

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B45

The term “neutron generation time” is defined as the average time between...

- A. neutron absorption and the resulting fission.
- B. the production of a delayed neutron and subsequent neutron thermalization.
- C. neutron absorption producing a fission and absorption or leakage of resultant neutrons.
- D. neutron thermalization and subsequent neutron absorption.

ANSWER: C.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B174

Which one of the following is the definition of the term, prompt neutron?

- A. A high-energy neutron emitted from a neutron precursor, immediately after the fission process.
- B. A neutron with an energy level greater than 0.1 MeV, emitted in less than 1.0×10^{-4} seconds following a nuclear fission.
- C. A neutron emitted in less than 1.0×10^{-14} seconds following a nuclear fission.
- D. A neutron emitted as a result of a gamma-neutron or alpha-neutron reaction.

ANSWER: C.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B245

Delayed neutrons are neutrons that...

- A. have reached thermal equilibrium with the surrounding medium.
- B. are expelled within 1.0×10^{-14} seconds of the fission event.
- C. are expelled with the lowest average kinetic energy of all fission neutrons.
- D. are responsible for the majority of U-235 fissions.

ANSWER: C.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B1146 (P1945)

Which one of the following types of neutrons has an average neutron generation lifetime of 12.5 seconds?

- A. Prompt
- B. Delayed
- C. Fast
- D. Thermal

ANSWER: B.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B1345 (P1445)

A neutron that is expelled 1.0×10^{-2} seconds after the associated fission event is a _____ neutron.

- A. thermal
- B. delayed
- C. prompt
- D. capture

ANSWER: B.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B1545 (P1145)

Which one of the following is a characteristic of a prompt neutron?

- A. Expelled with an average kinetic energy of 0.5 MeV.
- B. Usually emitted by the excited nucleus of a fission product.
- C. Accounts for more than 99 percent of fission neutrons.
- D. Released an average of 13 seconds after the fission event.

ANSWER: C.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B1845 (P545)

Delayed neutrons are fission neutrons that...

- A. are released at the instant of fission.
- B. are responsible for the majority of U-235 fissions.
- C. have reached thermal equilibrium with the surrounding medium.
- D. are expelled at a lower average kinetic energy than most other fission neutrons.

ANSWER: D.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B1945 (P845)

Delayed neutrons are neutrons that...

- A. are responsible for the majority of U-235 fissions.
- B. are expelled within 1.0×10^{-14} seconds of the fission event.
- C. have reached thermal equilibrium with the surrounding medium.
- D. are produced from the radioactive decay of certain fission fragments.

ANSWER: D.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B2046 (P2045)

In a comparison between a delayed neutron and a prompt neutron produced from the same fission event, the prompt neutron is more likely to... (Assume that both neutrons remain in the core.)

- A. require a greater number of collisions to become a thermal neutron.
- B. be captured by U-238 at a resonance energy peak between 1 eV and 1000 eV.
- C. be expelled with a lower kinetic energy.
- D. cause thermal fission of a U-235 nucleus.

ANSWER: A.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B2145 (P2145)

In a comparison between a delayed neutron and a prompt neutron produced from the same fission event, the prompt neutron is more likely to... (Assume that both neutrons remain in the core.)

- A. cause fast fission of a U-238 nucleus.
- B. be captured by a U-238 nucleus at a resonance energy between 1 eV and 1000 eV.
- C. be captured by a Xe-135 nucleus.
- D. cause thermal fission of a U-235 nucleus.

ANSWER: A.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B2245 (P5023)

In a comparison between a delayed neutron and a prompt neutron produced from the same fission event, the delayed neutron is more likely to... (Assume that each neutron remains in the core unless otherwise stated.)

- A. cause fission of a U-238 nucleus.
- B. travel to an adjacent fuel assembly.
- C. be absorbed in a B-10 nucleus.
- D. leak out of the core.

ANSWER: C.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B2345 (P2345)

A neutron that is released 1.0×10^{-10} seconds after the associated fission event is classified as a _____ fission neutron.

- A. delayed
- B. prompt
- C. thermal
- D. spontaneous

ANSWER: A.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B2545 (P2545)

In a comparison between a delayed neutron and a prompt neutron produced from the same fission event, the prompt neutron is more likely to...

- A. be captured by a Xe-135 nucleus.
- B. cause thermal fission of a U-235 nucleus.
- C. leak out of the core while slowing down.
- D. be captured by a U-238 nucleus at a resonance energy.

ANSWER: C.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B2645 (P2645)

In a comparison between a delayed neutron and a prompt neutron produced from the same fission event, the delayed neutron is more likely to...

- A. leak out of the core.
- B. cause fission of a U-238 nucleus.
- C. become a thermal neutron.
- D. cause fission of a Pu-240 nucleus.

ANSWER: C.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B2945 (P2945)

Which one of the following types of neutrons in a reactor is more likely to cause fission of a U-238 nucleus in the reactor fuel? (Assume that each type of neutron remains in the reactor until it interacts with a U-238 nucleus.)

- A. A thermal neutron.
- B. A prompt fission neutron beginning to slow down.
- C. A delayed fission neutron beginning to slow down.
- D. A fission neutron at a U-238 resonance energy.

ANSWER: B.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B3145 (P2845)

During a brief time interval in a typical reactor operating steady-state near the beginning of a fuel cycle, 1.0×10^3 delayed neutrons were emitted.

Approximately how many prompt neutrons were emitted during this same time interval?

- A. 1.5×10^5
- B. 6.5×10^6
- C. 1.5×10^7
- D. 6.5×10^8

ANSWER: A.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B3345 (P2445)

In a comparison between a prompt neutron and a delayed neutron produced from the same fission event, the delayed neutron requires _____ collisions in the moderator to become thermal; and is _____ likely to cause fission of a U-238 nucleus. (Assume that both neutrons remain in the core.)

- A. more; more
- B. more; less
- C. fewer; more
- D. fewer; less

ANSWER: D.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B3545 (P3545)

During a brief time interval in a typical reactor operating steady-state at the beginning of a fuel cycle, 1.0×10^5 delayed neutrons were emitted.

Approximately how many prompt neutrons were emitted in the reactor during this same time interval?

- A. 1.5×10^5
- B. 6.5×10^6
- C. 1.5×10^7
- D. 6.5×10^8

ANSWER: C.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B4123 (P4123)

A neutron that appears 1.0×10^{-16} seconds after the associated fission event is classified as a _____ fission neutron.

- A. delayed
- B. prompt
- C. thermal
- D. spontaneous

ANSWER: B.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B4923 (P4923)

During a brief time interval in a typical reactor operating steady-state near the beginning of a fuel cycle, 4.25×10^5 delayed neutrons were produced.

Approximately how many prompt neutrons were produced in the reactor during this same time interval?

- A. 1.5×10^6
- B. 6.5×10^6
- C. 1.5×10^7
- D. 6.5×10^7

ANSWER: D.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B7123 (P7123)

Which one of the following is the process that produces the majority of delayed neutrons in an operating nuclear power plant reactor?

- A. A thermal neutron is absorbed by a fuel nucleus. After a period of time, the nucleus fissions and releases a delayed neutron.
- B. A thermal neutron is absorbed by a fuel nucleus. The fuel nucleus fissions. During the decay process of the fission products, a delayed neutron is emitted.
- C. A fast neutron is absorbed by a fuel nucleus. After a period of time, the nucleus fissions and releases a delayed neutron.
- D. A fast neutron is absorbed by a fuel nucleus. The fuel nucleus fissions. During the decay process of the fission products, a delayed neutron is emitted.

ANSWER: B.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B7523 (P7523)

During a brief time interval in a typical reactor operating steady-state near the beginning of a fuel cycle, 4.25×10^{10} prompt neutrons were produced.

Approximately how many delayed neutrons were produced in the reactor during this same time interval?

- A. 2.8×10^8
- B. 6.5×10^8
- C. 2.8×10^9
- D. 6.5×10^9

ANSWER: A.

TOPIC: 292001
KNOWLEDGE: K1.02 [3.0/3.1]
QID: B7677 (P7677)

Which one of the following is the process that produces the majority of prompt neutrons in an operating nuclear power plant reactor?

- A. A thermal neutron is absorbed by a fuel nucleus. Almost immediately, the nucleus fissions and emits one or more prompt neutrons.
- B. A thermal neutron is absorbed by a fuel nucleus. Almost immediately, the fuel nucleus fissions and produces fission products. During the decay of the fission products, one or more prompt neutrons are emitted.
- C. A fast neutron is absorbed by a fuel nucleus. Almost immediately, the nucleus fissions and emits one or more prompt neutrons.
- D. A fast neutron is absorbed by a fuel nucleus. Almost immediately, the fuel nucleus fissions and produces fission products. During the decay of the fission products, one or more prompt neutrons are emitted.

ANSWER: A.

TOPIC: 292001
KNOWLEDGE: K1.03 [2.7/2.7]
QID: B345

A neutron that possesses the same kinetic energy as its surroundings is called a/an _____ neutron.

- A. slow
- B. intermediate
- C. resonance
- D. thermal

ANSWER: D.

TOPIC: 292001
KNOWLEDGE: K1.03 [2.7/2.7]
QID: B545

A neutron is 'thermal' when...

- A. its kinetic energy is in the 1 eV to 1,000 eV energy range.
- B. it is in energy equilibrium with the moderating medium.
- C. it is released from the fission of a U-235 atom.
- D. its cross-section for absorption in the fuel undergoes a sudden decrease.

ANSWER: B.

TOPIC: 292001
KNOWLEDGE: K1.03 [2.7/2.7]
QID: B645

The kinetic energy of thermal neutrons in a reactor operating at full power is...

- A. less than 0.1 eV.
- B. between 1 and 10 eV.
- C. between 100 and 1,000 eV.
- D. greater than 1 MeV.

ANSWER: A.

TOPIC: 292001
KNOWLEDGE: K1.03 [2.7/2.7]
QID: B846

Which one of the following describes the energy level of a thermal neutron in a reactor operating at full power?

- A. The kinetic energy of the neutron has decreased until it is in equilibrium with its surroundings.
- B. The potential energy of the neutron has decreased to nearly zero as the neutron approaches equilibrium with its surroundings.
- C. The kinetic energy of the neutron has decreased sufficiently to allow the neutron to be resonantly absorbed by U-238.
- D. The potential energy of the neutron has decreased to a level that will allow the neutron to be absorbed by U-235.

ANSWER: A.

TOPIC: 292001
KNOWLEDGE: K1.03 [2.7/2.7]
QID: B945

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

- A. was expelled greater than 10^{-14} seconds after the fission event.
- B. is a product of a thermal fission reaction.
- C. was released by the decay of fission fragments.
- D. is at the same energy level as the surrounding atoms.

ANSWER: D.

TOPIC: 292001
KNOWLEDGE: K1.03 [2.7/2.7]
QID: B2446

A thermal neutron exists at an energy _____ the epithermal range; and its cross section for absorption in U-235 _____ as the neutron energy decreases.

- A. above; decreases
- B. above; increases
- C. below; decreases
- D. below; increases

ANSWER: D.

TOPIC: 292001
KNOWLEDGE: K1.04 [3.2/3.2]
QID: B246

A fission neutron will typically lose the most energy when it interacts with a/an...

- A. hydrogen atom in a water molecule.
- B. oxygen atom in a water molecule.
- C. helium atom in the fuel pin fill gas.
- D. zirconium atom in the fuel clad.

ANSWER: A.

TOPIC: 292001
KNOWLEDGE: K1.04 [3.2/3.2]
QID: B445

Which one of the following conditions will increase the amount of neutron moderation in a reactor operating at 50 percent power?

- A. Increasing moderator temperature
- B. Reducing feedwater inlet temperature
- C. Reducing reactor vessel pressure
- D. Reducing reactor recirculation system flow rate

ANSWER: B.

TOPIC: 292001
KNOWLEDGE: K1.04 [3.2/3.2]
QID: B446

Neutron moderation refers to a decrease in neutron _____; primarily due to _____.

- A. population; neutron absorption by the control rods
- B. population; neutron leakage at the core boundary
- C. energy; scattering reactions in the fuel pellets
- D. energy; scattering reactions in the reactor coolant

ANSWER: D.

TOPIC: 292001
KNOWLEDGE: K1.04 [3.2/3.2]
QID: B745

During moderation of a fission neutron, the neutron is most susceptible to resonance absorption when it is a/an _____ neutron.

- A. slow
- B. fast
- C. epithermal
- D. thermal

ANSWER: C.

TOPIC: 292001
KNOWLEDGE: K1.04 [3.2/3.2]
QID: B1646

Which one of the following will decrease the ability of the coolant to moderate neutrons in a reactor operating at saturated conditions?

- A. Decreasing coolant temperature.
- B. Decreasing feedwater inlet temperature.
- C. Decreasing reactor vessel pressure.
- D. Increasing reactor recirculation system flow rate.

ANSWER: C.

TOPIC: 292001
KNOWLEDGE: K1.04 [3.2/3.2]
QID: B2746

A fast neutron will lose the greatest amount of energy during a scattering reaction in the moderator if it interacts with...

- A. an oxygen nucleus.
- B. a hydrogen nucleus.
- C. a deuterium nucleus.
- D. an electron orbiting a nucleus.

ANSWER: B.

TOPIC: 292001
KNOWLEDGE: K1.04 [3.2/3.2]
QID: B6623

Which one of the following accounts for the majority of energy transfer from a fission neutron while slowing down in a moderator?

- A. Collisions with the nuclei in the moderator.
- B. Collisions with the electrons in the moderator.
- C. Interactions with the electric fields of the nuclei in the moderator.
- D. Interactions with the electric fields of the electrons in the moderator.

ANSWER: A.

TOPIC: 292001
KNOWLEDGE: K1.04 [3.2/3.2]
QID: B7767 (P7767)

Which one of the following nuclei will cause the greater loss of kinetic energy from a 2.1 MeV fission neutron during a head-on collision? (Assume that each nucleus is stationary just prior to the collision and the neutron is elastically scattered in all cases.)

- A. A helium-4 nucleus in the fuel rod fill gas.
- B. An oxygen-16 nucleus in the reactor coolant.
- C. A zirconium-90 nucleus in the fuel cladding.
- D. A uranium-235 nucleus in a fuel pellet.

ANSWER: A.

TOPIC: 292001
KNOWLEDGE: K1.05 [2.4/2.6]
QID: B346

The best neutron moderator is _____ and is composed of _____ atoms.

- A. dense; large
- B. not dense; large
- C. dense; small
- D. not dense; small

ANSWER: C.

TOPIC: 292001
KNOWLEDGE: K1.05 [2.4/2.6]
QID: B1046

The ideal moderator has a _____ macroscopic absorption cross section for thermal neutrons and a _____ average logarithmic energy decrement.

- A. large; small
- B. large; large
- C. small; small
- D. small; large

ANSWER: D.

TOPIC: 292001
KNOWLEDGE: K1.05 [2.4/2.6]
QID: B5323

The ideal neutron moderator has a _____ microscopic scattering cross section for thermal neutrons and a _____ density.

- A. small; low
- B. small; high
- C. large; low
- D. large; high

ANSWER: D.