

Chemistry: Atoms First 2e
20: Nuclear Chemistry
20.2: Nuclear Equations

11. Write a brief description or definition of each of the following:

- (a) nucleon
- (b) α particle
- (c) β particle
- (d) positron
- (e) γ ray
- (f) nuclide
- (g) mass number
- (h) atomic number

Solution

(a) A nucleon is any particle contained in the nucleus of the atom, so it can refer to protons and neutrons. (b) An α particle is one product of natural radioactivity and is the nucleus of a helium atom. (c) A β particle is a product of natural radioactivity and is a high-speed electron. (d) A positron is a particle with the same mass as an electron but with a positive charge. (e) Gamma rays compose electromagnetic radiation of high energy and short wavelength. (f) Nuclide is a term used when referring to a single type of nucleus. (g) The mass number is the sum of the number of protons and the number of neutrons in an element. (h) The atomic number is the number of protons in the nucleus of an element.

13. Complete each of the following equations by adding the missing species:

- (a) ${}_{13}^{27}\text{Al} + {}_2^4\text{He} \longrightarrow ? + {}_0^1\text{n}$
- (b) ${}_{94}^{240}\text{Pu} + ? \longrightarrow {}_{96}^{262}\text{Cm} + {}_0^1\text{n}$
- (c) ${}_{92}^{235}\text{U} \longrightarrow ? + {}_{55}^{135}\text{Cs} + 4{}_0^1\text{n}$
- (d) ${}_{92}^{235}\text{U} \longrightarrow ? + {}_{55}^{135}\text{Cs} + 4{}_0^1\text{n}$

Solution

- (a) ${}_{13}^{27}\text{Al} + {}_2^4\text{He} \longrightarrow {}_{15}^{31}\text{P} + {}_0^1\text{n}$; (b) ${}_{94}^{240}\text{Pu} + {}_0^1\text{n} \longrightarrow {}_{96}^{262}\text{Cm} + {}_0^1\text{n}$; (c) ${}_{92}^{235}\text{U} + {}_2^4\text{He} \longrightarrow {}_{94}^{239}\text{Pu} + {}_0^1\text{n}$; (d) ${}_{92}^{235}\text{U} \longrightarrow {}_{55}^{135}\text{Cs} + {}_{37}^{98}\text{Rb} + 4{}_0^1\text{n}$

15. Write a balanced nuclear equation for each of the following nuclear reactions:

- (a) the production of ${}^{17}\text{O}$ from ${}^{14}\text{N}$ by α particle bombardment
- (b) the production of ${}^{14}\text{C}$ from ${}^{14}\text{N}$ by neutron bombardment
- (c) the production of ${}^{230}\text{Th}$ from ${}^{232}\text{Th}$ by neutron bombardment
- (d) the production of ${}^{239}\text{U}$ from ${}^{238}\text{U}$ by ${}^3_1\text{H}$ bombardment

Solution

- (a) ${}^{14}_7\text{N} + {}^4_2\text{He} \longrightarrow {}^{17}_8\text{O} + {}^1_1\text{H}$; (b) ${}^{14}_7\text{N} + {}^1_0\text{n} \longrightarrow {}^{14}_6\text{C} + {}^1_1\text{H}$; (c) ${}^{232}_{90}\text{Th} + {}^1_0\text{n} \longrightarrow {}^{233}_{90}\text{Th}$; (d) ${}^{238}_{92}\text{U} + {}^3_1\text{H} \longrightarrow {}^{239}_{93}\text{Np} + {}^0_{-1}\text{e}$

17. The mass of the atom ${}^{19}\text{F}$ is 18.99840 amu.

- (a) Calculate its binding energy per atom in millions of electron volts.
- (b) Calculate its binding energy per nucleon.

Solution

Ssm Intro Chemistry 2e

Sebastian Brünink



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Comprehensive Inorganic Chemistry II, 2013-07-23 Comprehensive Inorganic Chemistry II Nine Volume Set reviews and examines topics of relevance to today's inorganic chemists. Covering more interdisciplinary and high impact areas, Comprehensive Inorganic Chemistry II includes biological inorganic chemistry, solid state chemistry, materials chemistry, and nanoscience. The work is designed to follow on with a different viewpoint and format from our 1973 work, Comprehensive Inorganic Chemistry, edited by Bailar, Emel'us, Nyholm, and Trotman-Dickenson, which has received over 2 000 citations. The new work will also complement other recent Elsevier works in this area: Comprehensive Coordination Chemistry and Comprehensive Organometallic Chemistry, to form a trio of works covering the whole of modern inorganic chemistry. Chapters are designed to provide a valuable long standing scientific resource for both advanced students new to an area and researchers who need further background or answers to a particular problem on the elements, their compounds, or applications. Chapters are written by teams of leading experts under the guidance of the Volume Editors and the Editors in Chief. The articles are written at a level that allows undergraduate students to understand the material while providing active researchers with a ready reference resource for information in the field. The chapters will not provide basic data on the elements, which is available from many sources and the original work, but instead concentrate on applications of the elements and their compounds. Provides a comprehensive review which serves to put many advances in perspective and allows the reader to make connections to related fields such as biological inorganic chemistry, materials chemistry, solid state chemistry, and nanoscience. Inorganic chemistry is rapidly developing, which brings about the need for a reference resource such as this that summarises recent developments and simultaneously provide background information. Forms the new definitive source for researchers interested in elements and their applications, completely replacing the highly cited first edition which published in 1973.

Modern Nuclear Chemistry, Walter D. Loveland, David J. Morrissey, Glenn T. Seaborg, 2017-04-05. Written by established experts in the field, this book features in depth discussions of proven scientific principles, current trends, and applications of nuclear chemistry to the sciences and engineering. Provides up to date coverage of the latest research and examines the theoretical and practical aspects of nuclear and radiochemistry. Presents the basic physical principles of nuclear and radiochemistry in a succinct fashion, requiring no basic knowledge of quantum mechanics. Adds discussion of math tools and simulations to demonstrate various phenomena. New chapters on Nuclear Medicine, Nuclear Forensics, and Particle Physics, and updates to all other chapters. Includes additional in chapter sample problems with solutions to help students. Reviews of 1st edition: an authoritative, comprehensive but succinct state of the art textbook. The Chemical Educator and an excellent resource for libraries and laboratories supporting programs requiring familiarity with nuclear processes. CHOICE.

Nuclear and Radiochemistry, Jens-Volker Kratz, 2022-01-04. Nuclear and Radiochemistry. The leading resource for anyone looking for an accessible and authoritative introduction to nuclear and radiochemistry. In the

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Integrated Waste Biorefineries: Achieving Sustainable Development Goals, 2nd edition Mohammad

Rehan, Muhammad Amjad, Ala'A Al-Muhtaseb, Muhammad Abdul Qyum, Konstantinos Moustakas, Su Shiung Lam, Abdul-Sattar Nizami, Meisam Tabatabaei, Imtiaz Ali, Arshid Mahmood Ali, Muhammad Farooq, 2024-01-11 The United Nations Sustainable Development Goals SDGs are designed to revolutionize societies to prepare for the future challenges However the practical implementation of such goals in many domains is are yet to be achieved despite of unique essence Sustainable energy production aligned with SDG 7 clean water and sanitation aligned with SDG 6 sustainable waste services aligned with SDG 11 and mitigating climate change impacts aligned with SDG 13 have been the prime focus of SDGs Moreover much attention is being paid to research and development activities on waste prevention reduction recycling and reuse to achieve responsible consumption and production aligned with SDG 12 Waste biorefineries have emerged as a sustainable environmental management solution to achieve not only the aforementioned SDGs but also to accomplish no poverty aligned with SDG 1 and zero hunger aligned with SDG 2 and to maintain well being and good health aligned with SDG 3 and decent work and economic growth aligned with SDG 8 worldwide This is true because integrated waste biorefineries can efficiently and sustainably produce fuels heat energy power and multiple value added products and chemicals It can further facilitate the transition from linear to circular economies and mitigate the major challenges faced including environmental pollution climate change and adverse effects on public health This Research Topic will focus on different types of waste biorefineries current status practical implications optimization of waste to energy technologies detailed life assessment studies and future opportunities with a vision to achieve SDGs in the areas of sustainable energy generation waste management circular economies and climate change mitigation The editorial team of this special issue consisting of world renowned scientists including Highly Cited Researchers welcomes submissions of original research articles review articles short communications industrial and or country region case studies that covers the following enlisted topics Waste biorefineries e g organic waste biorefinery agricultural and forestry waste biorefinery etc Integration of different types of biorefineries Sustainable development goals Waste to energy technologies Energy and resource recovery from biomass and other waste Renewable and sustainable energy systems Biomass and waste supply chain Sustainable waste management systems Mitigation of environmental pollution and climate change Life cycle assessment Sustainable circular and bio based economies *Nuclear Structure Below 132Sn* Bryan Earl Tomlin, 2006 *Information Resources in Toxicology* P.J. Bert Hakkinen, Asish Mohapatra, Steven G. G. Gilbert, 2009-08-19 This latest version of Information Resources in Toxicology IRT continues a tradition established in 1982 with the publication of the first edition in presenting an extensive itemization review and commentary on the information infrastructure of the field This book is a unique wide ranging international annotated bibliography and compendium of major resources in toxicology and allied fields such as environmental and occupational

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