during shutdown.

D. Supplies the only shutdown source of neutrons available to begin a reactor startup.

[redacted]