

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 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 10^{-4} seconds following a nuclear fission.
- C. A neutron emitted in less than 10^{-14} seconds following a nuclear fission.
- D. A neutron emitted as a result of a gamma-n or alpha-n 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 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% 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

Delayed neutrons are fission neutrons that...

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

ANSWER: C.

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

Delayed neutrons are fission neutrons that...

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

ANSWER: C.

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...

- 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...

- 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 between 1 eV and 1000 eV.

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 nuclear 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 core until it interacts with a U-238 nucleus.)

- A. Thermal neutron
- B. Prompt fission neutron beginning to slow down
- C. Delayed fission neutron beginning to slow down
- D. 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 commercial nuclear reactor operating at 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)

As compared to a prompt neutron, a delayed neutron, produced from the same fission event, requires _____ collisions in the moderator to become thermal and is _____ likely to cause fission of a U-238 nucleus. (Neglect the effects of neutron leakage.)

- 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 commercial nuclear reactor operating 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 commercial nuclear reactor operating at the beginning of a fuel cycle, 4.25×10^5 delayed neutrons were emitted.

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

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

ANSWER: D.

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

Which one of the following ranges contains the energy level of thermal neutrons in a nuclear reactor operating at full power?

- A. less than 0.1 eV
- B. 1 to 10 eV
- C. 100 to 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 nuclear 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 nuclear reactor operating at 50% 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 describes...

- A. a decrease in the core neutron population from thermal neutron absorption.
- B. an increase in the neutron multiplication factor due to a reduction in neutron poisons.
- C. the loss of fission neutrons from the core by leakage.
- D. the reduction of neutron energy due to scattering reactions.

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: B1245

Which one of the following will increase the average distance traveled by a fission neutron to become thermal in an operating nuclear reactor? (Assume the neutron continues to migrate inside the reactor until it becomes a thermal neutron.)

- A. Moderator temperature decreases
- B. Average neutron energy decreases
- C. Reactor coolant system pressure increases
- D. Reactor coolant void percentage increases

ANSWER: D.

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 nuclear reactor operating at saturated conditions?

- A. Decreasing moderator 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 surrounding a nucleus.

ANSWER: B.

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.