

Chapter 1

- Given the atomic mass of uranium (^{238}U) is 238.0289 u and that it has a nuclear radius of $7.5 \times 10^{-15} \text{ m}$, calculate the density of the nucleus of ^{238}U . Hence, estimate the mass of a fuel pellet of diameter 10 mm and height 8 mm if it were possible for it to be comprised entirely of uranium with the composition of its nucleus.

Answer

Assuming the ^{238}U nucleus is spherical, the volume V is:

$$V = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi (7.5 \times 10^{-15})^3 \sim 1.8 \times 10^{-42} \text{ m}^3$$

The mass m_U of 1 atom of ^{238}U is:

$$m_U = 238.0289 \times 1.66 \times 10^{-27} = 4.0 \times 10^{-25} \text{ kg}$$

Hence, the density ρ is as follows:

$$\rho = \frac{4.0 \times 10^{-25}}{1.8 \times 10^{-42}} = 2.2 \times 10^{17} \text{ kg m}^{-3}$$

Thus the mass of the pellet would be:

$$m = 2.2 \times 10^{17} \times \pi (5 \times 10^{-3})^2 \times 8 \times 10^{-3} = 1.4 \times 10^{11} \text{ kg}$$

- Caesium-137 decays via β decay to an excited state of barium-137 which decays subsequently via the emission of a single γ ray having an energy of 662 keV. Convert this energy to joules. How many ^{137}Cs γ rays would need to be absorbed by 1 kg of water to raise its temperature by 1 °C if its specific heat capacity is $4.2 \text{ kJ kg}^{-1} \text{ °C}^{-1}$?

Answer

$$1 \text{ keV} = 1.6 \times 10^{-16} \text{ J}$$

$$E_\gamma = 662 \times 1.6 \times 10^{-16}$$

$$= 1.06 \times 10^{-13} \text{ J}$$

$$E = mc\Delta T$$

$$= 1 \times 4200 \times 1$$

$$= 4200 \text{ J}$$

$$N_\gamma = \frac{4200}{1.06 \times 10^{-13}} = 4.0 \times 10^{16} \text{ } \gamma \text{ rays}$$

Solution Manual For Nuclear Reactor

Tobias Bleicker



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Modelling and Solution Techniques for Multiphase Flow Alan Victor Jones, 1987 Materials presented at the Inspira Courses Seminar held in Inspira Italy Nov 1985 provide general principles and applications for the appreciation of the similarities and differences in the approaches taken An explanation of the physical nature of the particular multiphase flow application is followed by a presentation of the model adopted emphasizing its distinguishing features The technique employed for the numerical solution is discussed usually supported by numerical results No index Book club price 117 Annotation copyrighted by Book News Inc Portland OR **U.S. Government Research & Development Reports**, 1967

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Table of Contents Solution Manual For Nuclear Reactor

1. Understanding the eBook Solution Manual For Nuclear Reactor
 - The Rise of Digital Reading Solution Manual For Nuclear Reactor
 - Advantages of eBooks Over Traditional Books
2. Identifying Solution Manual For Nuclear Reactor
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Solution Manual For Nuclear Reactor
 - User-Friendly Interface

4. Exploring eBook Recommendations from Solution Manual For Nuclear Reactor
 - Personalized Recommendations
 - Solution Manual For Nuclear Reactor User Reviews and Ratings
 - Solution Manual For Nuclear Reactor and Bestseller Lists
5. Accessing Solution Manual For Nuclear Reactor Free and Paid eBooks
 - Solution Manual For Nuclear Reactor Public Domain eBooks
 - Solution Manual For Nuclear Reactor eBook Subscription Services
 - Solution Manual For Nuclear Reactor Budget-Friendly Options
6. Navigating Solution Manual For Nuclear Reactor eBook Formats
 - ePub, PDF, MOBI, and More
 - Solution Manual For Nuclear Reactor Compatibility with Devices
 - Solution Manual For Nuclear Reactor Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Solution Manual For Nuclear Reactor
 - Highlighting and Note-Taking Solution Manual For Nuclear Reactor
 - Interactive Elements Solution Manual For Nuclear Reactor
8. Staying Engaged with Solution Manual For Nuclear Reactor
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Solution Manual For Nuclear Reactor
9. Balancing eBooks and Physical Books Solution Manual For Nuclear Reactor
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Solution Manual For Nuclear Reactor
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Solution Manual For Nuclear Reactor
 - Setting Reading Goals Solution Manual For Nuclear Reactor
 - Carving Out Dedicated Reading Time

12. Sourcing Reliable Information of Solution Manual For Nuclear Reactor
 - Fact-Checking eBook Content of Solution Manual For Nuclear Reactor
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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