科目： 192002
知能類：K1.07 [3.1/3.1]
序號： P44 (B186)

The operator has just pulled control rods and changed the effective multiplication factor (K_{eff}) from 0.998 to 1.002. The reactor is...

A. prompt critical.

B. supercritical.

C. exactly critical.

D. subcritical.

ANSWER: B.

運轉員剛抽出控制棒，使得有效增殖因數(K_{eff})從0.998增加到1.002，則反應器此時處於……

A. 瞬發臨界

B. 超臨界

C. 臨界

D. 次臨界

答案：B.

科目： 192002
知能類：K1.07 [3.1/3.1]
序號： P445 (B247)

Which one of the following conditions describes a nuclear reactor that is exactly critical?

A. $K_{eff} = 0$; $\Delta K/K = 0$

B. $K_{eff} = 0$; $\Delta K/K = 1$

C. $K_{eff} = 1$; $\Delta K/K = 0$

D. $K_{eff} = 1$; $\Delta K/K = 1$

ANSWER: C.

下列何種情況描述核子反應器正好處於臨界？

A. $K_{eff} = 0$；$\Delta K/K = 0$

B. $K_{eff} = 0$；$\Delta K/K = 1$

C. $K_{eff} = 1$；$\Delta K/K = 0$

D. $K_{eff} = 1$；$\Delta K/K = 1$

答案：C.

科目： 192002
知能類：K1.08 [2.6/2.6]
序號： P45

The ratio of the number of neutrons in one generation to the number of neutrons in the previous generation is the...

A. effective multiplication factor.

B. fast fission factor.

C. neutron nonleakage factor.

D. neutron reproduction factor.

ANSWER: A.

某代中子數與其前一代中子數的比率，稱為……

A. 有效增殖因數

B. 快分裂因數

C. 中子不漏因數

D. 中子再生因數

答案：A.

科目： 192002
知能類：K1.08 [2.6/2.6]
序號： P1346 (B1447)

The effective multiplication factor (K_{eff}) can be determined by dividing the number of neutrons produced from fission in the third generation by the number of neutrons produced from fission in the _____ generation.

A. first

B. second

C. third

D. fourth

ANSWER: B.

將第三代分裂中子數除以第_____代分裂中子數，就能得出有效增殖因數(K_{eff})。

A. 一

B. 二

C. 三

D. 四

答案：B.

科目： 192002
知能類：K1.08 [2.6/2.6]
序號： P1846 (B847)

The effective multiplication factor (K_{eff}) describes the ratio of the number of fission neutrons at the end of one generation to the number of fission neutrons at the _____ of the _____ generation.

A. end; previous

B. beginning; next

C. beginning; previous

D. end; next

ANSWER: A.

有效增殖因數(K_{eff})是指這一代結束時的分裂中子數，除以_____代_____時分裂中子數的比值。

A. 前一；結束

B. 下一；開始

C. 前一；開始

D. 下一；結束

答案：A.

科目： 192002
知能類：K1.08 [2.6/2.6]
序號： P2046 (N/A)

A nuclear reactor is shutdown with the reactor vessel head removed for refueling. The core is covered by 23 feet of refueling water at a temperature of 100°F and a boron concentration of 2,000 ppm.

Which one of the following will increase core K_{eff} ?

A. An unrodded spent fuel assembly is removed from the core.

B. Refueling water temperature is increased to 105°F.

C. A new neutron source is installed in the core.

D. Excore nuclear instrumentation is repositioned to increase source range count rate.

ANSWER: B.

核子反應器停機並開啟反應爐蓋以更換燃料。爐心更換燃料時的水深為 23 英尺，水溫為 100°F，硼濃度為 2,000 ppm。

下列何者將提高爐心的 K_{eff}？

A. 從爐心移除用過的無控制棒燃料元件。

B. 更換燃料池的水溫升至 105°F。

C. 在爐心置入新的中子源。

D. 變更爐外核儀的位置以增加源階計數率。

答案：B.

科目： 192002
知能類：K1.08 [2.6/2.6]
序號： P2647 (B2647)

A thermal neutron is about to interact with a U-238 nucleus in an operating nuclear reactor core. Which one of the following describes the most likely interaction and the effect on core K_{eff}?

A. The neutron will be scattered, thereby leaving K_{eff} unchanged.

B. The neutron will be absorbed and U-238 will undergo fission, thereby decreasing K_{eff}.

C. The neutron will be absorbed and U-238 will undergo fission, thereby increasing K_{eff}.

D. The neutron will be absorbed and U-238 will undergo radioactive decay to Pu-239, thereby increasing K_{eff}.

ANSWER: A.

在一部運轉中的核子反應器爐心中，有一熱中子即將與U-238原子核發生反應。下列何者描述了它們之間最有可能的反應情形，以及其對爐心K_{eff}造成的影響？

A. 中子將被散射，所以對K_{eff}無影響。

B. 中子將被吸收，U-238將發生分裂，使得K_{eff}降低。

C. 中子將被吸收，U-238將發生分裂，使得K_{eff}增加。

D. 中子將被吸收，U-238將發生放射衰變而成為Pu-239，使得K_{eff}增加。

答案：A.

科目： 192002
知能類：K1.08 [2.6/2.6]
序號： P2746 (N/A)

A nuclear reactor is shutdown with the reactor vessel head removed for refueling. The core is covered by 23 feet of refueling water at a temperature of 105°F and a boron concentration of 2200 ppm.

Which one of the following will increase core K_{eff}?

A. A new neutron source is installed in the core.

B. Refueling water temperature is decreased to 100°F.

C. A spent fuel assembly is replaced with a new fuel assembly.

D. Excore nuclear instrumentation is repositioned to increase source range count rate.

ANSWER: C.

核子反應器停機並開啟反應爐蓋以更換燃料。爐心更換燃料時的水深為 23 英尺，水溫為 105°F，硼濃度為 2200 ppm。

下列何者將提高爐心的 K_{eff}？

A. 在爐心置入新的中子源。

B. 更換燃料池的水溫降至 100°F。

C. 用新的燃料元件更換用過的燃料元件。

D. 變更爐外核儀的位置以增加源階計數率。

答案：C.

科目： 192002
知能類：K1.08 [2.6/2.6]
序號： P3046 (B3147)

A nuclear power plant is currently operating at equilibrium 80% power near the end of its fuel cycle. During the next 3 days of equilibrium power operation no operator action is taken.

How will core K_{eff} be affected during the 3-day period?

A. Core K_{eff} will gradually increase during the entire period.

B. Core K_{eff} will gradually decrease during the entire period.

C. Core K_{eff} will tend to increase, but inherent reactivity feedback will maintain K_{eff} at 1.0.

D. Core K_{eff} will tend to decrease, but inherent reactivity feedback will maintain K_{eff} at 1.0.

ANSWER: D.

核能電廠目前處於燃料週期末期，並以80%的平衡功率運轉。在往後三天的平衡功率運轉中，運轉員沒有採取任何動作。

在此三天期間中，爐心K_{eff}將受到何種影響？

A. 爐心K_{eff}在整個期間將逐漸增加。

B. 爐心K_{eff}在整個期間將逐漸減少。

C. 爐心K_{eff}傾向增加，但因固有的反應度反饋(inherent reactivity feedback)將使K_{eff}維持在1.0。

D. 爐心K_{eff}傾向減小，但因固有的反應度反饋(inherent reactivity feedback)將使K_{eff}維持在1.0。

答案：D.

科目： 192002
知能類：K1.08 [2.6/2.6]
序號： P4224

A nuclear reactor is shutdown with the reactor vessel head removed for refueling. The core is covered by 23 feet of refueling water at a temperature of 100°F and a boron concentration of 2,000 ppm.

Which one of the following will decrease core K_{eff} ?

A. An unrodded spent fuel assembly is removed from the core.

B. Refueling water temperature is increased to 105°F.

C. A depleted neutron source is removed from the core.

D. Refueling water boron concentration is decreased by 5 ppm.

ANSWER: A.

核子反應器停機並開啟反應爐蓋以更換燃料。爐心更換燃料時的水深為 23 英尺，水溫為 100°F，硼濃度為 2,000 ppm。

下列何者將降低爐心的 K_{eff}？

A. 從爐心移除用過的無控制棒燃料元件。

B. 更換燃料池的水溫升至 105°F。

C. 從爐心取出耗盡的中子源。

D. 將更換燃料池的硼濃度降低 5 ppm。

答案：A.

科目： 192002
知能類：K1.09 [2.5/2.7]
序號： P546

During core refueling, burnable poisons are often installed in the core to help control K_{excess}. Why are more burnable poison rods installed during fuel load for the first fuel cycle than for subsequent fuel cycles?

A. Control rod worth is lower at the beginning of subsequent fuel cycles.

B. More fuel reactivity is present at the beginning of subsequent fuel cycles.

C. More fission product poisons are present at the beginning of subsequent fuel cycles.

D. Reactor coolant boron concentration is higher at the beginning of subsequent fuel cycles.

ANSWER: C.

爐心更換燃料期間，常於爐心置入可燃性毒物以協助控制 K_{excess}。為何在第一燃料週期期間裝入燃料時所裝的可燃毒物棒，多於後續燃料週期所裝的數量？

A. 控制棒本領於後續燃料週期初期時較低。

B. 後續燃料週期初期，出現較高的燃料反應度。

C. 後續燃料週期初期，出現較多的分裂產物毒物。

D. 後續燃料週期初期，反應器冷卻水的硼濃度較高。

答案：C.

科目： 192002
知能類：K1.09 [2.5/2.7]
序號： P646 (B1848)

Select the equation that defines K-excess (excess reactivity).

A. $K_{eff} + 1$

B. $K_{eff} - 1$

C. $K_{eff}(1\text{-SDM})$

D. $1/(1- K_{eff})$

ANSWER: B.

下列何者為K-excess(過剩反應度)的定義？

A. $K_{eff} + 1$

B. $K_{eff} - 1$

C. $K_{eff}(1\text{-SDM})$

D. $1/(1-K_{eff})$

答案：B.

科目： 192002
知能類：K1.09 [2.5/2.7]
序號： P946 (N/A)

Which one of the following combinations of critical core conditions indicates the most excess reactivity exists in the core?

	CONTROL ROD POSITION	RCS BORON CONCENTRATION
A.	25% inserted	500 ppm
B.	50% inserted	500 ppm
C.	25% inserted	1,000 ppm
D.	50% inserted	1,000 ppm

ANSWER: D.

下列何組臨界爐心條件表示爐心的過剩反應度最高？

	控制棒位置	RCS 硼濃度
A.	插入 25%	500 ppm
B.	插入 50%	500 ppm
C.	插入 25%	1,000 ppm
D.	插入 50%	1,000 ppm

答案：D.

科目： 192002
知能類：K1.09 [2.5/2.7]
序號： P1147 (N/A)

The following are combinations of critical conditions that exist for the same nuclear reactor operating at the point of adding heat at different times in core life. Which one of the following combinations indicates the least amount of excess reactivity present in the core?

	CONTROL ROD POSITION	RCS BORON CONCENTRATION
A.	25% inserted	500 ppm
B.	25% inserted	1,000 ppm
C.	50% inserted	500 ppm
D.	50% inserted	1,000 ppm

ANSWER: A.

下面是同一核子反應器在爐心壽命期間的不同加熱時間點運轉時，所出現的臨界條件。下列何組表示爐心的過剩反應度最低？

	控制棒位置	RCS 硼濃度
A.	插入 25%	500 ppm
B.	插入 25%	1,000 ppm
C.	插入 50%	500 ppm
D.	插入 50%	1,000 ppm

答案：A.

科目： 192002
知能類：K1.09 [2.5/2.7]
序號： P1246 (B2048)

Which one of the following is a reason for installing excess reactivity (K_{excess}) in the core?

A. To compensate for burnout of Xe-135 and Sm-149 during power changes.

B. To ensure reactor coolant boron concentration is low enough to maintain a negative moderator coefficient.

C. To compensate for the negative reactivity added by the power coefficient during a power increase.

D. To compensate for the conversion of U-238 to Pu-239 over core life.

ANSWER: C.

下列何者是在爐心加入過剩反應度(K_{excess})的原因之一？

A. 為了補償Xe-135與Sm-149在功率變化時的燃耗。

B. 為了確保反應器冷卻水的硼濃度，低到足以讓緩和劑係數維持負值。

C. 為了補償在功率增加時，由功率係數增加的負反應度。

D. 為了補償在爐心壽命中，U-238轉變為Pu-239的影響。

答案：C.

科目： 192002
知能類：K1.09 [2.5/2.7]
序號： P2847 (B2747)

A nuclear reactor is operating at full power at the beginning of a fuel cycle. A neutron has just been absorbed by a U-238 nucleus at a resonance energy of 6.7 electron volts.

Which one of the following describes the most likely reaction for the newly formed U-239 nucleus and the effect of this reaction on K_{excess}?

A. Decays over several days to Pu-239, which increases K_{excess}.

B. Decays over several days to Pu-240, which increases K_{excess}.

C. Immediately undergoes fast fission, which decreases K_{excess}.

D. Immediately undergoes thermal fission, which decreases K_{excess}.

ANSWER: A.

一部核子反應器於燃料週期初期以全功率運轉。一中子剛於共振能量6.7電子伏特(ev)下，被一U-238原子核吸收。

下列何者對於新形成U-239原子核的反應，以及此反應對過剩反應度K_{excess}之影響的描述，最有可能發生？

A. 幾天內衰變成為Pu-239，而增加K_{excess}。

B. 幾天內衰變成為Pu-240，而增加K_{excess}。

C. 立即進行快分裂，而降低K_{excess}。

D. 立即進行熱分裂，而降低K_{excess}。

答案：A.

科目： 192002
知能類：K1.09 [2.5/2.7]
序號： P3547 (B3547)

Which one of the following is a benefit of installing excess reactivity (K_{excess}) in a nuclear reactor core?

A. Ensures that sufficient control rod negative reactivity is available to shut down the reactor.

B. Ensures that the reactor can be made critical during a peak xenon condition after a reactor scram.

C. Ensures that positive reactivity additions result in controllable reactor power responses.

D. Ensures that the U-235 fuel enrichment is the same at the beginning and the end of a fuel cycle..

ANSWER: B.

下列何者為核子反應器爐心加入過剩反應度(K_{excess})的優點之一？

A. 確保有足夠的控制棒負反應度以供反應器停機之用。

B. 確保反應器於急停後，能克服氙的最大值而仍可臨界。

C. 確保增加的正反應度，可控制反應器功率反應。

D. 確保在燃料週期初期與末期時，U-235燃料濃縮度不變。

答案：B.

科目： 192002
知能類：K1.10 [3.2/3.6]
序號： P127

Shutdown margin is the actual amount of reactivity...

A. inserted by burnable poisons at beginning of life.

B. due to dissolved boron in the reactor coolant system.

C. by which the reactor is subcritical.

D. which would be inserted by shutdown bank rods.

ANSWER: C.

停機餘裕為下列何者的實際反應度之量？

A. 於燃料壽命初期插入可燃性毒物所致。

B. 反應爐冷卻水系統的硼酸溶解所致。

C. 使反應器達次臨界狀態所需。

D. 由停機棒組插入所致。

答案：C.

科目： 192002
知能類：K1.10 [3.2/3.6]
序號： P245 (B248)

When determining shutdown margin for an operating nuclear reactor, how many control rods are assumed to remain fully withdrawn?

A. A single control rod of the highest reactivity worth

B. A symmetrical pair of control rods of the highest reactivity worth

C. A single control rod of average reactivity worth

D. A symmetrical pair of control rods of average reactivity worth

ANSWER: A.

決定一運轉中反應器的停機餘裕時，通常假設有多少的控制棒維持在全出狀態？

A. 具有最高反應度本領的單一控制棒。

B. 具有最高反應度本領的一組對稱控制棒。

C. 具有平均反應度本領的單一控制棒。

D. 具有平均反應度本領的一組對稱控制棒。

答案：A.

科目： 192002
知能類：K1.10 [3.2/3.6]
序號： P345

With a nuclear power plant operating at 85% power and rod control in Manual, the operator borates the reactor coolant system an additional 10 ppm. Assuming reactor power does not change during the boration, shutdown margin will...

A. decrease and stabilize at a lower value.

B. decrease, then increase to the original value as coolant temperature changes.

C. increase and stabilize at a higher value.

D. increase, then decrease to the original value as coolant temperature changes.

ANSWER: C.

核能電廠以 85%功率運轉，而且控制棒處於手動模式，運轉員此時加硼，讓反應爐冷卻水系統的硼濃度增加 10 ppm。假設反應器功率於加硼時維持不變，停機餘裕將……

A. 降低並穩定於較低數值。

B. 降低，然後隨著冷卻水溫度的變化增至原先數值。

C. 增加並穩定於較高數值。

D. 增加，然後隨著冷卻水溫度的變化減至原先數值。

答案：C.

科目： 192002
知能類：K1.10 [3.2/3.6]
序號： P746

With a nuclear power plant operating at 75% power and rod control in Manual, the operator dilutes reactor coolant system (RCS) boron concentration by 5 ppm to adjust RCS temperature. Assuming reactor power does not change, shutdown margin will...

A. increase and stabilize at a higher value.

B. increase, then decrease to the original value as coolant temperature changes.

C. decrease and stabilize at a lower value.

D. decrease, then increase to the original value as coolant temperature changes.

ANSWER: C.

核能電廠以 75%功率運轉，而且控制棒處於手動模式，運轉員此時為了調整 RCS 溫度，稀釋反應器冷卻水系統(RCS)，讓硼濃度降低 5 ppm。假設反應器功率沒有改變，停機餘裕將……

A. 增加並穩定於較高數值。

B. 增加，然後隨著冷卻水溫度的變化減至原先數值。

C. 降低並穩定於較低數值。

D. 降低，然後隨著冷卻水溫度的變化增至原先數值。

答案：C.

科目： 192002
知能類：K1.10 [3.2/3.6]
序號： P1747

A nuclear power plant is operating with the following initial conditions:

Reactor power is 50%
Rod control is in manual
Reactor coolant system (RCS) boron concentration is 600 ppm

Disregarding the effects of fission product poisons, which one of the following will result in a decrease in stable shutdown margin?

A. Reactor power is reduced to 45% with final RCS boron concentration at 620 ppm.

B. Reactor power is increased to 55% with final RCS boron concentration at 580 ppm.

C. Control rods are withdrawn 3 inches with no change in steady-state reactor power or RCS boron concentration.

D. Control rods are inserted 3 inches with no change in steady-state reactor power or RCS boron concentration.

ANSWER: B.

核能電廠以下列初始條件運轉：

反應器功率為 50%
控制棒為手動模式
反應器冷卻水系統(RCS)的硼濃度為 600 ppm

假設忽略分裂產物毒素的效應，下列何者將導致穩定的停機餘裕降低？

A. 反應器功率降至 45%，反應器冷卻水系統的最終硼濃度為 620 ppm。

B. 反應器功率增至 55%，反應器冷卻水系統的最終硼濃度為 580 ppm。

C. 在反應器穩態功率或冷卻水系統硼濃度維持不變下，將控制棒抽出 3 吋。

D. 在反應器穩態功率或冷卻水系統硼濃度維持不變下，將控制棒插入 3 吋。

答案：B.

科目： 192002
知能類：K1.10 [3.2/3.6]
序號： P2347 (B2348)

Which one of the following core changes will decrease shutdown margin? Assume no operator actions.

A. Depletion of fuel during reactor operation

B. Depletion of burnable poisons during reactor operation

C. Buildup of Sm-149 following a reactor power transient

D. Buildup of Xe-135 following a reactor power transient

ANSWER: B.

假設在運轉員不採取行動下，下列何種爐心變化將減少停機餘裕？

A. 燃料在反應器運轉時的燃耗。

B. 可燃性毒物在反應器運轉時的燃耗。

C. Sm-149在反應器功率變化後的累積。

D. Xe-135在反應器功率變化後的累積。

答案：B.

科目： 192002
知能類：K1.10 [3.2/3.6]
序號： P2546

A nuclear power plant is operating at 100% power with rod control in Manual. If no operator action is taken, then during the next two weeks of steady-state operation at 100% power shutdown margin will...

A. continuously decrease

B. initially decrease, then return to the same value due to changing coolant temperature.

C. continuously increase

D. initially increase, then return to the same value due to changing coolant temperature.

ANSWER: C.

核能電廠以 100%功率運轉，而且控制棒處於手動模式。如果運轉員不採取行動，在往後兩週以 100%功率穩態運轉的期間，停機餘裕將……

A. 持續降低。

B. 冷卻水溫度改變所致，停機餘裕先降低，再回到原先數值。

C. 持續增加。

D. 冷卻水溫度改變所致，停機餘裕先增加，再回到原先數值。

答案：C.

科目： 192002
知能類：K1.11 [2.9/3.0]
序號： P46

Reactivity is defined as the fractional change in...

A. reactor power per second.

B. neutron population per second.

C. reactor period from criticality.

D. the effective multiplication factor from criticality.

ANSWER: D.

反應度的定義是下列何者的分率變化……

A. 每秒反應器功率。

B. 每秒中子數。

C. 反應器週期與臨界。

D. 有效增殖因數與臨界。

答案：D.

科目： 192002
知能類：K1.11 [2.9/3.0]
序號： P846

Which term is described by the following?

"The fractional change of the effective multiplication factor from criticality."

A. 1/M

B. K_{eff}

C. Reactor period

D. Reactivity

ANSWER: D.

「有效增殖因數與臨界之分率變化」意指下列何者？

A. 1/M

B. K_{eff}

C. 反應器週期

D. 反應度

答案：D.

科目： 192002
知能類：K1.12 [2.4/2.5]
序號： P130

With K_{eff} = 0.985, how much reactivity must be added to make the nuclear reactor critical?

A. 1.48% ΔK/K

B. 1.50% ΔK/K

C. 1.52% ΔK/K

D. 1.54% ΔK/K

ANSWER: C.

假設 K_{eff} = 0.985，必須加入多少反應度，才能讓核子反應器臨界？

A. 1.48% ΔK/K

B. 1.50% ΔK/K

C. 1.52% ΔK/K

D. 1.54% ΔK/K

答案：C.

科目： 192002
知能類：K1.12 [2.4/2.5]
序號： P446 (B1548)

With core K_{eff} equal to 0.987, how much reactivity must be added to make the nuclear reactor exactly critical? (Answer options are rounded to the nearest 0.01% ΔK/K.)

A. 1.01% ΔK/K

B. 1.03% ΔK/K

C. 1.30% ΔK/K

D. 1.32% ΔK/K

ANSWER: D.

在爐心K_{eff} = 0.987的情況下，欲使核子反應器剛好達到臨界，需加入多少反應度？(答案要四捨五入至0.01%ΔK/K)

A. 1.01% ΔK/K

B. 1.03% ΔK/K

C. 1.30% ΔK/K

D. 1.32% ΔK/K

答案：D.

科目： 192002
知能類：K1.12 [2.4/2.5]
序號： P1946 (B648)

In a subcritical nuclear reactor, K_{eff} was increased from 0.85 to 0.95 by rod withdrawal. Which one of the following is closest to the amount of reactivity that was added to the core?

A. 0.099 ΔK/K

B. 0.124 ΔK/K

C. 0.176 ΔK/K

D. 0.229 ΔK/K

ANSWER: B.

在一部次臨界核子反應器中，K_{eff}因控制棒抽出而從0.85增加到0.95。下列何者最接近加入爐心的反應度？

A. 0.099 ΔK/K

B. 0.124 ΔK/K

C. 0.176 ΔK/K

D. 0.229 ΔK/K

答案：B.

科目： 192002
知能類：K1.12 [2.4/2.5]
序號： P2146 (B2848)

With K_{eff} = 0.982, how much positive reactivity is required to make the nuclear reactor critical?

A. 1.720% ΔK/K

B. 1.767% ΔK/K

C. 1.800% ΔK/K

D. 1.833% ΔK/K

ANSWER: D.

於K_{eff} = 0.982的情況下，欲使核子反應器達到臨界，則需多少正反應度？

A. 1.720% ΔK/K

B. 1.767% ΔK/K

C. 1.800% ΔK/K

D. 1.833% ΔK/K

答案：D.

科目： 192002
知能類：K1.12 [2.4/2.5]
序號： P2447 (B1947)

With K_{eff} = 0.985, how much positive reactivity is required to make the nuclear reactor exactly critical?

A. 1.487% ΔK/K

B. 1.500% ΔK/K

C. 1.523% ΔK/K

D. 1.545% ΔK/K

ANSWER: C.

在K_{eff} = 0.985的情況下，欲使核子反應器剛好達到臨界，則需多少正反應度？

A. 1.487% ΔK/K

B. 1.500% ΔK/K

C. 1.523% ΔK/K

D. 1.545% ΔK/K

答案：C.

科目： 192002
知能類：K1.12 [2.4/2.5]
序號： P3347 (B748)

With K_{eff} equal to 0.983, how much reactivity must be added to make the nuclear reactor exactly critical?(Round answer to nearest 0.01% ΔK/K.)

A. 1.70% ΔK/K

B. 1.73% ΔK/K

C. 3.40% ΔK/K

D. 3.43% ΔK/K

ANSWER: B.

在K_{eff} = 0.983的情況下，欲使核子反應器剛好達到臨界，則需加入多少反應度？(答案要四捨五入至0.01% ΔK/K)

A. 1.70% ΔK/K

B. 1.73% ΔK/K

C. 3.40% ΔK/K

D. 3.43% ΔK/K

答案：B.

科目： 192002
知能類：K1.13 [3.5/3.7]
序號： P246

A nuclear reactor at the end of core life has been shut down from 100% power and cooled down to 140°F over three days. During the cooldown, boron concentration was increased by 100 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.

Control rods = ( ) 6.918% ΔK/K
Xenon = ( ) 2.675% ΔK/K
Power defect = ( ) 1.575% ΔK/K
Boron = ( ) 1.040% ΔK/K
Temperature = ( ) 0.500% ΔK/K

A. -8.558% ΔK/K

B. -6.358% ΔK/K

C. -3.208% ΔK/K

D. -1.128% ΔK/K

ANSWER: C.

一部處於爐心壽命末期的核子反應器於 100%功率時停機，並在三天內降溫至 140°F。機組降溫期間，硼濃度增加 100 ppm。已知在停機降溫期間，加入下列反應度絕對值，請添加適用的(+)或(-)，並選出目前的停機餘裕值。

控制棒 = ( ) 6.918% ΔK/K
氙 = ( ) 2.675% ΔK/K
功率欠缺(power defect) = ( ) 1.575% ΔK/K
硼 = ( ) 1.040% ΔK/K
溫度 = ( ) 0.500% ΔK/K

A. -8.558% ΔK/K

B. -6.358% ΔK/K

C. -3.208% ΔK/K

D. -1.128% ΔK/K

答案：C.

科目： 192002
知能類：K1.13 [3.5/3.7]
序號： P346

A nuclear reactor was operating at steady-state 100% power with all control rods fully withdrawn and RCS T_{ave} at 588°F when a reactor trip occurred.

After the trip T_{ave} stabilized at 557°F and all control rods were verified to be fully inserted.

Given the following information, select the post-trip value of shutdown margin. (Assume no operator actions and disregard any reactivity effects of xenon.)

Power coefficient = -0.015% ΔK/K/% power
Control/regulating rod worth = -2.788% ΔK/K
Shutdown/safety rod worth = -4.130% ΔK/K
Moderator temperature coefficient = -0.0012% ΔK/K per°F

A. -5.381% ΔK/K

B. -5.418% ΔK/K

C. -8.383% ΔK/K

D. -8.418% ΔK/K

ANSWER: B.

一部核子反應器以 100%功率穩態運轉，所有控制棒都完全抽出，RCS T_{ave} 為 588°F，該反應器於此時發生急停。

反應器急停後，T_{ave} 穩定在 557°F，並確認所有控制棒都完全插入。

請於下列已知條件下，選出急停後的停機餘裕值。(假設運轉員沒有採取任何行動，並忽略氙的反應度效應)

功率係數 = -0.015% ΔK/K/%功率
控制/調節棒本領 = -2.788% ΔK/K
停機/安全棒本領 = -4.130% ΔK/K
緩和劑溫度係數 = 每°F 為-0.0012% ΔK/K

A. -5.381% ΔK/K

B. -5.418% ΔK/K

C. -8.383% ΔK/K

D. -8.418% ΔK/K

答案：B.

科目： 192002
知能類：K1.13 [3.5/3.7]
序號： P447

A nuclear reactor is operating at steady-state 90% power with all control rods fully withdrawn and T_{ave} at 580°F. A reactor trip occurs, after which T_{ave} stabilizes at 550°F and all rods are verified to be fully inserted.

Given the following information, calculate the value of shutdown margin. Assume no operator actions and disregard any reactivity effects of xenon.

Power coefficient = -0.01% ΔK/K/% power
Control/regulating rod worth = -2.788% ΔK/K
Shutdown/safety rod worth = -4.130% ΔK/K
Moderator temperature coefficient = -0.01% ΔK/K per°F

A. -5.718% ΔK/K

B. -6.018% ΔK/K

C. -7.518% ΔK/K

D. -7.818% ΔK/K

ANSWER: B.

一部核子反應器以 90%功率穩態運轉，所有控制棒都完全抽出，T_{ave} 為 580°F。反應器於此時發生急停，之後 T_{ave} 穩定在 550°F，並確認所有控制棒都完全插入。

假設運轉員沒有採取任何行動，並忽略氙的反應度效應，請於下列已知條件下，算出停機餘裕值。

功率係數 = -0.01% ΔK/K/%功率
控制/調節棒本領= -2.788% ΔK/K
停機/安全棒本領= -4.130% ΔK/K
緩和劑溫度係數 = 每°F 為-0.01% ΔK/K

A. -5.718% ΔK/K

B. -6.018% ΔK/K

C. -7.518% ΔK/K

D. -7.818% ΔK/K

答案：B.

科目： 192002
知能類：K1.13 [3.5/3.7]
序號： P647

At the time of a reactor trip from 100% power, shutdown margin was determined to be -5.883% ΔK/K. Over the next 72 hours the reactor coolant system was cooled down and boron concentration was increased. The reactivities affected by the change in plant conditions are as follows:

Reactivity	Change (+ or -)
Xenon	2.675% ΔK/K
Moderator temperature	0.5% ΔK/K
Boron	1.04% ΔK/K

What is the shutdown margin 72 hours after the trip? (Assume end of core life.)

A. -1.668% ΔK/K

B. -3.748% ΔK/K

C. -7.018% ΔK/K

D. -9.098% ΔK/K

ANSWER: B.

採 100%功率運轉的反應器發生急停時，停機餘裕為-5.883% ΔK/K。經過 72 小時後，反應器冷卻水系統降溫，硼濃度則增加。受到電廠條件變化所影響的反應度如下所示：

反應度	變化(+或-)
氙	2.675% ΔK/K
緩和劑溫度	0.5% ΔK/K
硼	1.04% ΔK/K

請問急停 72 小時後的停機餘裕為多少(假設處於爐心壽命末期)？

A. -1.668% ΔK/K

B. -3.748% ΔK/K

C. -7.018% ΔK/K

D. -9.098% ΔK/K

答案：B.

科目： 192002
知能類：K1.13 [3.5/3.7]
序號： P747

A nuclear reactor at end of life has been shut down from 100% power and cooled down to 140°F over three days. During the cooldown, boron concentration was increased by 100 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 = ( ) 2.5% ΔK/K
Temperature = ( ) 0.5% ΔK/K
Power defect = ( ) 1.5% ΔK/K
Rods = ( ) 7.0% ΔK/K
Boron = ( ) 1.0% ΔK/K

A. -8.5% ΔK/K

B. -6.5% ΔK/K

C. -3.5% ΔK/K

D. -1.5% ΔK/K

ANSWER: C.

一部處於壽命末期的核子反應器於 100%功率時停機，並在三天內降溫至 140°F。機組降溫期間，硼濃度增加 100 ppm。

已知在停機降溫期間，加入下列反應度絕對值，請添加適用的(+)或(-)，並選出目前的停機餘裕值。

氙 = ( ) 2.5% ΔK/K
溫度 = ( ) 0.5% ΔK/K
功率欠缺(Power defect) = ( ) 1.5% ΔK/K
控制棒 = ( ) 7.0% ΔK/K
硼 = ( ) 1.0% ΔK/K

A. -8.5% ΔK/K

B. -6.5% ΔK/K

C. -3.5% ΔK/K

D. -1.5% ΔK/K

答案：C.

科目： 192002
知能類：K1.13 [3.5/3.7]
序號： P1047

A nuclear reactor at end of core life has been shut down from 100% power and cooled down to 140°F over three days. During the cooldown, boron concentration was increased by 100 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.

Coolant temperature	= ( ) 0.50% ΔK/K
Control rods	= ( ) 6.50% ΔK/K
Boron	= ( ) 1.50% ΔK/K
Power defect	= ( ) 1.75% ΔK/K
Xenon	= ( ) 2.75% ΔK/K

A. -0.0% ΔK/K

B. -3.0% ΔK/K

C. -3.5% ΔK/K

D. -8.5% ΔK/K

ANSWER: B.

一部處於爐心壽命末期的核子反應器於 100%功率停機，並在三天內降溫至 140°F。機組降溫期間，硼濃度增加 100 ppm。

已知在停機降溫期間，加入下列反應度絕對值，請添加適用的(+)或(-)，並選出目前的停機餘裕值。

冷卻水溫度	= ( ) 0.50% ΔK/K
控制棒	= ( ) 6.50% ΔK/K
硼	= ( ) 1.50% ΔK/K
功率欠缺(Power defect)	= ( ) 1.75% ΔK/K
氙	= ( ) 2.75% ΔK/K

A. -0.0% ΔK/K

B. -3.0% ΔK/K

C. -3.5% ΔK/K

D. -8.5% ΔK/K

答案：B.

科目： 192002
知能類：K1.13 [3.5/3.7]
序號： P1446

A nuclear 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 = ( ) 3.0% ΔK/K
Boron = ( ) 3.5% ΔK/K
Power defect = ( ) 4.0% ΔK/K
Rods = ( ) 7.0% ΔK/K
Cooldown = ( ) 2.0% ΔK/K

A. -1.5% ΔK/K

B. -2.5% ΔK/K

C. -7.5% ΔK/K

D. -9.5% ΔK/K

ANSWER: A.

一部處於爐心壽命初期的核子反應器於 100%功率停機，並在三天內降溫至 340°F。機組降溫期間，硼濃度增加 200 ppm。

已知在停機降溫期間，加入下列反應度絕對值，請添加適用的(+)或(-)，並選出目前的停機餘裕值。

氙 = ( ) 3.0% ΔK/K
硼 = ( ) 3.5% ΔK/K
功率欠缺(Power defect) = ( ) 4.0% ΔK/K
控制棒 = ( ) 7.0% ΔK/K
降溫 = ( ) 2.0% ΔK/K

A. -1.5% ΔK/K

B. -2.5% ΔK/K

C. -7.5% ΔK/K

D. -9.5% ΔK/K

答案：A.

科目： 192002
知能類：K1.13 [3.5/3.7]
序號： P1647

A nuclear reactor was operating at 100% power for two months when a reactor trip occurred. During the 14 hours since the trip the reactor has been cooled to 340°F and boron concentration has been 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 = ( ) 2.0% ΔK/K
Boron = ( ) 2.5% ΔK/K
Power defect = ( ) 4.0% ΔK/K
Rods = ( ) 7.0% ΔK/K
Cooldown = ( ) 2.0% ΔK/K

A. -1.5% ΔK/K

B. -3.5% ΔK/K

C. -5.5% ΔK/K

D. -7.5% ΔK/K

ANSWER: C.

一部核子反應器在發生急停時，已經以 100%功率運轉兩個月。急停後 14 小時內，該反應器降溫至 340°F，硼濃度增加 200 ppm。

已知在停機降溫期間，加入下列反應度絕對值，請添加適用的(+)或(-)，並選出目前的停機餘裕值。

氙 = ( ) 2.0% ΔK/K
硼酸 = ( ) 2.5% ΔK/K
功率欠缺(Power defect) = ( ) 4.0% ΔK/K
控制棒 = ( ) 7.0% ΔK/K
降溫 = ( ) 2.0% ΔK/K

A. -1.5% ΔK/K

B. -3.5% ΔK/K

C. -5.5% ΔK/K

D. -7.5% ΔK/K

答案：C.

科目： 192002
知能類：K1.14 [3.8/3.9]
序號： P124

Which one of the following plant parameter changes will result in an increase in shutdown margin for a shutdown nuclear reactor at end of core life?

A. Reactor coolant boron concentration is decreased by 100 ppm.

B. One control rod is fully withdrawn for a test.

C. Xenon has decayed for 72 hours following shutdown.

D. The reactor coolant system is allowed to heat up 30°F.

ANSWER: D.

對於一部處於爐心壽命末期的停機核子反應器，下列何種電廠參數變化，將導致停機餘裕增加？

A. 反應器冷卻水硼濃度降低 100 ppm。

B. 基於測試之用，將一控制棒完全抽出。

C. 氙於停機後衰變 72 小時。

D. 反應器冷卻水系統加熱 30°F。

答案：D.

科目： 192002
知能類：K1.14 [3.8/3.9]
序號： P547

A nuclear power plant is operating at 70% power with manual rod control. Which one of the following conditions will increase shutdown margin? (Assume that no unspecified operator actions occur and the reactor does not trip.)

A. The reactor coolant system is diluted by 10 ppm.

B. A control rod in a shutdown bank (safety group) drops.

C. Power is decreased to 50% using boration.

D. The plant experiences a 3% load rejection.

ANSWER: C.

核能電廠以 70%功率運轉，而且控制棒處於手動模式。請問下列何者將增加停機餘裕？(假設運轉員沒有採取特別行動，反應器亦無急停)

A. 反應器冷卻水系統稀釋 10 ppm。

B. 停機棒組(安全棒組)內的控制棒掉落。

C. 添加硼讓功率降至 50%。

D. 電廠發生 3%棄載(load rejection)。

答案：C.

科目： 192002
知能類：K1.14 [3.8/3.9]
序號： P2247

A nuclear reactor is operating at 80% power when the operator adds 10 gallons of boric 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

ANSWER: C.

一部核子反應器以 80%功率運轉，運轉員於此時添加 10 加侖硼酸至反應器冷卻水系統(RCS)。幾分鐘後，運轉員視需要調整控制棒位置，讓反應器冷卻水的平均溫度維持固定。

電廠趨於穩定時，停機餘裕將_____；軸向功率分佈將朝爐心_____移動。

A. 維持相同；頂部

B. 維持相同；底部

C. 變大；頂部

D. 變大；底部

答案：C.

科目： 192002
知能類：K1.14 [3.8/3.9]
序號： P2547

A nuclear power plant malfunction requires a rapid reactor power decrease from 100% to 90%. The crew hurriedly performs the downpower transient using control rod insertion when necessary. Reactor coolant boron concentration is not changed.

If the initial shutdown margin was 3.5% ΔK/K, which one of the following describes the shutdown margin at the lower power level? (Neglect any changes in core fission product reactivity.)

A. Less than 3.5% ΔK/K due only to the power defect.

B. Greater than 3.5% ΔK/K due only to the insertion of control rods.

C. Less than 3.5% ΔK/K due to the combined effects of control rod insertion and power defect.

D. Equal to 3.5% ΔK/K regardless of the reactivity effects of control rod insertion and power defect.

ANSWER: D.

由於核能電廠發生故障，必須將反應器功率從 100%迅速降至 90%。電廠人員視需要趕緊插入控制棒以急降功率(downpower transient)。反應器冷卻水系統的硼濃度沒有改變。

如果初始停機餘裕為 3.5% ΔK/K，下列何者為降低功率時的停機餘裕？(忽略爐心分裂產物反應度的變化)

A. 僅是功率欠缺一項，就導致停機餘裕小於 3.5% ΔK/K。

B. 僅是插入控制棒，就導致停機餘裕大於 3.5% ΔK/K。

C. 插入控制棒與功率欠缺的合併效應，導致停機餘裕小於 3.5% ΔK/K。

D. 無論插入控制棒與功率欠缺的反應度效應為何，停機餘裕都等於 3.5% ΔK/K。

答案：D.

科目： 192002
知能類：K1.14 [3.8/3.9]
序號： P2747 (N/A)

Nuclear reactors A and B are identical except that reactor A is operating at steady-state 80% power while reactor B is operating at steady-state 100% power. Initial control rod positions are the same for each reactor.

How will the shutdown margins (SDM) compare for the two reactors following a reactor scram? (Assume no post-scram operator actions are taken that would affect SDM.)

A. Reactor A will have the greater SDM.

B. Reactor B will have the greater SDM.

C. When sufficient time has passed to allow both cores to become xenon-free, the SDMs will be equal.

D. Within a few minutes after the scrams, when all parameters have returned to normal post scram conditions, the SDMs will be equal.

ANSWER: A.

核子反應器 A 與 B 完全相同，只是反應器 A 以 80%功率穩態運轉，反應器 B 則以 100%功率穩態運轉。各反應器的控制棒初始位置相同。

請比較兩部反應器於急停後的停機餘裕(SDM)。(假設運轉員在急停後，沒有採取影響到停機餘裕的行動)

A. 反應器 A 的停機餘裕較大。

B. 反應器 B 的停機餘裕較大。

C. 經過充分時間以讓兩部爐心無氙之後，停機餘裕將相等。

D. 所有參數若能在急停後幾分鐘內，恢復至急停後的正常狀況，停機餘裕將相等。

答案：A.

科目： 192002
知能類：K1.14 [3.8/3.9]
序號： P2947 (N/A)

A nuclear reactor is operating at steady-state 50% power. A plant test requires a 4°F decrease in reactor coolant system (RCS) average temperature (T-avg). The operator accomplishes this temperature decrease by adjusting RCS boron concentration. No other operator actions are taken.

If the initial shutdown margin was 3.0% ΔK/K, which one of the following describes the shutdown margin at the lower RCS T-avg with the reactor still at steady-state 50% power?

A. Less than 3.0% ΔK/K, because RCS T-avg is lower.

B. More than 3.0% ΔK/K, because RCS boron concentration is higher.

C. Equal to 3.0% ΔK/K, because the reactivity change caused by the change in RCS T-avg offsets the reactivity change caused by the change in RCS boron concentration.

D. Equal to 3.0% ΔK/K because shutdown margin in an operating reactor will not change unless control rod position changes.

ANSWER: B.

一部核子反應器以 50%功率穩態運轉。電廠測試要求將反應器冷卻水系統(RCS)的平均溫度(T-avg)降低 4°F。運轉員於是調整 RCS 硼濃度來降溫，此外沒有採取任何行動。

如果初始停機餘裕為 3.0% ΔK/K，下列何者為反應器仍以 50%功率穩態運轉時，處於較低 RCS 平均溫度的停機餘裕？

A. 由於 RCS 平均溫度較低，停機餘裕小於 3.0% ΔK/K。

B. 由於 RCS 硼濃度較高，停機餘裕大於 3.0% ΔK/K。

C. 由於 RCS 平均溫度改變造成的反應度變化，抵銷了 RCS 硼濃度改變造成的反應度變化，所以停機餘裕等於 3.0% ΔK/K。

D. 除非控制棒的位置改變，否則運轉中反應器的停機餘裕不會改變，所以等於 3.0% ΔK/K。

答案：B.

科目： 192002
知能類：K1.14 [3.8/3.9]
序號： P3647 (B3648)

A nuclear reactor is initially operating at steady-state 60% power near the end of core life when a fully withdrawn control rod suddenly inserts completely into the core. No operator action is taken and the plant control systems stabilize the reactor at a power level in the power range.

Compared to the initial shutdown margin (SDM), the new steady-state SDM is _____; compared to the initial 60% power core K_{eff}, the new steady-state core K_{eff} is _____.

A. the same; smaller

B. the same; the same

C. less negative; smaller

D. less negative; the same

ANSWER: B.

一部核子反應器於爐心壽命末期時，原本以60%穩態功率運轉，此時一完全抽出的控制棒，突然完全插入爐心。在運轉員沒有採取行動下，電廠控制系統將反應器穩定於另一功率階(power range)功率。

相較於初始停機餘裕(SDM)，新的穩態停機餘裕會_____；而與初始60%功率爐心K_{eff}相比，新的穩態爐心K_{eff}會_____。

A. 仍然相同；較小

B. 仍然相同；相同

C. 較少負值；較小

D. 較少負值；相同

答案：B.

科目： 192002
知能類：K1.14 [3.8/3.9]
序號： P3747 (B3748)

A nuclear power plant has just completed a refueling outage. Reactor engineers have predicted a control rod configuration at which the reactor will become critical during the initial reactor startup following the refueling outage based on the expected core loading. However, the burnable poisons scheduled to be loaded were inadvertently omitted.

Which one of the following describes the effect of the burnable poison omission on achieving reactor criticality during the initial reactor startup following the refueling outage?

A. The reactor will become critical before the predicted critical control rod configuration is achieved.

B. The reactor will become critical after the predicted critical control rod configuration is achieved.

C. The reactor will be unable to achieve criticality because the fuel assemblies contain insufficient positive reactivity to make the reactor critical.

D. The reactor will be unable to achieve criticality because the control rods contain insufficient positive reactivity to make the reactor critical.

ANSWER: A.

核能電廠剛完成燃料更換大修。反應器工程師根據預期的爐心負載，預測在更換燃料大修後初次啟動反應器時，該反應器達到臨界的棒位。然而，排定裝填的可燃性毒物卻意外遭到忽略。

對於反應器在更換燃料大修後初次啟動期間，忽略可燃性毒物對其達成臨界的影響，下列何者為真？

A. 反應器將在達到預測的臨界棒位前臨界。

B. 反應器將在達到預測的臨界棒位後臨界。

C. 反應器無法達到臨界，因為燃料元件包含的正反應度，不足以讓反應器臨界。

D. 反應器無法達到臨界，因為控制棒包含的正反應度，不足以讓反應器臨界。

答案：A.

科目/題號：192002/1)/212 (2016新增)
知能類：K1.08 [2.6/2.6]
序號：P6424 (B6424)

A 1.5 MeV neutron is about to interact with a U-238 nucleus in an operating reactor. Which one of the following describes the most likely interaction and its effect on Keff?
A. The neutron will be scattered, thereby leaving Keff unchanged.
B. The neutron will be absorbed and the nucleus will fission, thereby decreasing Keff.
C. The neutron will be absorbed and the nucleus will fission, thereby increasing Keff.
D. The neutron will be absorbed and the nucleus will decay to Pu-239, thereby increasing Keff.
ANSWER: A.

一座運轉反應器中，一個 1.5 MeV 的中子與鈾-238 原子核發生交互作用。下列何者最能描述其交互作用和對有效增殖因數的影響？
A.中子將會散射，因此有效增殖因數並不受影響
B.中子將會被吸收，原子核將會分裂，因此有效增殖因數將會減少
C.中子將會被吸收，原子核將會分裂，因此有效增殖因數將會增加
D.中子將會被吸收，而且原子核將會衰變為鈽-239，因此有效增殖因數將會增加

答案： A

科目/題號：192002/2)/213 (2016新增)
知能類：K1.12 [2.4/2.5]
序號：P7647 (B7647)

A reactor was initially shutdown at a stable power level of 2.0 x 10^{-5} percent. After a small positive reactivity addition, the current stable power level is 3.0 x 10^{-5} percent. If the initial Keff was 0.982, what is the current Keff?
A. 0.988
B. 0.992
C. 0.996
D. Cannot be determined without additional information.
ANSWER: A.

一座反應器最初停機穩定在 2.0×10^{-5}%功率。在加入某一小量的正反應度後，目前的穩定功率是 3.0×10^{-5}%。假如最初的有效增殖因數是 0.982，目前的有效增殖因數是多少？
A.0.988
B.0.992
C.0.996
D.在無更多資訊下無法決定

答案： A

科目/題號：192002/3)/214 (2016新增)
知能類：K1.13 [3.5/3.7]
序號：P5224

A reactor near the middle of a fuel cycle was initially operating at steady-state 100 percent power when it was shut down and cooled down to 200°F over a three-day period. During the cooldown, reactor coolant boron concentration was increased by 80 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 core reactivity.

Control rods = ( ) 6.75 %ΔK/K
Xenon = ( ) 2.50 %ΔK/K
Power defect = ( ) 2.00 %ΔK/K
Boron = ( ) 1.25 %ΔK/K
Moderator temperature = ( ) 0.50 %ΔK/K

A. -0.5 %ΔK/K
B. -3.0 %ΔK/K
C. -7.0 %ΔK/K
D. -8.0 %ΔK/K
ANSWER: B.

一反應器接近燃料週期中期起初運轉在穩定 100%功率，當其停機並以 3 天時間降溫至 200˚F。當降溫過程，反應器冷卻水硼酸濃度增加 80ppm。已知在停機和降溫過程中，各項反應度所加入絕對值，請適當的選定其為(＋)或(－)值，並算出爐心反應度的現值為何？

控制棒 = ( )6.75%△K/K
氙毒 = ( )2.5%△K/K
功率欠缺 = ( )2.00%△K/K
硼酸= ( )1.25%△K/K
緩和劑溫度= ( )0.50%△K/K

A.-0.5%△K/K
B. -3.0%△K/K
C. -7.0%△K/K
D. -8.0%△K/K

答案： B

科目/題號：192002/4)/215 (2016新增)
知能類：K1.14 [3.8/3.9]
序號：P2046

A reactor is shutdown with the reactor vessel head removed for refueling. The core is covered by 23 feet of refueling water at 100°F with a boron concentration of 2,000 ppm.
Which one of the following will increase core Keff?
A. An unrodded spent fuel assembly is removed from the core.
B. Refueling water temperature is increased to 105°F.
C. A new neutron source is installed in the core.
D. Excore nuclear instrumentation is repositioned to increase source range count rate.
ANSWER: B.

一反應器停機且爐蓋移除以更換燃料。爐心以溫度 100°F、硼酸濃度 2,000ppm 及高 23 feet 更換燃料水淹蓋。下列何者將增加爐心的有效增殖因數？
A.從爐心移除一支不含控制棒的用過燃料組件
B.增加水溫至 105°F
C.一組新中子源安裝在爐心
D.移動爐外核儀位置以增加源階計數率

答案： B

科目/題號：192002/4)/215 (2016新增)
知能類：K1.14 [3.8/3.9]
序號：P2746

A reactor is shutdown with the reactor vessel head removed for refueling. The core is covered by 23 feet of refueling water at 105°F with a boron concentration of 2,200 ppm.
Which one of the following will increase core Keff?
A. A new neutron source is installed in the core.
B. Refueling water temperature is decreased to 100°F.
C. A spent fuel assembly is replaced with a new fuel assembly.
D. Excore nuclear instrumentation is repositioned to increase source range count rate.
ANSWER: C.

一反應器停機且爐蓋移除以更換燃料。爐心以溫度 105℉、硼酸濃度 2,200ppm 及高 23feet 更換燃料水淹蓋。
下列何者將增加爐心的有效增殖因數？
A.在爐心安裝一組新中子源
B.燃料更換冷卻水溫度下降至 100℉
C.用一支新燃料組件替換一支用過燃料組件
D.移動爐外核儀位置以增加源階計數率

答案： C

科目/題號：192002/6)/217 (2016新增)
知能類：K1.14 [3.8/3.9]
序號：P4224

A reactor is shutdown with the reactor vessel head removed for refueling. The core is covered by 23 feet of refueling water at 100°F with a boron concentration of 2,000 ppm.
Which one of the following will decrease core Keff?
A. An unrodded spent fuel assembly is removed from the core.
B. Refueling water temperature is increased to 105°F.
C. A depleted neutron source is removed from the core.
D. Refueling water boron concentration is decreased by 5 ppm.
ANSWER: A.

一反應器停機且爐蓋移除以更換燃料。爐心以溫度 100℉、硼酸濃度 2,000ppm 及高 23 feet 更換燃料水淹蓋。
下列何者將減少爐心的有效增殖因數？
A.從爐心移除一支不含控制棒的用過燃料組件
B.增加水溫至 105℉
C.從爐心移除一組耗乏中子源
D.燃料更換冷卻水之硼酸濃度減少 5ppm

答案： A

科目/題號：192002/7)/218 (2016新增)
知能類：K1.14 [3.8/3.9]
序號：P4924

Reactors A and B are identical except that reactor A is operating near the beginning of a fuel cycle (BOC) and reactor B is operating near the end of a fuel cycle (EOC). Both reactors are operating at 100 percent power with all control rods fully withdrawn.
If the total reactivity worth of the control rods is the same for both reactors, which reactor will have the smaller Keff five minutes after a reactor trip, and why?

A. Reactor A, because the power coefficient is less negative near the BOC.
B. Reactor A, because the concentration of U-235 in the fuel rods is higher near the BOC.
C. Reactor B, because the power coefficient is more negative near the EOC.
D. Reactor B, because the concentration of U-235 in the fuel rods is lower near the EOC.

ANSWER: A.

反應器 A 和 B 係相同，除了反應器 A 是運轉於接近燃料週期初期，而反應器 B 是運轉於接近燃料週期末期。兩座反應器均以 100%功率運轉且控制棒全部抽出。假設兩座反應器的控制棒總反應度本領均相同，何者反應器在反應器跳脫 5 分鐘後具有較小有效增殖因數及理由為何？

A.反應器 A，因為在燃料週期初期，功率係數負值較小
B.反應器 A，因為在燃料週期初期，燃料棒內鈾-235 濃度較高
C.反應器 B，因為在燃料週期末期，功率係數負值較大
D.反應器 B，因為在燃料週期末期，燃料棒內鈾-235 濃度較低

答案： A

科目/題號：192002/8)/219 (2016新增)
知能類：K1.14 [3.8/3.9]
序號：P5324

A reactor is shutdown with the reactor vessel head removed for refueling. The core is covered by 23 feet of refueling water at 105°F with a boron concentration of 2,000 ppm.
Which one of the following will decrease Keff?
A. Refueling water temperature decreases by 5°F.
B. A depleted neutron source is removed from the core.
C. A spent fuel assembly is replaced with a new fuel assembly.
D. Refueling water boron concentration decreases by 5 ppm.
ANSWER: A.

一反應器停機且爐蓋移除以更換燃料。爐心以溫度 105˚F、硼酸濃度 2,000ppm 及高 23feet 更換燃料水淹蓋。
下列何者將減少有效增殖因數？
A.降低燃料更換冷卻水溫度 5˚F
B.從爐心移除一組耗乏中子源
C.用一支新燃料組件替換一支用過燃料組件
D.燃料更換水硼酸濃度降低 5ppm

答案： A

科目/題號：192002/9)/220 (2016新增)
知能類：K1.14 [3.8/3.9]
序號：P6224

Reactors A and B are identical except that reactor A is operating near the beginning of a fuel cycle (BOC) and reactor B is operating near the end of a fuel cycle (EOC). Both reactors are operating at 100 percent power with all control rods fully withdrawn.
If the total reactivity worth of the control rods is the same for both reactors, which reactor will have the greater Keff five minutes after a reactor trip, and why?

A. Reactor A, because the pre-trip reactor coolant boron concentration is lower near the BOC.
B. Reactor A, because the power coefficient adds less positive reactivity after a trip near the BOC.
C. Reactor B, because the pre-trip reactor coolant boron concentration is higher near the EOC.
D. Reactor B, because the power coefficient adds more positive reactivity after a trip near the EOC.

ANSWER: D.

反應器 A 和 B 係相同，除了反應器 A 是運轉於接近燃料週期初期，而反應器 B 是運轉於接近燃料週期末期。兩座反應器均以 100%功率運轉且控制棒全部抽出。假設兩座反應器的控制棒總反應度本領均相同，何者在反應器跳脫 5 分鐘後具有較大有效增殖因數及其理由為何？

A.反應器 A，因為在接近燃料週期初期，反應器跳脫前反應器冷卻水硼酸濃度較小
B.反應器 A，因為在接近燃料週期初期，反應器跳脫後功率係數加入正反應度較少
C.反應器 B，因為在接近燃料週期末期，反應器跳脫前反應器冷卻水硼酸濃度較大
D.反應器 B，因為在接近燃料週期末期，反應器跳脫後功率係數加入正反應度較多

答案： D

科目/題號：192002/10)/221 (2016新增)
知能類：K1.14 [3.8/3.9]
序號：P6624

A nuclear power plant was initially operating at steady state 70 percent power near the middle of a fuel cycle when a control rod dropped into the core. Consider the following two possible operator responses:
Response 1: An operator adjusts the reactor coolant system (RCS) boron concentration to restore the initial reactor coolant temperatures.
Response 2: An operator withdraws some of the remaining control rods to restore the initial reactor coolant temperatures.
In a comparison between the two responses, which response, if any, will result in the greater shutdown margin (SDM) when the plant is stabilized at 70 percent power, and why?
A. Response 1, because a smaller (than response 2) amount of positive reactivity will be added by the RCS cooldown that occurs immediately after a reactor trip.
B. Response 2, because a larger (than response 1) amount of negative reactivity will be added by the control rods upon a reactor trip.
C. The SDM is the same for both responses because the plant is stabilized at the same initial steady state power level.
D. The SDM is the same for both responses because the same amount of positive reactivity is added in both responses.
ANSWER: B.

一座核能電廠初始運轉在接近燃料週期中期，功率穩定在 70%，此時一支控制棒掉落爐心時。考慮下列兩種運轉員可能的反應：
反應一：運轉員調整反應器冷卻水系統硼酸濃度，以回復至初始反應器冷卻水溫度。
反應二：運轉員將其他控制棒抽出，以回復至初始反應器冷卻水溫度。
當電廠穩定在 70%功率，比較此兩種反應，何者將會具有更大停機餘裕(SDM)，及其理由為何？
A.反應一，因為在反應器跳脫後，反應器冷卻水系統立即發生冷卻，反應一將較反應二加入較少量之正反應度
B.反應二，因為在反應器跳脫後，控制棒在反應二將較反應一加入更多量之負反應度
C.兩種反應的停機餘裕均相同，因為電廠穩定在相同初始功率運轉
D.兩種反應的停機餘裕均相同，因為兩種反應所加入的正反應度相同

答案： B

科目/題號：192002/11)/222 (2016新增)
知能類：K1.14 [3.8/3.9]
序號：P7124

A reactor is shutdown with the reactor vessel head removed for refueling. The core is covered by 23 feet of refueling water at 120°F with a boron concentration of 2,000 ppm. Source range instrumentation indicates 100 cps.
How will source range indication be affected if refueling water temperature decreases to 100°F?

A. Indication will increase because the effect of increased Keff more than offsets the effect of decreased neutron leakage from the core.
B. Indication will increase because of the cooperative effects of increased neutron leakage from the core and increased Keff.
C. Indication will decrease because the effect of decreased neutron leakage from the core more than offsets the effect of increased Keff.
D. Indication will decrease because of the cooperative effects of decreased Keff and decreased neutron leakage from the core.

ANSWER: D.

反應器停機且爐蓋移除以更換燃料。爐心以溫度 120˚F、硼酸濃度 2,000ppm 及高 23feet 更換燃料水淹蓋。源階核儀指示為 100 cps。假如更換燃料水溫度降低至 100˚F，則源階指示將受何種影響？

A.指示將會增加，因為有效增殖因數增加之效應超過從爐心中子洩漏減少的影響。
B.指示將會增加，因為中子從爐心洩漏的增加和有效增殖因數增加之共同影響。
C.指示將會減少，因為中子從爐心洩漏減少之效應超過有效增殖因數增加的影響。
D.指示將會減少，因為有效增殖因數的減少和中子從爐心洩漏減少之共同影響。

答案： D

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A nuclear power plant was initially operating at equilibrium 100 percent power just prior to a refueling outage. The plant was shut down, refueled, restarted, and is currently operating at equilibrium 100 percent power. Assume the 100 percent power fission rate did not change.
Which one of the following describes the current plant status as compared to the conditions just prior to the refueling?
A. The reactor shutdown margin is greater.
B. The reactor coolant boron concentration is smaller.
C. The equilibrium core Xe-135 concentration is smaller.
D. The difference between the reactor coolant hot leg and cold leg temperatures is greater.
ANSWER: A.

核能電廠在更換燃料停機前以 100%平衡功率運轉。電廠經歷停機、更換燃料大修、再啟動，目前運轉在 100%平衡功率。假設 100%功率的分裂率不變。
下列何者敘述係目前電廠與更換燃料前狀況的比較？
A.反應器停機餘裕較大
B.反應器冷卻水硼酸濃度較低
C.爐心氙-135 毒平衡濃度較低
D.反應器冷卻水熱端和冷端溫度差較大

答案： A