Characteristics and types of fast reactors

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1 Quiz

1.1 Questions

1. Which one of the following is responsible for eliminating the use of heavy water as coolant in fast reactors? Justify your answer

(a) Low thermal conductivity (b) low boiling point
(c) high moderation capability (d) cost

2. Which one of the following materials is ideal for use as fuel in fast reactors? Justify

(a) U-235 (b) Pu-239 (c) U-233 (d) Th-232

3. Which one of the following facilitates the operation of fast breeder reactors at lower pressures than that of thermal reactors?

(a) use of high boiling point sodium as coolant
(b) use of Pu-239 as the main fuel
(c) higher thermal conductivity of liquid sodium
(d) none of the above

4. For the same reactor thermal power output, higher levels of enrichment are required for a fast reactor compared to a thermal reactor. Say true of false. Justify

5. Which of the following are advantages of pool-type fast reactors over loop-type reactors?

(a) High thermal inertia (b) confinement of radioactivity within single vessel
(c) use of sodium as coolant (d) use of primary and secondary sodium circuit

6. Which one of the following represents the nature of sodium-water reaction?

(a) endothermic (b) exothermic (c) no appreciable heat changes
(d) none of the above

1.2 Answers

1. (c) high moderation capability.

Justification: Use of heavy water as coolant will result in slowing down of neutrons due to elastic scattering of neutrons with heavy water. Hence for operation of a

reactor in fast neutron spectrum, materials with high moderating capability must not be used in the core.

2. (b) Pu-239

Justification: Among the four isotopes, Th-232 is not a fissile isotope. Comparing U-235 and Pu-239, the ratio of fission cross section to absorption cross section (s_f/s_a) is greater for Pu-239 than that of U-235 in fast spectrum.

3. (a) use of high boiling point sodium as coolant

4. True

Justification: The fission cross section of fissile material (Pu-239) in fast spectrum is very low (1.85 b) compared to fission cross section of fissile material (U-235) in thermal spectrum (586 b). Since the thermal Hence higher levels of enrichment

5. (a) High thermal inertia (b) confinement of radioactivity within single vessel

6. (b) exothermic