

THE UNIVERSITY OF SHEFFIELD

DEPARTMENT OF PHYSICS AND ASTRONOMY

Autumn Semester 2010 – 2011

2 hours

NUCLEAR PHYSICS

*Answer question ONE (COMPULSORY) and two other questions.**A formula sheet and table of physical constants is attached to this paper.**All questions are marked out of ten. The breakdown on the right-hand side of the paper is meant as a guide to the marks that can be obtained from each part.*

[2]

(b) $N_{197} = d/A = 1000dN_A/197\text{kg} = 1.22 \times 10^{22} \text{ atoms/m}^2$
 each neutron that travels through the foil has a probability of collision equal to the product of the number of atoms and the cross section:

$$P = N_{197} \times 7.8 \times 10^{-24} = 0.095$$

This is equivalent to the attenuation of the beam.

(c)

$$(1 - 0.095) \times \text{intensity} = 10^{10} \text{ so intensity} = 10^{10}/(1-0.095) = 1.105 \times 10^{10}$$

(d)

$$\frac{dN_{198}}{dt} = R - \lambda N_{198}$$

(e)

$$-B\lambda e^{-\lambda t} = R - \lambda(A + Be^{-\lambda t}) \text{ giving } A = R/\lambda \text{ and } B = -R/\lambda$$

so

$$N_{198}(t) = \frac{R}{\lambda} (1 - e^{-\lambda t})$$

substituting for R and λ gives $N_{198} = 2.64 \times 10^{15}$

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David Halliday



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An Introduction to Nuclear Physics Norman Feather, N. Feather, 1936 **An Introduction to Nuclear Physics** W. N. Cottingham, D. A. Greenwood, 1992 *Nuclear Physics 1* Ibrahima Sakho, 2021-12-29 This book presents the foundations of nuclear physics covering several themes that range from subatomic particles to stars Also described in this book are experimental facts relating to the discovery of the electron positron proton neutron and neutrino The general properties of nuclei and the various nuclear de excitation processes based on the nucleon layer model are studied in greater depth This book addresses the conservation laws of angular momentum and parity the multipolar transition probabilities E and M gamma de excitation internal conversion and nucleon emission de excitation processes The fundamental properties of and disintegrations electron capture radioactive filiations and Bateman equations are also examined Nuclear Physics 1 is intended for high school physics teachers students research teachers and science historians specializing in nuclear physics

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Enge,1970 *Introduction to Nuclear Physics* Harald A. Enge,1972 *Nuclear and Particle Physics* C. Amsler,2015 This book provides an introductory course on Nuclear and Particle physics for undergraduate and early graduate students which the author has taught for several years at the University of Zurich It contains fundamentals on both nuclear physics and particle physics Emphasis is given to the discovery and history of developments in the field and is experimentally phenomenologically oriented It contains detailed derivations of formulae such as 2 3 body phase space the Weinberg Salam model and neutrino scattering Originally published in German as Kern und Teilchenphysik several sections have been added to this new English version to cover very modern topics including updates on neutrinos the Higgs boson the top quark and bottom quark physics **Nuclear Physics** Enrico Fermi,1956 **Introductory Nuclear Physics** David Halliday,1959

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