科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P347 (B350)

Which one of the following statements 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 a given control rod will produce an equivalent equilibrium count rate increase, whether K_{eff} is 0.88 or 0.92.

ANSWER: A.

下列何者是次臨界增殖(subcritical multiplication)的特性？

A. 次臨界中子位階與中子源強度成正比。

B. 如果增加反應度而使計數率加倍時，將會減少臨界餘裕約四分之一。

C. 如果增加相同反應度，當K_{eff}趨近於1時，達到新的平衡源階計數率所需時間較少。

D. 任一等量的控制棒抽出，將增加相同的平衡計數率，不論K_{eff}是0.88或0.92亦然。

答案：A.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P448 (B1949)

A subcritical nuclear reactor has an initial source/startup range count rate of 150 cps with a shutdown reactivity of -2.0% ΔK/K. How much positive reactivity must be added to establish a stable count rate of 300 cps?

A. 0.5% ΔK/K

B. 1.0% ΔK/K

C. 1.5% ΔK/K

D. 2.0% ΔK/K

ANSWER: B.

一次臨界反應器在源階/啟動階(source/startup range)的初始計數率為150 cps，其停機反應度為-2.0% ΔK/K。請問大約需要增加多少正反應度，方能使穩定計數率達到300 cps？

A. 0.5% ΔK/K

B. 1.0% ΔK/K

C. 1.5% ΔK/K

D. 2.0% ΔK/K

答案：B.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P848 (B2149)

A subcritical nuclear reactor has an initial K_{eff} of 0.8 at a source range count rate of 100 cps. Positive reactivity is added until K_{eff} equals 0.95. What is the final equilibrium source range count rate?

A. 150 cps

B. 200 cps

C. 300 cps

D. 400 cps

ANSWER: D.

一次臨界反應器的初始K_{eff}為0.8，源階(source range)計數率為100 cps。增加正反應度至K_{eff}等於0.95，則最終的源階平衡計數率為多少？

A. 150 cps

B. 200 cps

C. 300 cps

D. 400 cps

答案：D.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P1348 (B1449)

A nuclear reactor is shutdown by 1.8% ΔK/K. Positive reactivity is added which increases stable neutron count rate from 15 to 300 cps.

Assuming the reactor is still subcritical, what is the current value of K_{eff}?

A. 0.982

B. 0.990

C. 0.995

D. 0.999

ANSWER: D.

一部核子反應器停機於-1.8% ΔK/K的反應度，之後添加正反應度，使穩定中子計數率從15 cps增至300 cps。

假設反應器仍處於次臨界，請問目前的K_{eff}為多少？

A. 0.982

B. 0.990

C. 0.995

D. 0.999

答案：D.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P1448 (B1840)

A subcritical nuclear reactor has an initial source/startup range count rate of 150 cps with a shutdown reactivity of -2.0% ΔK/K. Approximately how much positive reactivity must be added to establish a stable count rate of 600 cps?

A. 0.5% ΔK/K

B. 1.0% ΔK/K

C. 1.5% ΔK/K

D. 2.0% ΔK/K

ANSWER: C.

一部次臨界核子反應器的初始源階/啟動階(source/startup range)計數率為 150 cps，停機時的反應度為-2.0% ΔK/K。該反應器若欲建立 600 cps 的穩定計數率，約需加入多少正反應度？

A. 0.5% ΔK/K

B. 1.0% ΔK/K

C. 1.5% ΔK/K

D. 2.0% ΔK/K

答案：C.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P1748

A subcritical nuclear reactor has an initial source/startup range count rate of 60 cps with a shutdown reactivity of -2.0% ΔK/K. How much positive reactivity must be added to establish a stable count rate of 300 cps?

A. 0.4% ΔK/K

B. 0.6% ΔK/K

C. 1.4% ΔK/K

D. 1.6% ΔK/K

ANSWER: D.

一部次臨界核子反應器的初始源階/啟動階(source/startup range)計數率為 60 cps，停機時的反應度為-2.0% ΔK/K。該反應器若欲建立 300 cps 的穩定計數率，必須加入多少正反應度？

A. 0.4% ΔK/K

B. 0.6% ΔK/K

C. 1.4% ΔK/K

D. 1.6% ΔK/K

答案：D.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P1848 (B1170)

A nuclear power plant that has been operating at rated power for two months experiences a reactor trip. 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/startup range nuclear instruments.

The majority of the source/startup 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

ANSWER: C.

核能電廠以額定功率運轉兩個月，並經歷一次反應器急停。急停兩個月後，所有控制棒仍完全插入，源階/啟動階(source/startup range)核能儀器所示的穩定計數率為20 cps。

源階/啟動階中子偵測系統的輸出值，主要是因為_____與偵測器的作用而產生。

A. 固有的源中子(intrinsic source neutrons)。

B. 先前功率運轉所產生的分裂伽馬。

C. 次臨界增殖(subcritical multiplication)所產生的分裂中子。

D. 先前功率運轉所產生的遲延分裂中子。

答案：C.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P2248 (B2249)

Two nuclear 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 K_{eff} 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
A.	5,000	10,000
B.	10,000	20,000
C.	10,000	40,000
D.	20,000	40,000

ANSWER: A.

核子反應器A與B目前停機，其中一部準備啟動。兩部反應器完全相同，但反應器A的中子源強度為100 n/sec，反應器B的中子源強度為200 n/sec。控制棒固定不動，兩部反應器的K_{eff}皆為0.98。兩部反應器的爐心中子位階都達到平衡。

下列反應器A與B的爐心中子位階(n/sec)何者正確？

	反應器A	反應器 B
A.	5,000	10,000
B.	10,000	20,000
C.	10,000	40,000
D.	20,000	40,000

答案：A.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P2448 (B2649)

A nuclear reactor startup is being performed with xenon-free conditions. Control rod withdrawal is stopped when K_{eff} equals 0.995 and count rate satbilizes at 1,000 cps. No additional operator actions are taken.

Which one of the following describes the count rate 20 minutes after rod withdrawal is stopped?

A. 1,000 cps and constant.

B. Less than 1,000 cps and decreasing toward the prestartup count rate.

C. Less than 1,000 cps and stable above the prestartup count rate.

D. Greater than 1,000 cps and increasing toward criticality.

ANSWER: A.

一部核子反應器在無氙條件下啟動。抽出控制棒直到K_{eff}等於0.995時停止，而計數率穩定在1,000 cps。運轉員未採取任何動作。

下列何者正確描述了停止抽棒20分鐘後的計數率？

A. 等於1,000 cps，並維持固定。

B. 小於1,000cps，並朝向啟動前的計數率減小。

C. 小於1,000cps，並穩定在高於啟動前計數率的數值。

D. 大於1,000cps，並朝向臨界增加。

答案：A.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P3048 (B3049)

A nuclear reactor startup is being commenced with initial source (startup) range count rate stable at 20 cps. After a period of control rod withdrawal, count rate stabilizes at 80 cps.

If the total reactivity added by the above control rod withdrawal is 4.5 %ΔK/K, how much additional positive reactivity must be inserted to make the reactor critical?

A. 1.5 %ΔK/K

B. 2.0 %ΔK/K

C. 2.5 %ΔK/K

D. 3.0 %ΔK/K

ANSWER: A.

一部核子反應器於源階(啟動階)計數率為20 cps的穩定值開始啟動。抽棒後經過一段時間，計數率穩定於80 cps。

若上述抽棒增加的總反應度為4.5 %ΔK/K，需增加多少正反應度，方能使反應器達到臨界？

A. 1.5 %ΔK/K

B. 2.0 %ΔK/K

C. 2.5 %ΔK/K

D. 3.0 %ΔK/K

答案：A.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P3348

A xenon-free shutdown nuclear power plant is slowly cooling down due to an unisolable steam leak. When the cooldown started at 400°F, the readings on all source range nuclear instruments were 80 counts per second (cps). After one hour, when the reactor coolant temperature reached 350°F, source range count rate was 160 cps on all source range instruments.

Assume that the moderator temperature coefficient remains constant throughout the cooldown, and no operator action is taken. What will be the status of the reactor when reactor coolant temperature reaches 290°F?

A. Subcritical, with source range count rate below 320 cps

B. Subcritical, with source range count rate above 320 cps

C. Supercritical, with source range count rate below 320 cps

D. Supercritical, with source range count rate above 320 cps

ANSWER: D.

在無氙條件下停機的核能電廠，由於無法隔離的蒸汽洩漏(unisolable steam leak)而緩慢降溫。電廠從 400°F 開始降溫時，所有源階核能儀器的讀數都是 80 cps。一小時後，反應器的冷卻水溫度達到 350°F，所有源階儀器的源階計數率為 160 cps。

假設緩和劑溫度係數於降溫時維持不變，運轉員沒有採取任何行動，該反應器在冷卻水溫度達到 290°F 時的狀況為何？

A. 處於次臨界，源階計數率低於 320 cps。

B. 處於次臨界，源階計數率高於 320 cps。

C. 處於超臨界，源階計數率低於 320 cps。

D. 處於超臨界，源階計數率高於 320 cps。

答案：D.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P3848 (B3849)

A nuclear reactor is shutdown with a K_{eff} of 0.8. The source range count rate is stable at 800 cps. What percentage of the core neutron population is being contributed directly by neutron sources other than neutron-induced fission?

A. 10%

B. 20%

C. 80%

D. 100%

ANSWER: B.

一部核子反應器停機時的K_{eff}為0.8。源階(source range)偵測器計數率穩定於800 cps。爐心中子數之中，直接由中子源提供而非其它中子引發分裂反應供應的百分比為何？

A. 10%

B. 20%

C. 80%

D. 100%

答案：B.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P3925 (B3925)

A nuclear reactor startup is in progress at a nuclear power plant with core K_{eff} equal to 0.90. By what factor will the core neutron level have increased when the reactor is stabilized with core K_{eff} equal to 0.99?

A. 10

B. 100

C. 1,000

D. 10,000

ANSWER: A.

一部核能電廠反應器於爐心K_{eff}為0.90時啟動。反應器爐心穩定在K_{eff}等於0.99時，爐心中子量增加多少倍？

A. 10

B. 100

C. 1,000

D. 10,000

答案：A.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P4225 (B4225)

A nuclear reactor is shutdown with a K_{eff} of 0.96 and a stable source range indication of 50 counts per second (cps) when a reactor startup is commenced. Which one of the following will be the stable source range indication when K_{eff} reaches 0.995?

A. 400 cps

B. 800 cps

C. 4,000 cps

D. 8,000 cps

ANSWER: A.

一部核子反應器停機時的 K_{eff} 為 0.96，該反應器開始啟動時，穩定源階指示值為 50 cps。當 K_{eff} 到達 0.995 時，穩定源階指示值將是多少？

A. 400 cps

B. 800 cps

C. 4,000 cps

D. 8,000 cps

答案：A.

科目： 192003
知能類：K1.01 [2.7/2.8]
序號： P4525 (B4525)

A nuclear power plant is being cooled down from 500°F to 190°F. Just prior to commencing the cooldown, the readings for all source range nuclear instruments were stable at 32 counts per second (cps). After two hours, with reactor coolant temperature at 350°F, the source range count rate is stable at 64 cps.

Assume that the moderator temperature coefficient remains constant throughout the cooldown, reactor power remains below the point of adding heat, and no reactor protection actions occur.

Without additional operator action, what will be the status of the reactor when reactor coolant temperature reaches 190°F?

A. Subcritical, with source range count rate below 150 cps

B. Subcritical, with source range count rate above 150 cps

C. Exactly critical

D. Supercritical

ANSWER: D.

核能電廠從 500°F 降溫至 190°F。就在開始降溫前，所有源階核能儀器的讀數都穩定在 32 cps。兩小時後，反應器冷卻水溫度為 350°F，源階計數率穩定在 64 cps。

假設緩和劑溫度係數於降溫期間維持不變，反應器功率維持在加熱階段起始點之下，反應器亦無任何保護動作。

運轉員沒有採取額外行動下，反應器冷卻水溫達到 190°F 時，反應器將處於何種狀態？

A. 次臨界，源階計數率低於 150 cps。

B. 次臨界，源階計數率高於 150 cps。

C. 臨界。

D. 超臨界。

答案：D.

科目： 192003
知能類：K1.05 [2.7/2.8]
序號： P548

Reactor power was increased from 10^{-9}% to 10^{-6}% in 6 minutes. The average startup rate was_____ decades per minute.

A. 0.5

B. 1.3

C. 2.0

D. 5.2

ANSWER: A.

反應器功率若在 6 分鐘內，從 10^{-9}% 增至 10^{-6}%，平均啟動率為_____ dpm。

A. 0.5

B. 1.3

C. 2.0

D. 5.2

答案：A.

科目： 192003
知能類：K1.05 [2.7/2.8]
序號： P648

Reactor power increases from 10^{-8}% to 5 x 10^{-7}% in 2 minutes. What is the average startup rate?

A. 0.95 dpm

B. 0.90 dpm

C. 0.85 dpm

D. 0.82 dpm

ANSWER: C.

反應器功率若在 2 分鐘內，從 10^{-8}% 增至 5 x 10^{-7}%，平均啟動率為多少？

A. 0.95 dpm

B. 0.90 dpm

C. 0.85 dpm

D. 0.82 dpm

答案：C.

科目： 192003
知能類：K1.05 [2.7/2.8]
序號： P2349 (B2351)

During a nuclear reactor startup, reactor power increases from 1E-8% to 2E-8% in 2 minutes with no operator action. Which one of the following is the average reactor period during the power increase?

A. 173 seconds

B. 235 seconds

C. 300 seconds

D. 399 seconds

ANSWER: A.

啟動核子反應器時，在沒有運轉員動作的情況下，反應器功率於2分鐘內，從1E-8%增至2E-8%。請問在功率增加期間，反應器平均週期為多少？

A. 173秒

B. 235秒

C. 300秒

D. 399秒

答案：A.

科目： 192003
知能類：K1.05 [2.7/2.8]
序號： P2648 (B1651)

During a nuclear reactor startup, reactor power increases from $3x10^{-6}$% to $5x10^{-6}$% in 2 minutes with no operator action. Which one of the following was the average reactor period during the power increase?

A. 357 seconds

B. 235 seconds

C. 155 seconds

D. 61 seconds

ANSWER: B.

啟動核子反應器時，在無運轉員動作下，反應器功率於2分鐘內，從$3x10^{-6}$%增至$5x10^{-6}$%。請問在功率增加期間，下列何者為反應器平均週期？

A. 357秒

B. 235秒

C. 155秒

D. 61秒

答案：B.

科目： 192003
知能類：K1.06 [3.2/3.3]
序號： P47 (B451)

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

Which one of the following will have a significant effect on the magnitude of the stable reactor period achieved for this reactivity addition?

A. Moderator temperature coefficient

B. Fuel temperature coefficient

C. Prompt neutron lifetime

D. Average effective decay constant

ANSWER: D.

將少量反應度加入處於源階/啟動階(source/startup range)的臨界反應器。加入反應度小於平均有效遲延中子分率(β_{eff})。

下列何者將因為加入此反應度，而對穩定反應器週期的大小有顯著影響？

A. 緩和劑溫度係數

B. 燃料溫度係數

C. 瞬發中子壽命

D. 平均有效衰變常數

答案：D.

科目： 192003
知能類：K1.06 [3.2/3.3]
序號： P126

A nuclear power plant is operating steady-state at 50% power at middle of core life. Which one of the following conditions will initially produce a positive startup rate?

A. Increase in turbine loading

B. Unintentional boration

C. Turbine runback

D. Closure of a letdown isolation valve

ANSWER: A.

處於爐心壽命中期的核能電廠，正以 50%穩態功率運轉中。下列何者將產生正啟動率？

A. 汽機負載增加

B. 硼濃度意外增加

C. 汽機回退(runback)

D. 引水隔離閥關閉

答案：A.

科目： 192003
知能類：K1.06 [3.2/3.3]
序號： P248

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

A. prompt neutron lifetime; axial flux distribution

B. prompt neutron lifetime; average delayed neutron fraction

C. average effective decay constant; average delayed neutron fraction

D. average effective decay constant; axial flux distribution

ANSWER: C.

臨界核子反應器加入已知的正反應度後，此時產生的穩定啟動率，端視_____和_____而定。

A. 瞬發中子壽命：軸向通量分佈

B. 瞬發中子壽命；平均遲延中子分率

C. 平均有效衰變常數；平均遲延中子分率

D. 平均有效衰變常數；軸向通量分佈

答案：C.

科目： 192003
知能類：K1.06 [3.2/3.3]
序號： P2748 (B2751)

A nuclear reactor is exactly critical at 10^{-8}% power during a reactor startup. β_{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 initiate a reactor power increase toward the point of adding heat with a stable startup rate of 1 dpm?

A. 0.2% ΔK/K

B. 0.5% ΔK/K

C. 1.0% ΔK/K

D. 2.0% ΔK/K

ANSWER: A.

一部核子反應器於起動時，在10^{-8}%功率下達到臨界。此反應器的β_{eff}值是0.0072。欲在穩定啟動率為1 dpm的條件下，讓反應器功率開始朝加熱起始點增加，需利用抽棒在爐心加入多少正反應度？

A. 0.2% ΔK/K

B. 0.5% ΔK/K

C. 1.0% ΔK/K

D. 2.0% ΔK/K

答案：A.

科目： 192003
知能類：K1.06 [3.2/3.3]
序號： P3148 (B3151)

A nuclear reactor is being started for the first time following a refueling outage. Reactor Engineering has determined that during the upcoming fuel cycle β_{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 insert a net positive reactivity of 0.1% ΔK/K into the reactor core. Assuming no other reactivity additions, what will be the approximate stable reactor period for this reactor until the point of adding heat is reached?

A. 20 seconds

B. 40 seconds

C. 60 seconds

D. 80 seconds

ANSWER: C.

一部核子反應器在更換燃料大修後首次啟動。反應器工程師決定，新燃料週期的β_{eff}將在最大值0.007及最小值0.005之間變化。

一旦反應器達到臨界，將抽棒以加入正反應度0.1% ΔK/K至爐心。假設沒有加入其它反應度，此反應器到達加熱起始點之前，其穩定週期約為多少？

A. 20秒

B. 40秒

C. 60秒

D. 80秒

答案：C.

科目： 192003
知能類：K1.06 [3.2/3.3]
序號： P3548 (B3551)

Nuclear reactors A and B are identical except that the reactor cores 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 ΔK/K is suddenly added to each reactor, how will the resulting stable reactor startup rates (SUR) compare? (Consider only the reactor response while power is below the point of adding heat.)

A. Reactor A stable SUR will be higher because it will have the higher positive reactivity in the core.

B. Reactor B stable SUR will be higher because it has the smaller effective delayed neutron fraction.

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.

ANSWER: A.

除了反應器爐心處於不同壽命階段外，反應器A與B完全相同。反應器A的有效遲延中子分率(β_{eff})為0.007，反應器B的有效遲延中子分率為0.005。兩反應器目前處於次臨界穩定狀態，其中子通量位階穩定於源階(source range)。

已知：

反應器A K_{eff} = 0.999
反應器B K_{eff} = 0.998

若將正反應度0.003 ΔK/K突然加入兩反應器，請比較兩者的穩定啟動率(SUR)，下列何者正確？(僅考慮反應器在功率低於加熱起始點時的反應)

A. 反應器A的穩定SUR將較高，因為其爐心的正反應度較高。

B. 反應器B的穩定SUR將較高，因為其有效遲延中子分率較小。

C. 反應器A與B的穩定SUR相同，因為兩反應器將維持在次臨界。

D. 反應器A與B的穩定SUR相同，因為兩反應器將獲得等量正反應度。

答案：A.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P48 (B1950)

Over core life, plutonium isotopes are produced with delayed neutron fractions that are _____ than uranium delayed neutron fractions, thereby causing reactor power transients to be _____ near the end of core life.

A. larger; slower

B. larger; faster

C. smaller; slower

D. smaller; faster

ANSWER: D.

在爐心壽命中，鈽同位素產生的遲延中子分率，較鈾產生的遲延中子分率_____，因而導致在接近爐心壽命末期時，反應器的功率暫態變化_____。

A. 大；較慢

B. 大；較快

C. 小；較慢

D. 小；較快

答案：D.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P129

When does the power decrease rate initially stabilize at negative one-third decade per minute following a reactor trip?

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

ANSWER: D.

反應器急停後，功率遞減率於何時首次穩定在-1/3 dpm 處？

A. 伽馬衰變熱開始加入負反應度時。

B. 長命遲延中子母核已經衰變殆盡時。

C. 裝置中子源供應總中子通量的情形轉為顯著時。

D. 短命遲延中子母核已經衰變殆盡時。

答案：D.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P249

Delayed neutrons contribute more to nuclear 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

ANSWER: A.

遲延中子對核子反應器穩定度的影響高於瞬發中子，因為前者_____平均中子代間時間(neutron generation time)，並於_____動能下產生。

A. 增加；較低

B. 增加；較高

C. 減少；較低

D. 減少；較高

答案：A.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P348 (B2450)

Which one of the following statements describes the effect of changes in the delayed neutron fraction from beginning of core life (BOL) to end of core life (EOL)?

A. A given set of plant parameters at EOL yields a greater shutdown margin (SDM) than at BOL.

B. A given set of plant parameters at EOL yields a smaller SDM than at BOL.

C. A given reactivity addition at EOL results in a higher startup rate (SUR) than it would at BOL.

D. A given reactivity addition at EOL results in a lower SUR than it would at BOL.

ANSWER: C.

從爐心壽命初期(BOL)至爐心壽命末期(EOL)的過程中，由於遲延中子分率變化所產生的效應，下列何者為正確敘述？

A. 同一組電廠參數在EOL時產生的停機餘裕(SDM)，大於BOL時產生的停機餘裕。

B. 同一組電廠參數在EOL時產生的停機餘裕，小於BOL時產生的停機餘裕。

C. EOL時增加一定反應度而產生的啟動率(SUR)，高於BOL時產生的啟動率。

D. EOL時增加一定反應度而產生的啟動率(SUR)，低於BOL時產生的啟動率。

答案：C.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P1149 (B2651)

Delayed neutrons are important for nuclear reactor control because...

A. they are produced with 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 neutron generation lifetime.

ANSWER: D.

遲延中子對於核子反應器的控制很重要，因為……

A. 它們產生時具有的平均動能高於瞬發中子。

B. 它們防止緩和劑溫度係數變成正值。

C. 在分裂產生的中子中，它們佔了最大部分。

D. 它們大大地延長了每代中子的平均壽命。

答案：D.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P1248 (B1349)

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

If the reactor systems for each reactor respond identically to the trip and no operator action is taken, reactor A will attain a negative _____ second stable period and reactor B will attain a negative _____second stable period. (Assume control rod worth equals -0.9700 ΔK/K and λ_{eff} equals 0.0124 sec^{-1}.)

A. 80; 56

B. 80; 80

C. 56; 56

D. 56; 80

ANSWER: B.

兩部相同的核子反應器A與B，反應器A處於爐心壽命末期，而反應器B處於爐心壽命初期。兩部於100%功率下運轉時，同時發生急停。

若反應器系統對急停的反應相同，同時運轉員沒有採取行動，則反應器A將得到負_____秒的穩定週期，反應器B將得到負_____秒的穩定週期。(假設控制棒本領等於-0.9700 ΔK/K，而 λ_{eff} 等於 0.0124 sec^{-1})。

A. 80；56

B. 80；80

C. 56；56

D. 56；80

答案：B.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P1548 (B1250)

Two nuclear 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; smaller

B. A; larger

C. B; smaller

D. B; larger

ANSWER: A.

兩部相同的核子反應器A與B，其中反應器A處於爐心壽命末期，而反應器B處於爐心壽命初期。兩部皆處於10^{-5}%功率臨界狀態。

若同時將等量正反應度加入二部反應器，則反應器_____將先達到加熱起始點，因為其有_____的遲延中子分率。

A. A；較小

B. A；較大

C. B；較小

D. B；較大

答案：A.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P1649 (B1649)

Two nuclear 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 operating at 100% power when a reactor trip occurs at the same time on each reactor.

If the reactor systems for each reactor respond identically to the trip and no operator action is taken, a power level of 10^{-5}% 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.

兩部相同的核子反應器A與B，其中反應器A處於爐心壽命末期，而反應器B處於爐心壽命初期。兩部於100%功率運轉時，同時發生急停。

若反應器系統對急停的反應相同，同時運轉員沒有採取行動，則反應器_____將先達到10^{-5}%功率，因為其有_____的遲延中子分率。

A. A；較大

B. B；較大

C. A；較小

D. B；較小

答案：C.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： 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 in the core compared to prompt neutrons.

B. Delayed neutrons have a long mean lifetime 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.

ANSWER: B.

下列何者是遲延中子能有效控制反應器功率變化率的原因？

A. 與瞬發中子相較，遲延中子構成大多數的分裂中子。

B. 與瞬發中子相較，遲延中子具有較長的平均壽命。

C. 與瞬發中子相較，遲延中子製造大量的快分裂。

D. 與瞬發中子相較，遲延中子產生時具有較高動能。

答案：B.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P2249 (B2250)

Which one of the following distributions of fission percentages in a nuclear reactor will result in the largest reactor core 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%

ANSWER: A.

下列何種核子反應器分裂百分率的分配，將導致反應器爐心具有最大有效遲延中子分率(β_{eff})？

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

答案：A.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P2348 (B2349)

Which one of the following percentages of fission, by fuel, ocurring in a nuclear reactor will result in the smallest reactor core 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%

ANSWER: D.

已知核子反應器發生分裂，下列哪組燃料之分裂百分率，將導致最小有效遲延中子分率(β_{eff})？

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

答案：D.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P2849 (B2850)

Two nuclear reactors are identical in every way except that reactor A is at the beginning of core life and reactor B is at the end 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; smaller

B. A; larger

C. B; smaller

D. B; larger

ANSWER: C.

兩部相同的核子反應器A與B，其中反應器A處於爐心壽命初期，而反應器B處於爐心壽命末期。兩部皆處於10^{-5}%功率臨界狀態。

若同時將等量正反應度加入此二反應器，則反應器_____將先達到加熱起始點，因為其有_____的遲延中子分率。

A. A；較小

B. A；較大

C. B；較小

D. B；較大

答案：C.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P2948 (B2950)

A typical PWR nuclear power plant is operating at equilibrium 50% power when a control rod is ejected from the core. Which one of the following combinations of fission percentages, by fuel, would result in the highest reactor startup rate? (Assume the reactivity worth of the ejected control rod is the same for each case.)

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

ANSWER: A.

一部典型的壓水式反應器(PWR)於50%平衡功率下運轉，其中一控制棒從爐心射出。下列哪組燃料分裂百分率，將產生最高啟動率？(假設射出控制棒的反應度本領在各情況下都相同)

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

答案：A.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P3248 (B3249)

Two nuclear reactors are identical in every way 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% power when a reactor trip occurs at the same time on each reactor. The reactor systems for each reactor respond identically to the trip and no operator action is taken.

Ten minutes after the trip, the higher fission rate will exist in reactor _____ because it has a _____ delayed neutron fraction.

A. A; larger

B. B; larger

C. A; smaller

D. B; smaller

ANSWER: B.

兩部相同的核子反應器A與B，其中反應器A接近爐心壽命末期，而反應器B則近於爐心壽命初期。兩部反應器於100%功率運轉時，同時發生反應器急停。兩部反應器系統對急停的反應相同，運轉員亦沒有採取行動。

急停十分鐘後，反應器_____將有較高分裂率，因為其有_____的遲延中子分率。

A. A；較大

B. B；較大

C. A；較小

D. B；較小

答案：B.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P3648 (B3650)

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

Ten minutes after the trip, the higher shutdown fission rate will exist in reactor _____ because it has a _____ delayed neutron fraction.

A. A; larger

B. B; larger

C. A; smaller

D. B; smaller

ANSWER: A.

兩部相同的核子反應器A與B，其中反應器A處於爐心壽命初期，而反應器B處於爐心壽命末期。兩部反應器於100%功率運轉時，同時發生反應器急停。反應器系統對急停的反應相同，運轉員沒有採取行動。

急停十分鐘後，反應器_____將有較高的停機分裂率，因為其有_____的遲延中子分率。

A. A；較大

B. B；較大

C. A；較小

D. B；較小

答案：A.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P3748 (B3749)

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

Case 1: The reactor is near the beginning of core life.
Case 2: The reactor is near the end of core life.

Assume the initial core neutron population is the same for each case. Which one of the following correctly compares the prompt jump in core neutron population and the final stable core neutron population for the two cases?

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

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

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

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

ANSWER: B.

將正反應度0.001 ΔK/K，加入具穩定中子數、初始爐心K_{eff}為0.99的核子反應器。請思考下列兩種情況：

情況1：反應器接近爐心壽命初期
情況2：反應器接近爐心壽命末期

假設兩種情況的初始爐心中子數相等，比較兩情況之中，爐心中子數的瞬發跳升(prompt jump)與最終穩定爐心中子數，下列何者正確？

A. 情況1的瞬發跳升較大，但兩情況的最終穩定中子數相等。

B. 情況2的瞬發跳升較大，但兩情況的最終穩定中子數相等。

C. 兩情況的瞬發跳升相等，但情況1的最終穩定中子數較大。

D. 兩情況的瞬發跳升相等，但情況2的最終穩定中子數較大。

答案：B.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P3849

A nuclear reactor is critical in the source range during the initial reactor startup immediately following a refueling outage. The core average 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 at the end of core life with a core average delayed neutron fraction of 0.005, what would be the approximate stable startup rate 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

ANSWER: B.

一部核子反應器於更換燃料大修後隨即首度啟動，此時處於源階臨界狀態。爐心平均遲延中子分率為 0.0062。運轉員加入正反應度以建立穩定啟動率 0.5 dpm。

該反應器若處於爐心壽命末期，爐心平均遲延中子分率為 0.005，加入等量的正反應度以後，穩定啟動率約為多少？

A. 0.55 dpm

B. 0.65 dpm

C. 0.75 dpm

D. 0.85 dpm

答案：B.

科目： 192003
知能類：K1.07 [3.0/3.0]
序號： P4425 (B4425)

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

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 approximate core average delayed neutron fraction for this reactor?

A. 0.0052

B. 0.0054

C. 0.0062

D. 0.0068

ANSWER: C.

已知運轉中的核子反應器爐心燃料數據如下：

核種	遲延中子分率	總燃料構成分率	總分裂率分率
U-235	0.0065	0.03	0.73
U-238	0.0148	0.96	0.07
Pu-239	0.0021	0.01	0.20

該反應器的爐心平均遲延中子分率約為多少？

A. 0.0052

B. 0.0054

C. 0.0062

D. 0.0068

答案：C.

科目： 192003
知能類：K1.08 [2.8/2.9]
序號： P549 (B3351)

Which one of the following describes a condition in which a nuclear reactor is prompt critical?

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

B. The fission process is occurring so rapidly that the 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 average effective delayed neutron fraction.

ANSWER: D.

下列何者正確描述了處於瞬發臨界(prompt critical)的核子反應器狀態？

A. 非常長的反應器週期，使得反應器控制非常緩慢與反應不良。

B. 分裂程序發生非常快，以致於遲延中子分率趨近於零。

C. 任何反應器功率的增加，需要加入等於爐心瞬發中子分率的反應度。

D. 爐心的淨正反應度，大於或等於平均有效遲延中子分率(β_{eff})的大小。

答案：D.

科目： 192003
知能類：K1.08 [2.8/2.9]
序號： P748 (B664)

A critical nuclear reactor will become prompt critical when reactivity is added equal in magnitude to the...

A. shutdown margin.

B. average effective delayed neutron fraction.

C. average effective decay constant.

D. worth of the most reactive rod.

ANSWER: B.

處於臨界的核子反應器，加入的反應度等於下列何者時，將成為瞬發臨界(prompt critical)？

A. 停機餘裕。

B. 平均有效遲延中子分率。

C. 平均有效衰變常數。

D. 反應度最大的控制棒本領。

答案：B.

科目： 192003
知能類：K1.08 [2.8/2.9]
序號： P949

A nuclear reactor is operating at 75% 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 take the reactor "prompt critical"?

A. 0.0157 ΔK/K

B. 0.0241 ΔK/K

C. 0.0058 ΔK/K

D. 0.9942 ΔK/K

ANSWER: C.

一部核子反應器以 75%功率運轉中，其條件如下：

功率欠缺(power defect) = -0.0157 Δ/K/K
停機餘裕 = 0.0241 Δ/K/K
有效遲延中子分率 = 0.0058
有效瞬發中子分率 = 0.9942

請問必須加入多少正反應度，才能讓反應器達到「瞬發臨界」？

A. 0.0157 ΔK/K

B. 0.0241 ΔK/K

C. 0.0058 ΔK/K

D. 0.9942 ΔK/K

答案：C.

科目： 192003
知能類：K1.08 [2.8/2.9]
序號： P1449 (B1850)

A nuclear reactor is exactly critical several decades below the point of adding heat (POAH) with a xenon-free core. The operator continuously withdraws control rods until a positive 60 second reactor period is reached and then stops control rod motion.

When rod withdrawal is stopped, reactor period will immediately: (Neglect reactivity effects of fission products.)

A. stabilize at 60 seconds until power reaches the POAH.

B. lengthen, and then stabilize at a value greater than 60 seconds until power reaches the POAH.

C. stabilize, and then slowly and continuously lengthen until power reaches the POAH.

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

ANSWER: B.

一部爐心無氙的核子反應器，於加熱起始點(POAH)下方數個decade處達到臨界。運轉員持續抽出控制棒，直到反應器週期到達+60秒，然後停止控制棒動作。

停止抽棒時，反應器週期將立刻……(忽略分裂產物對反應度的效應)

A. 穩定於60秒，直到功率達到加熱起始點為止。

B. 增長，並穩定在大於60秒的數值，直到功率達到加熱起始點為止。

C. 穩定，然後緩慢並持續增長，直到功率達到加熱起始點為止。

D. 增長，然後緩慢並持續增長，直到功率達到加熱起始點為止。

答案：B.

科目： 192003
知能類：K1.08 [2.8/2.9]
序號： P1948 (B1150)

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

A. 1.0001

B. 1.001

C. 1.01

D. 1.1

ANSWER: C.

一部核子反應器連續加入正反應度至臨界。下列那一個爐心K_{eff}值最先在反應器引發瞬發臨界(prompt critical)？

A. 1.0001

B. 1.001

C. 1.01

D. 1.1

答案：C.

科目： 192003
知能類：K1.08 [2.8/2.9]
序號： P2049

A nuclear reactor has a stable positive 1.0 dpm startup rate with no control rod motion several decades below the point of adding heat (POAH). The operator then inserts control rods until a 0.5 dpm startup rate is attained and then stops control rod motion.
When rod insertion is stopped, reactor 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. stabilize, and then slowly and continuously decrease until startup rate is zero when power reaches the POAH.

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

ANSWER: B.

一部核子反應器的穩定啟動率為+1.0 dpm，並處於加熱起始點(POAH)下方數個 decade 處，控制棒沒有任何動作。運轉員接著插入控制棒，直到啟動率抵達 0.5 dpm 之後，不再移動控制棒。

停止插入控制棒時，反應器啟動率將隨即……

A. 穩定在0.5 dpm處，直到功率達到POAH為止。

B. 增加，然後穩定在大於0.5 dpm的數值，直到功率達到POAH為止。

C. 穩定，然後持續緩慢降低，啟動率於功率達到POAH時為零。

D. 增加，然後持續緩慢降低，啟動率於功率達到POAH時為零。

答案：B.

科目： 192003
知能類：K1.08 [2.8/2.9]
序號： P2549

A nuclear reactor was stable at 80% power when the reactor operator withdrew control rods 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 duration of control rod withdrawal

B. The differential control rod worth

C. The total control rod worth

D. The magnitude of the fuel temperature coefficient

ANSWER: B.

一部核子反應器穩定於 80%功率，此時，反應器運轉員持續抽出控制棒達 2 秒。下列何者影響了抽棒所致反應器功率的「瞬發跳升(prompt jump)」增加量？

A. 抽棒持續時間。

B. 微分控制棒本領。

C. 總控制棒本領。

D. 燃料溫度係數值。

答案：B.

科目： 192003
知能類：K1.08 [2.8/2.9]
序號： P2949 (B2951)

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

Total power defect	= -0.0185 ΔK/K
Shutdown margin	= 0.0227 ΔK/K
Effective delayed neutron fraction	= 0.0061
Effective prompt neutron fraction	= 0.9939

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

A. 0.0061 ΔK/K

B. 0.0185 ΔK/K

C. 0.0227 ΔK/K

D. 0.9939 ΔK/K

ANSWER: A.

一部核子反應器於75%平衡功率下運轉，其條件如下：

總功率欠缺	= -0.0185 ΔK/K
停機餘裕	= 0.0227 ΔK/K
有效遲延中子分率(β_{eff})	= 0.0061
有效瞬發中子分率	= 0.9939

欲使該反應器達到「瞬發臨界(prompt critical)」，需加入多少正反應度？

A. 0.0061 ΔK/K

B. 0.0185 ΔK/K

C. 0.0227 ΔK/K

D. 0.9939 ΔK/K

答案：A.

科目： 192003
知能類：K1.08 [2.8/2.9]
序號： P3249 (B3250)

Refer to the unlabeled nuclear 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

ANSWER: C.

請參照下圖中無標示刻度的核子反應器反應曲線，該反應器原本穩定在源階(source range)。兩軸為線性尺度。時間為0秒時，加入少量的正反應度。

此反應曲線代表了原本處於_____狀態的反應器之_____對時間的關係圖。

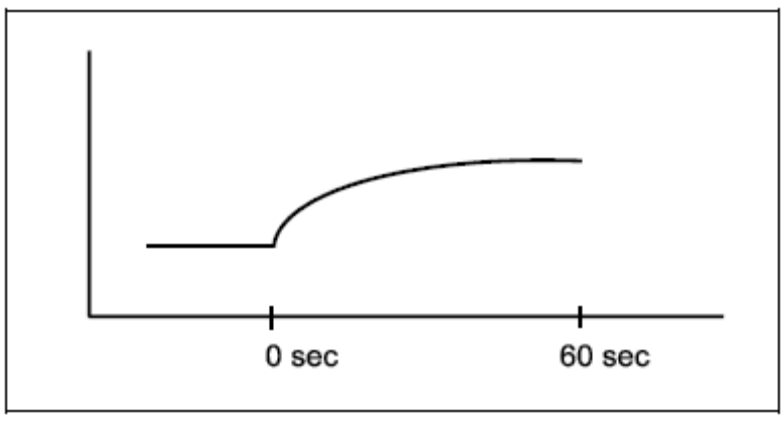
A. 次臨界；啟動率

B. 臨界；啟動率

C. 次臨界；反應器分裂率

D. 臨界；反應器分裂率

答案：C.



科目： 192003
知能類：K1.08 [2.8/2.9]
序號： P3449 (B3450)

Two nuclear reactors, A and B, are exactly critical low in the intermediate range (well below the point of adding heat). The reactors are identical except that reactor A is near the beginning of core life (BOL) and reactor B is near the end of core life (EOL). Assume that a step addition of positive reactivity (0.001 ΔK/K) is added to each reactor. Select the combination below that completes the following statement.

The size of the prompt jump in core power observed for reactor B (EOL) will be _____ than reactor A (BOL); and the stable startup rate observed for reactor B (EOL) will be _____ than reactor A (BOL).

A. larger; larger

B. larger; smaller

C. smaller; larger

D. smaller; smaller

ANSWER: A.

兩部核子反應器A與B處於中程階(intermediate range)下方剛好達到臨界(遠低於加熱起始點)。兩部反應器完全相同，除了反應器A接近爐心壽命初期(BOL)，反應器B接近爐心壽命末期(EOL)。假設階段加入(step addition)正反應度(0.001 ΔK/K)至兩部反應器。請選出正確答案以填入下列敘述。

反應器B(EOL)觀察到的爐心功率瞬發跳升(prompt jump)大小將_____反應器A(BOL)；而在反應器B(EOL)觀察到的穩定啟動率將_____反應器A(BOL)。

A. 大於；大於

B. 大於；小於

C. 小於；大於

D. 小於；小於

答案：A.

科目： 192003
知能類：K1.08 [2.8/2.9]
序號： P3649 (B3651)

Refer to the unlabeled nuclear reactor response curve shown below for a reactor that was initially subcritical in the source range. 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

ANSWER: D.

請參照下圖中無標示刻度的核子反應器反應曲線，該反應器原本處於源階(source range)內的次臨界。時間為0秒時，加入少量的正反應度。

此反應曲線代表了目前(時間＝60秒)處於_____狀態的反應器，其_____對時間的關係圖。

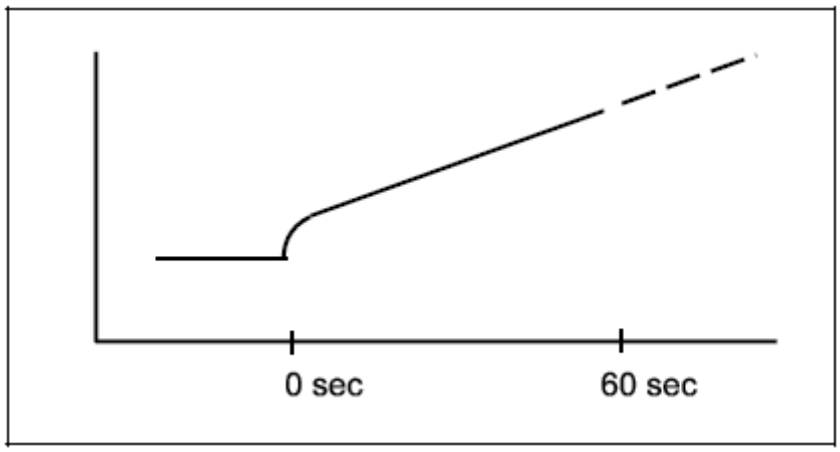
A. 臨界；啟動率

B. 超臨界；啟動率

C. 臨界；反應器分裂率

D. 超臨界；反應器分裂率

答案：D.



科目： 192003
知能類：K1.08 [2.8/2.9]
序號： P3749 (B3750)

A nuclear reactor is operating at equilibrium 75% 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

ANSWER: A.

一部核子反應器於75%平衡功率下運轉，其條件如下：

總功率欠缺	= -0.0176 ΔK/K
停機餘裕	= 0.0234 ΔK/K
有效遲延中子分率(β_{eff})	= 0.0067
有效瞬發中子分率	= 0.9933

欲使此反應器達到「瞬發臨界(prompt critical)」，需加入多少正反應度？

A. 0.0067 ΔK/K

B. 0.0176 ΔK/K

C. 0.0234 ΔK/K

D. 0.9933 ΔK/K

答案：A.

科目： 192003
知能類：K1.11 [2.7/2.8]
序號： P49

An installed neutron source...

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.

ANSWER: D.

裝置中子源能夠……

A. 讓產生中子數足以使反應器達到臨界。

B. 做為讓次臨界反應器發生反應度變化的方法。

C. 產生足夠中子數，進而開始分裂過程並引發次臨界增殖。

D. 提供源階核能儀器得以偵測出的中子量。

答案：D.

科目： 192003
知能類：K1.11 [2.7/2.8]
序號： P349

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

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

B. To compensate for those neutrons absorbed in burnable poisons

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

D. To provide enough neutrons in a shutdown reactor to start a chain reaction for reactor startup

ANSWER: C.

下列何者為核子反應爐心裝置中子源的理由？

A. 降低達到臨界所需的燃料負載量。

B. 彌補可燃性毒物吸收的中子數。

C. 增加停機中子數量，以利核能儀器進行偵測。

D. 提供停機中反應器充分的中子，藉此引發連鎖反應以啟動反應器。

答案：C.

科目： 192003
知能類：K1.11 [2.7/2.8]
序號： P1249

Which one of the following neutron reactions produces the largest contribution to the intrinsic source neutron level immediately following a reactor trip from extended power operations during the tenth fuel cycle? (Neglect any contribution from an installed neutron source.)

A. Alpha-neutron reactions

B. Beta-neutron reactions

C. Photo-neutron reactions

D. Spontaneous fission

ANSWER: C.

處於第十燃料週期的反應器，若從長期運轉中急停，下列何種中子反應隨即能提供最大的內在源階中子量(intrinsic source neutron level)？(忽略裝置中子源的供應部分)

A. 阿伐-中子反應

B. 貝塔-中子反應

C. 光子-中子反應

D. 自發分裂

答案：C.

科目： 192003
知能類：K1.11 [2.7/2.8]
序號： P1549 (B1549)

Which one of the following intrinsic/natural neutron sources undergoes the most significant source strength reduction during the 1-hour period immediately following a reactor scram from steady-state 100% power?

A. Spontaneous fission reactions

B. Photo-neutron reactions

C. Alpha-neutron reactions

D. Transuranic isotope decay

ANSWER: B.

一部反應器從100%穩態功率運轉下急停，在急停後的一小時內，下列那種固有/自然中子源，其強度降低最為顯著？

A. 自發分裂反應

B. 光激中子(γ-n)反應

C. 阿伐-中子(α-n)反應

D. 超鈾同位素衰變

答案：B.

科目： 192003
知能類：K1.11 [2.7/2.8]
序號： P2149 (B2150)

After the first fuel cycle, subcritical multiplication can produce a visible neutron level indication on the source range nuclear instrumentation for a significant time period following a reactor shutdown from extended power operations, without installed neutron sources. This is because a sufficient number of source neutrons is being produced by intrinsic sources, with the largest contributor during the first few days after shutdown being...

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.

ANSWER: B.

經過第一燃料週期，在未裝置任何中子源的情況下，反應器在長時間功率運轉後，停機一段相當長的時間內，次臨界增殖(subcritical multiplication)仍可在源階(source range)之中子偵測器上，產生可察覺的中子量。這是因為固有中子源(intrinsic sources)產生足夠的中子量所致。停機後最初幾天中，最大的中子來源是……

A. 控制棒的自發中子放射

B. 緩和劑的光激中子(photoneutron)(γ-n)反應

C. 燃料中的自發分裂

D. 燃料中的阿伐-中子(α-n)反應

答案：B.

科目： 192003
知能類：K1.11 [2.7/2.8]
序號： P3149 (B967)

Which one of the following describes the purpose of a neutron source that is installed in a nuclear 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/startup range instrumentation during shutdown.

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

ANSWER: A.

下列何者正確描述了在第三燃料週期更換燃料時，裝置中子源的目的？

A. 確保停機時，中子量多到足以被中子偵測儀器偵測。

B. 提供額外的過剩反應度，以增加燃料週期長度。

C. 放大停機期間在源階/啟動階(source/startup range)中子偵測儀器的電子雜訊波動。

D. 提供停機時僅有的中子源，此中子源可於啟動時所用。

答案：A.

科目/題號：192003/1 (2016新增)
知能類：K1.06 [3.2/3.3]
序號：P6825 (B6825)

Given the following stable initial conditions for a reactor:

Power level = 1.0 x 10^{-8} percent

Keff = 0.999

Core βeff = 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
ANSWER: D.

已知一反應器下列初始穩定條件如下：

功率 = 1.0 x 10-8 %

有效增殖因數 Keff = 0.999

爐心有效遲延中子因數 β eff = 0.006

當反應器加入 0.15 %ΔK/K 正反應度後穩定的週期將為多少？(假設反應器的穩定週期在到達加熱點前發生).

A. 30秒
B. 50秒
C. 80秒
D. 110秒

答案： D

科目/題號：192003/2 (2016 新增)
知能類：K1.06〔3.2/3.3〕
序號：P7225

Given the following stable initial conditions for a reactor:

Power level = 1.0 x 10-8 percent

Keff = 0.999

Core βeff = 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

ANSWER: C.

已知下列反應器之穩定初始條件：

功率 = 1.0 × 10-8 %

有效增殖因數 Keff = 0.999

爐心有效遲延中子因數 βeff = 0.006

在反應器中加入正 0.2%△K/K 後，穩定的啟動率將是多少？(假設穩定啟動率發生在反應器到達加熱點之前)

A.0.24dpm

B.0.33dpm

C.0.52dpm

D.1.30dpm

答案： C

科目/題號：192003/3 (2016 新增)
知能類：K1.06〔3.2/3.3〕
序號：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, βeff 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 no 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
ANSWER: C.

核能電廠剛完成更換燃料大修，反應器正進行啟動。核工師已決定下一個燃料週期有效遲延中子分數的範圍將從最小的 0.0052 到最大的 0.0064。反應器臨界後控制棒再抽出額外 0.1 %ΔK/K。假若無其它反應度改變發生，則直到此反應器達到加熱點前，其穩定的啟動率約為多少？
A.1.0dpm
B.0.6dpm
C.0.5dpm
D.0.3dpm

答案： C

科目/題號：192003/4 (2016新增)
知能類：K1.07 [3.0/3.0]
序號：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

ANSWER: B.

已知運轉中的核子反應器爐心燃料數據如下：

核種	遲延中子分率	總燃料構成分率	總分裂率分率
U-235	0.0065	0.023	0.63
U-238	0.0148	0.965	0.07
Pu-239	0.0021	0.012	0.30

該反應器的爐心遲延中子分率約為多少？

A. 0.0052

B. 0.0058

C. 0.0072

D. 0.0078

答案： B

科目/題號：192003/5 (2016新增)
知能類：K1.07 [3.0/3.0]
序號：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.
ANSWER: D.

遲延中子的何種特性是主要用以提升反應器在反應度變化後的穩定性？
A.遲延中子產生時的平均能量比瞬發中子更低
B.遲延中子比瞬發中子更可能遭遇共振吸收
C.遲延中子勝於瞬發中子構成總中子通量的一小部分
D.遲延中子比瞬發中子在分裂事件後產生所需時間更長

答案： D

科目/題號：192003/6 (2016新增)
知能類：K1.07 [3.0/3.0]
序號：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.

ANSWER: A.

對一運轉中反應器有效遲延中子分數可能與遲延中子分數不同，因為與瞬發中子比較，遲延中子…

A.較少可能洩漏至反應爐外，且較少可能引發快中子分裂
B.較少可能引發快中子分裂，且需要較長時間完成中子世代
C.需要較長時間完成中子世代，且在共振能量區停留較少時間
D.在共振能量區停留較少時間，且較少可能洩漏至反應爐外

答案： A

科目/題號：192003/7 (2016新增)
知能類：K1.07 [3.0/3.0]
序號：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
ANSWER: A.

已知一反應器的下列數據:

- ●平均遲延中子分數是 0.0068
- ●有效遲延中子分數是 0.0065

上述數據顯示此反應器運轉接近燃料週期_____；且典型的遲延中子是_____可能比典型的瞬發中子引發此反應器的其它分裂

A.初期；更少
B.初期；更多
C.末期；更少
D.末期；更多

答案： A

科目/題號：192003/8 (2016新增)
知能類：K1.07 [3.0/3.0]
序號：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} ΔK/K reactivity to the reactor.

Case 2: An operator adds negative 1.0×10^{-4} ΔK/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
ANSWER: D

一反應器初始臨界穩定功率在加熱點(POAH)之下，並為了下列兩種狀況而維持在 POAH 下：

狀況一：運轉員加入反應器 1.0×10^{-4} ΔK/K 正反應度

狀況二：運轉員加入反應器 1.0×10^{-4} ΔK/K 負反應度

反應器功率改變 10 倍所需時間較長的是__，因為當反應器功率_____時，遲延中子在緩慢的反應器功率改變中更有效果。

A.狀況一；增加
B.狀況一；減少
C.狀況二；增加
D.狀況二；減少

答案： D

科目/題號：192003/9 (2016新增)
知能類：K1.07 [3.0/3.0]
序號：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.

ANSWER: A.

兩座相同的反應器 A 和 B 於接近燃料循環初期臨界在 1.0X10^{-8}%功率水準。瞬間
0.001 ΔK/K 正反應度加入反應器 A，而 0.001 ΔK/K 負反應度加入反應器 B。一分鐘後，假如有的話何者反應器的週期較短及其理由？

A.反應器 A，因為當分裂率增加發生在減速功率改變時，遲延中子的有效性較低.
B.反應器 B，因為當分裂率減少發生在減速功率改變時，遲延中子的有效性較低.
C.兩座反應器的週期相同，因為其有效遲延中子分數均相同.
D.兩座反應器的週期相同，因為所加入反應度的絕對值均相同.

答案： A

科目/題號：192003/10 (2016新增)
知能類：K1.07 [3.0/3.0]
序號：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.
ANSWER: C.

一運轉中反應器的燃料在更換燃料停機前給予下列數據：

核種	遲延中子分數	總分裂率分數
鈾-235	0.0065	0.64
鈾-238	0.0148	0.07
鈽-239	0.0021	0.29

當更換燃料時，1/3 的燃料束卸下，改以鈾-235 平均濃縮度為 3.5%的新燃料束更換。下列何者敘述為上述數據如何因完成更換燃料停機後而改變？
A.鈾-235 的遲延中子分數將減少
B.鈽-239 的遲延中子分數將減少
C.鈾-235 的總分裂率分數將增加
D.鈽-239 的總分裂率分數將增加

答案： C

科目/題號：192003/11 (2016新增)
知能類：K1.07 [3.0/3.0]
序號：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.
ANSWER: B.

下列何者為遲延中子分數從燃料週期初期到末期改變的最主要原因？
A.可燃耗毒素的燃耗.
B.燃料組成的改變.
C.分裂產物毒素逐漸增加.
D.爐心軸向功率分布的改變.

答案： B

科目/題號：192003/12 (2016新增)
知能類：K1.07 [3.0/3.0]
序號：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

ANSWER: B.

已知一運轉中反應器燃料的下列數據：

核種	遲延中子分數	熱分裂截面積	總分裂率分數
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

此反應器的遲延中子分數為多少？

A. 0.0044
B. 0.0055
C. 0.0063
D. 0.0071

答案： B

科目/題號：192003/13 (2016新增)
知能類：K1.07 [3.0/3.0]
序號：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.
ANSWER: B.

一核子反應器於燃料週期中期穩定運轉於 100%功率。下列何者改變將會引起爐心有效遲延中子分數的增加？
A.快中子不洩漏因子增加
B.快中子不洩漏因子減少
C.熱中子利用因子增加
D.熱中子利用因子減少

答案： B

科目/題號：192003/14 (2016新增)
知能類：K1.07 [3.0/3.0]
序號：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
ANSWER: D.

已知一反應器的下列數據：

- ●平均遲延中子分數是 0.0052.
- ●有效遲延中子分數是 0.0054.

上述數據顯示此反應器運轉接近燃料週期_____；且典型的遲延中子是_____可能比典型的瞬發中子引發此反應器的其它分裂

A.初期；更少
B.初期；更多
C.末期；更少
D.末期；更多

答案： D