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| 1. Identify the missing particle in the following equation:                U → He + ?   |  |  |  | | --- | --- | --- | |  | a. | Pu | |  | b. | Th | |  | c. | Th | |  | d. | U | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear equation | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 2. The ratio of the atomic radius to the nuclear radius is approximately:   |  |  |  | | --- | --- | --- | |  | a. | 10–5 | |  | b. | 105 | |  | c. | 102 | |  | d. | 1015 | |  | e. | 10–15 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 3. An unstable isotope of rhenium, 191Re, has a half-life of 9.8 minutes and is a beta producer. What is the other product of the reaction?   |  |  |  | | --- | --- | --- | |  | a. | 191Os | |  | b. | 191W | |  | c. | 192Pt | |  | d. | 190W | |  | e. | 190Os |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear equation | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 4. The nuclide Th is radioactive. When one of these atoms decays, a series of α and β-particle emissions occurs, taking the atom through many transformations to end up as an atom of Pb. How many α particles are emitted in converting Th into Pb?   |  |  |  | | --- | --- | --- | |  | a. | 6 | |  | b. | 8 | |  | c. | 2 | |  | d. | 214 | |  | e. | 4 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive decay series | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/16/2017 7:28 AM | |

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| 5. It is desired to determine the concentration of arsenic in a lake sediment sample by means of neutron activation analysis. The nuclide captures a neutron to form , which in turn undergoes β decay. The daughter nuclide produces the characteristic γ rays used for the analysis. What is the daughter nuclide?   |  |  |  | | --- | --- | --- | |  | a. | Se | |  | b. | Ge | |  | c. | Ga | |  | d. | Se | |  | e. | Se |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | beta emission | Chemistry | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 6. Which of the following is a product of α decay of U?   |  |  |  | | --- | --- | --- | |  | a. | Th | |  | b. | Np | |  | c. | Pa | |  | d. | U | |  | e. | Pu |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | alpha emission | Chemistry | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 7. Electron capture transforms K into what nuclide?   |  |  |  | | --- | --- | --- | |  | a. | Ca | |  | b. | Ar | |  | c. | He | |  | d. | K– | |  | e. | Ca |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | electron capture | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 8. Which of the following processes decreases the atomic number by one?   |  |  |  | | --- | --- | --- | |  | a. | gamma-ray production | |  | b. | electron capture | |  | c. | beta-particle production | |  | d. | positron production | |  | e. | at least two of the above processes |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 9. If Pb undergoes a beta decay and the product of this decay undergoes another beta decay, which nuclide is produced?   |  |  |  | | --- | --- | --- | |  | a. | Bi | |  | b. | Pb | |  | c. | Po | |  | d. | Bi | |  | e. | Pb |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | beta emission | Chemistry | general chemistry | nuclear chemistry | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 10. Electron capture transforms Be into what nuclide?   |  |  |  | | --- | --- | --- | |  | a. | Li | |  | b. | B | |  | c. | Li | |  | d. | B | |  | e. | C |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | electron capture | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 11. A radioactive isotope of vanadium, V, decays by producing a β particle and gamma ray. The nuclide formed has the atomic number:   |  |  |  | | --- | --- | --- | |  | a. | 22 | |  | b. | 21 | |  | c. | 23 | |  | d. | 24 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | beta emission | Chemistry | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 12. The nuclide Tl is the daughter nuclide resulting from the α decay of what parent nuclide?   |  |  |  | | --- | --- | --- | |  | a. | Pb | |  | b. | Au | |  | c. | Hg | |  | d. | Bi | |  | e. | He |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | alpha emission | Chemistry | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 13. The nuclide N is unstable. What type of radioactive decay would be expected?   |  |  |  | | --- | --- | --- | |  | a. | e | |  | b. | e | |  | c. | σ | |  | d. | α | |  | e. | n |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear stability | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 14. Nuclides with too many neutrons to be in the band of stability are most likely to decay by what mode?   |  |  |  | | --- | --- | --- | |  | a. | alpha emission | |  | b. | fission | |  | c. | positron production | |  | d. | electron capture | |  | e. | beta emission |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear stability | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 15. The most likely decay mode (or modes) of the unstable nuclide C would be:   |  |  |  | | --- | --- | --- | |  | a. | positron production | |  | b. | α-particle production | |  | c. | electron capture | |  | d. | β-particle production | |  | e. | either positron production or electron capture, or both. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear stability | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 16. When Np undergoes β– emission, the products are:   |  |  |  | | --- | --- | --- | |  | a. | U + e*–* | |  | b. | Pu + e*–* | |  | c. | U + e*–* | |  | d. | Pa + He | |  | e. | Np + e*–* |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | beta emission | Chemistry | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 17. Which reaction will produce an isotope of the parent nuclide?   |  |  |  | | --- | --- | --- | |  | a. | Po → He + ? | |  | b. | Br → n + ? | |  | c. | Ac → e*–* + ? | |  | d. | N → e*–* + ? | |  | e. | As + e*–* → ? |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| The Fe-56 nucleus is known to be stable. Answer the following questions. |

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| 18. What is the most likely decay for the Fe-53 nucleus?   |  |  |  | | --- | --- | --- | |  | a. | β decay | |  | b. | positron emission | |  | c. | α decay | |  | d. | γ-ray emission | |  | e. | two of these |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 19-1 | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear stability | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 19. What is the most likely decay for the Fe-59 nucleus?   |  |  |  | | --- | --- | --- | |  | a. | β decay | |  | b. | positron emission | |  | c. | α decay | |  | d. | γ-ray emission | |  | e. | two of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 19-1 | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear stability | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| The U-238 nucleus decays to form Pb-206 by α and β decays. |

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| 20. Calculate the number of α decays.   |  |  |  | | --- | --- | --- | |  | a. | 2 | |  | b. | 4 | |  | c. | 6 | |  | d. | 8 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 19-2 | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive decay series | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 21. Calculate the number of β decays.   |  |  |  | | --- | --- | --- | |  | a. | 2 | |  | b. | 4 | |  | c. | 6 | |  | d. | 8 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 19-2 | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive decay series | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 22. Which types of processes are likely when the neutron-to-proton ratio in a nucleus is too low?   |  |  | | --- | --- | | I. | α decay | | II. | β decay | | III. | positron production | | IV. | electron capture |   ​   |  |  |  | | --- | --- | --- | |  | a. | I, II | |  | b. | II, III | |  | c. | III, IV | |  | d. | II, III, IV | |  | e. | II, IV |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear stability | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/9/2017 5:05 AM | |

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| 23. The so-called “magic numbers” of protons and neutrons produce special chemical stability.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear stability | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 24. As atomic mass increases, the proton/neutron ratio of stable nuclides decreases.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear stability | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 25. The rate constant for the beta decay of thorium-234 is 2.876 × 10–2 / day. What is the half-life of this nuclide?   |  |  |  | | --- | --- | --- | |  | a. | 48.19 days | |  | b. | 1.220 days | |  | c. | 0.693 days | |  | d. | 24.10 days | |  | e. | 96.38 days |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | half-life | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 26. Consider a certain type of nucleus that has a rate constant of 2.96 × 10–2 min–1. Calculate the time required for the sample to decay to one-fourth of its initial value.   |  |  |  | | --- | --- | --- | |  | a. | 2.96 min | |  | b. | 0.0592 min | |  | c. | 23.4 min | |  | d. | 29.3 min | |  | e. | 46.8 min |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 27. Consider a certain type of nucleus that has a half-life of 32 min. Calculate the percent of original sample of nuclides remaining after 1.9 hours have passed.   |  |  |  | | --- | --- | --- | |  | a. | 92% | |  | b. | 50% | |  | c. | 11.5% | |  | d. | 8.5% | |  | e. | 7.8% |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 28. Consider a certain type of nucleus that has a half-life of 32 min. Calculate the time required for 66% of the nuclides to decompose.   |  |  |  | | --- | --- | --- | |  | a. | 19 min | |  | b. | 21 min | |  | c. | 65 min | |  | d. | 58 min | |  | e. | 50 min |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 29. The number of a certain radioactive nuclide present in a sample decays from 160. to 20. in 33 minutes. What is the half-life of this radioactive species?   |  |  |  | | --- | --- | --- | |  | a. | 6 minutes | |  | b. | 11 minutes | |  | c. | 16 minutes | |  | d. | 21 minutes | |  | e. | 26 minutes |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | half-life | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 30. The half-life of is 28 years. How long will it take for a given sample of to be 64% decomposed?   |  |  |  | | --- | --- | --- | |  | a. | 9.0 half-lives | |  | b. | 18 years | |  | c. | 41 years | |  | d. | 1.0 years | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 31. The number of half-lives needed for a radioactive element to decay to about 6% of its original activity is (choose nearest number):   |  |  |  | | --- | --- | --- | |  | a. | 2 | |  | b. | 3 | |  | c. | 4 | |  | d. | 5 | |  | e. | 6 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | half-life | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 32. The Br-82 nucleus has a half-life of about 1.0 × 103 minutes. If you wanted 3.6 g of Br-82 and the delivery time was three days, about how much NaBr should you order (assuming all of the Br in the NaBr was Br-82)?   |  |  |  | | --- | --- | --- | |  | a. | 3.6 g | |  | b. | 7.2 g | |  | c. | 4.5 g | |  | d. | 93 g | |  | e. | 9.6 g |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/16/2017 7:29 AM | |

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| 33. A radioactive sample has an initial activity of 2.00 × 106 cpm (counts per minute), and after 4.0 days, its activity is 9.0 × 105 cpm. What is its activity after 27 days?   |  |  |  | | --- | --- | --- | |  | a. | 9.1 cpm | |  | b. | 9.1 × 103 cpm | |  | c. | 2.2 × 102 cpm | |  | d. | 2.3 × 10–9 cpm | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| A certain radioactive sample contains 2.4 × 103 nuclides at a certain time (*t* = 0); 3.0 h later the sample contains 6.0 × 102 nuclides. |

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| 34. For this sample the ratio of the decay rates at *t* = 0 to *t* = 3.0 h is:   |  |  |  | | --- | --- | --- | |  | a. | 1.0 | |  | b. | 8.0 | |  | c. | 4.0 | |  | d. | 16 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 19-3 | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 35. The value of the rate constant for this process is:   |  |  |  | | --- | --- | --- | |  | a. | 2.2 h–1 | |  | b. | 4.6 × 10–1 h–1 | |  | c. | 1.6 h–1 | |  | d. | 3.0 h–1 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 19-3 | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 36. The half-life of is 28.1 years. How long will it take a 10.0-g sample of to decompose to 0.56 g?   |  |  |  | | --- | --- | --- | |  | a. | 78 years | |  | b. | 234 years | |  | c. | 117 years | |  | d. | 175 years | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 37. The rate constant for the decay of is 4.230 × 10–3 / day. What is the half-life of   |  |  |  | | --- | --- | --- | |  | a. | 81.91 days | |  | b. | 163.8 days | |  | c. | 327.7 days | |  | d. | 409.6 days | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | half-life | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 38. A radioactive element has a half-life of 2.3 hours. How many hours will it take for the number of atoms present to decay to one-sixteenth of the initial value?   |  |  |  | | --- | --- | --- | |  | a. | 37 | |  | b. | 18 | |  | c. | 9.2 | |  | d. | 0.21 | |  | e. | 23 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | half-life | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 39. The half-life of a sample has been defined as the time it takes for half of a sample to decay. The fifth-life can be defined as the time it takes for one-fifth of a sample to decay. Given these definitions, calculate the fifth-life of a sample that has a half-life of 29 years.   |  |  |  | | --- | --- | --- | |  | a. | 9.3 years | |  | b. | 67 years | |  | c. | 19 years | |  | d. | 33 years | |  | e. | 47 years |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | half-life | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 40. The Cs-131 nuclide has a half-life of 30. years. After 107 years, about 3.0 grams remain. The original mass of the Cs-131 sample is closest to   |  |  |  | | --- | --- | --- | |  | a. | 71 g | |  | b. | 18 g | |  | c. | 36 g | |  | d. | 124 g | |  | e. | 43 g |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 41. The I-131 nuclide has a half-life of 8.0 days. If you originally have a 1.8-kg sample, after 1.4 months you will have approximately   |  |  |  | | --- | --- | --- | |  | a. | 95 g | |  | b. | 62 g | |  | c. | 71 g | |  | d. | 47 g | |  | e. | less than 1 g |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 42. Use the following table to assist in answering the question below.   |  |  | | --- | --- | | **Nuclide** | **Half-Life** | | Uranium-238 | 4.51 × 109 years | | Uranium-234 | 2.48 × 105 years | | Thorium-230 | 8.0 × 104 years | | Radium-226 | 1.62 × 103 years | | Lead-210 | 20.4 years |   The rate constant for the decay of unstable nuclide X by alpha-particle emission is 2.37 × 10–8 / day. What is the identity of X?   |  |  |  | | --- | --- | --- | |  | a. | Uranium-234 | |  | b. | Uranium-238 | |  | c. | Radium-226 | |  | d. | Thorium-230 | |  | e. | Lead-210 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | half-life | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 43. The half-life for electron capture for is 1.30 × 109 years. What percent of the original remains after 3.37 × 109 years?   |  |  |  | | --- | --- | --- | |  | a. | 83.4% | |  | b. | 16.6% | |  | c. | 76.5% | |  | d. | 23.5% | |  | e. | 41.5% |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | half-life | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 44. Identify the missing particle in the following nuclear equation:                Am + He → \_\_\_\_\_\_\_\_\_\_ + 2 n   |  |  |  | | --- | --- | --- | |  | a. | Bk | |  | b. | Bk | |  | c. | Bk | |  | d. | Bk | |  | e. | Bk |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear bombardment reactions | nuclear chemistry | radioactivity and nuclear bombardment reactions | transmutation | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 45. In the following nuclear equation, identify the missing product:                Ca + α → \_\_\_\_\_\_\_\_\_\_ + H   |  |  |  | | --- | --- | --- | |  | a. | Ti | |  | b. | Sc | |  | c. | Ti | |  | d. | Ar | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear bombardment reactions | nuclear chemistry | radioactivity and nuclear bombardment reactions | transmutation | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 46. Identify the missing particle in the following nuclear equation:                Al + \_\_\_\_\_\_\_\_\_\_ → Na + α   |  |  |  | | --- | --- | --- | |  | a. | n | |  | b. | n | |  | c. | e | |  | d. | e | |  | e. | 2 n |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear equation | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 47. When the Pd-106 nucleus is struck with an alpha particle, a proton is produced along with a new element. What is this new element?   |  |  |  | | --- | --- | --- | |  | a. | Cd-112 | |  | b. | Cd 109 | |  | c. | Ag-108 | |  | d. | Ag-109 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear bombardment reactions | nuclear chemistry | radioactivity and nuclear bombardment reactions | transmutation | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 48. An archaeological sample contains 0.743 g of lead-206 and 2.145 g of uranium-238. Assume that all the lead now present in the rock came from the radioactive decay of the uranium and that no appreciable amounts of other radioactive nuclides are present in the sample. The decay rate constant for the uranium is 1.544 × 10–10/ year. Determine the half-life of the uranium.   |  |  |  | | --- | --- | --- | |  | a. | 4.488 × 109 years | |  | b. | 1.070 × 10–10 years | |  | c. | depends on the age of the sample | |  | d. | depends on the organic content of the sample | |  | e. | two of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | half-life | nuclear chemistry | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 49. An archaeological sample contains 0.622 g of lead-206 and 2.198 g of uranium-238. Assume that all the lead now present in the rock came from the radioactive decay of the uranium and that no appreciable amounts of other radioactive nuclides are present in the sample. The decay rate constant for the uranium is 1.54 × 10–10/year. What is the age of the sample?   |  |  |  | | --- | --- | --- | |  | a. | 9.1 × 109 years | |  | b. | 7.98 × 108 years | |  | c. | 1.84 × 109 years | |  | d. | 7.26 × 109 years | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive dating | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 50. Use the following data to determine the expected 14C activity in the Shroud of Turin. The atmospheric activity of 14C is 15 cpm/gC (counts per minute per gram of carbon). Assume that the cloth was made in the year 24 A.D. The half-life of 14C is 5730 years.   |  |  |  | | --- | --- | --- | |  | a. | 28 cpm/gC | |  | b. | 7.3 cpm/gC | |  | c. | 5.1 cpm/gC | |  | d. | 11 cpm/gC | |  | e. | 12 cpm/gC |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive dating | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 51. A sample of wood from an Egyptian mummy case gives a count of 8.7 cpm/gC (counts per minute per gram of carbon). How old is the wood? (The initial decay rate of is 15.3 cpm/g C, and its half-life is 5730 years.)   |  |  |  | | --- | --- | --- | |  | a. | 2334 yr | |  | b. | 7168 yr | |  | c. | 4668 yr | |  | d. | 5718 yr | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive dating | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 52. If a tree dies and the trunk remains undisturbed for 13,535 years, what percentage of original is still present? (half-life of = 5730 years)   |  |  |  | | --- | --- | --- | |  | a. | 80.5% | |  | b. | 19.5% | |  | c. | 38.9% | |  | d. | 29.2% | |  | e. | 2.36% |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive dating | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 53. The half-life for electron capture for is 1.3 billion years. What will be the / ratio in a rock that is 5.8 billion years old?   |  |  |  | | --- | --- | --- | |  | a. | 0.045 | |  | b. | 21 | |  | c. | 0.048 | |  | d. | 4.5 | |  | e. | 22 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive dating | radioactivity and nuclear bombardment reactions | rate of radioactive decay | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 54. It is desired to determine the blood volume of a live mouse. To do this, 0.10 mL of a saline suspension of red blood cells labeled with Fe is injected into the tail vein. Before injection, the gamma rays were counted for this 0.10-mL solution and the count rate found to be 1.0 × 104 cpm. After a sufficient time for the blood to be thoroughly mixed, 0.10 mL of blood is removed and counted. The sample is found to have a count rate of 575 cpm. What is the approximate blood volume of the mouse?   |  |  |  | | --- | --- | --- | |  | a. | 0.57 mL | |  | b. | 17 mL | |  | c. | 5.8 mL | |  | d. | 5.7 mL | |  | e. | 1.7 mL |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | applications of radioactive isotopes | chemical anaylsis | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 55. A 0.20-mL sample of a solution containing H that produces 3.7 × 103 cps is injected into the bloodstream of an animal. After allowing circulatory equilibrium to be established, a 0.20-mL sample of blood is found to have an activity of 17 cps. Calculate the blood volume of the animal.   |  |  |  | | --- | --- | --- | |  | a. | 1.09 L | |  | b. | 44 mL | |  | c. | 22 mL | |  | d. | 218 mL | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.4 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | applications of radioactive isotopes | chemical analysis | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/2/2017 11:44 PM | | *DATE MODIFIED:* | 3/9/2017 5:45 AM | |

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| 56. Radioactive tracers are useful in studying very low concentrations of chemical species. A chemist has a sample of HgI2 in which part of the iodine is the radioactive nuclide of mass 131, so that the count rate is 5.0 × 1011 counts per minute per mole of I. The solid mercuric iodide is placed in water and allowed to come to equilibrium. Then 100 mL of the solution is withdrawn, and its radioactivity is measured and found to give 22 counts per minute. What is the molar concentration of iodide ion in the solution?   |  |  |  | | --- | --- | --- | |  | a. | 1.1 × 10–9 | |  | b. | 4.4 × 10–10 | |  | c. | 1.1 × 10–10 | |  | d. | 1.1 × 10–11 | |  | e. | 4.4 × 10–11 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | applications of radioactive isotopes | chemical anaylsis | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 57. Which statement is true about the following reaction?   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  | N | + | He | → | O | + | H | |  |  | 13.992 |  | 4.0015 |  | 16.9986 |  | 1.0073 | |  |  | amu |  | amu |  | amu |  | amu |  |  |  |  | | --- | --- | --- | |  | a. | Energy is absorbed in the reaction. | |  | b. | Energy is released in the reaction. | |  | c. | No energy change is associated with the reaction. | |  | d. | Not enough information is given to determine the energy change. | |  | e. | None of these. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | mass-energy calculations | nuclear chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/2/2017 7:38 AM | |

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| 58. One of the hopes for solving the world's energy problem is to make use of the fusion reaction:                 H + H → He + n + energy  How much energy is released when one mole of deuterium is fused with one mole of tritium according to the above reaction? The masses of the atoms and the neutrons are:                 H = 2.0140 amu           H = 3.01605 amu                 He = 4.002603 amu     n = 1.008665 amu  The speed of light is 2.9979 × 108 m/s   |  |  |  | | --- | --- | --- | |  | a. | 5.63 × 108 J | |  | b. | 56.3 J | |  | c. | 1.69 × 1012 J | |  | d. | 7.84 × 1044 J | |  | e. | 8.44 × 1011 J |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | mass-energy calculations | nuclear chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/2/2017 7:39 AM | |

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| 59. Consider the following process:   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | |  | N | + | He | → | O | + | H | | Masses (amu): | 14.003074 |  | 4.002603 |  | 16.999133 |  | 1.007825 |   Which statement describes Δ*E* for the process?   |  |  |  | | --- | --- | --- | |  | a. | 1.15 × 1011 J/mol are released. | |  | b. | 1.15 × 1014 J/mol are released. | |  | c. | 1.15 × 1018 J/mol are absorbed. | |  | d. | 1.15 × 1011 J/mol are absorbed. | |  | e. | None of these. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | mass-energy calculations | nuclear chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 60. Calculate Δ*E* in kilojoules per mole for the following reaction:                Th → He + Ra Atomic masses: 230Th = 230.0332, 4He = 4.00260, 226Ra = 226.02544.   |  |  |  | | --- | --- | --- | |  | a. | –4.6 × 108 kJ/mol | |  | b. | –2.4 × 106 kJ/mol | |  | c. | 0 | |  | d. | +2.4 × 106 kJ/mol | |  | e. | +4.6 × 108 kJ/mol |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | mass-energy calculations | nuclear chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 61. Calculate the change in energy in kJ/mol for the transmutation of radium from the given molar masses:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  | Ra | → |  | He | + |  | |  | 226.0254 g/mol |  | ​ | 4.0026 g/mol | 222.0176 g/mol | |  |  |  |  | | --- | --- | --- | |  | a. | –5.2 kJ/mol | |  | b. | –1.6 kJ/mol | |  | c. | –4.7 × 1014 kJ/mol | |  | d. | –4.7 × 108 kJ/mol | |  | e. | +1.6 × 108 kJ/mol |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | mass-energy calculations | nuclear chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/2/2017 7:48 AM | |

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| 62. If one mole of oxygen-16 were formed from protons and neutrons, 0.1366 g of mass would be lost. What can best account for this loss?   |  |  |  | | --- | --- | --- | |  | a. | When fission occurs, the nuclei remaining always has a smaller mass. | |  | b. | Converting from the atomic scale (in amu's) to the macroscopic scale (in grams) can often cause minor errors to occur. | |  | c. | The process was so exothermic, the system lost energy, which meant that it also lost mass. | |  | d. | This is impossible because of the Law of Conservation of Matter (so mass must be conserved). | |  | e. | Both A and C are correct. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | mass-energy calculations | nuclear chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 63. Iron-56 (Fe) has a binding energy per nucleon of 8.79 MeV. (1MeV is 1.60 × 10–13 J). Determine the difference in mass between one mole of iron-56 nuclei and the component nucleons of which it is made.   |  |  |  | | --- | --- | --- | |  | a. | 9.41 × 10–6 kg | |  | b. | 2.43 × 10–5 kg | |  | c. | 6.65 × 10–5 kg | |  | d. | 5.27 × 10–4 kg | |  | e. | 7.21 × 10–4 kg |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | mass-energy calculations | nuclear chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 64. The bismuth-209 nucleus has a binding energy per nucleon of 7.6154 MeV. (1 MeV is 1.60 × 10–13 J). Determine the difference in mass between one mole of bismuth-209 nuclei and the component nucleons of which it is made.   |  |  |  | | --- | --- | --- | |  | a. | 1.71 × 10–3Kg | |  | b. | 3.91 × 10–8Kg | |  | c. | 8.16 × 10–6Kg | |  | d. | 2.55 × 10–10Kg | |  | e. | 6.78 × 10–4Kg |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | mass-energy calculations | nuclear chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/3/2017 12:14 AM | | *DATE MODIFIED:* | 3/3/2017 3:40 AM | |

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| 65. The aluminum-27 nucleus has a mass defect of  0.2359 g/mol.  Determine the binding energy per nucleon for aluminum-27 nuclei. (1 MeV is 1.602 × 10–13 J).   |  |  |  | | --- | --- | --- | |  | a. | 2.198 × 10–5MeV | |  | b. | 2.198 × 102 MeV | |  | c. | 16.96476 MeV | |  | d. | 3.394 MeV | |  | e. | 8.139 MeV |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | mass-energy calcultaions | nuclear chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/3/2017 3:47 AM | | *DATE MODIFIED:* | 3/3/2017 4:44 AM | |

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| 66. The mass defect arises because the sum of masses of the component nucleons is less than that of the nucleus.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.5 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | mass-energy calculations | nuclear binding energy | nuclear chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 67. In the following fission reaction, identify the other product:                U + n → I + 2n + \_\_\_\_\_\_\_\_\_\_   |  |  |  | | --- | --- | --- | |  | a. | Y | |  | b. | Y | |  | c. | Mo | |  | d. | Mo | |  | e. | Zr |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear equation | radioactive decay series | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 68. What nuclide is necessary to balance the following fission reaction?                U + n → 3n + Ba + \_\_\_\_\_\_\_\_\_\_   |  |  |  | | --- | --- | --- | |  | a. | Br | |  | b. | Kr | |  | c. | Rb | |  | d. | Kr | |  | e. | Sr |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear equation | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 69. Which of the following balanced equations is labeled incorrectly?   |  |  |  | | --- | --- | --- | |  | a. | fission: Bi +He → At + 2n | |  | b. | fusion: H + H → H + H | |  | c. | bombardment: Pu + n → Am + e | |  | d. | beta production: U → Np + e | |  | e. | all correctly labeled |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 70. Breeder reactors are used to convert the nonfissionable nuclide U to a fissionable product. Neutron capture of the U is followed by two successive beta decays. What is the final fissionable product?   |  |  |  | | --- | --- | --- | |  | a. | Pu | |  | b. | Ra | |  | c. | U | |  | d. | Pu | |  | e. | Np |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear equation | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/16/2017 7:34 AM | |

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| When the U-235 nucleus is struck with a neutron, the Ce-144 and Sr-90 nuclei are produced along with some neutrons and electrons. |

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| 71. How many neutrons are emitted?   |  |  |  | | --- | --- | --- | |  | a. | 2 | |  | b. | 3 | |  | c. | 4 | |  | d. | 5 | |  | e. | 6 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 19-4 | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear equation | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 72. How many electrons are emitted?   |  |  |  | | --- | --- | --- | |  | a. | 2 | |  | b. | 3 | |  | c. | 4 | |  | d. | 5 | |  | e. | 6 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 19-4 | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear equation | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 73. When the U-235 nucleus is struck with a neutron, the Zn-72 and Sm-160 nuclei are produced along with some neutrons. How many neutrons are emitted?   |  |  |  | | --- | --- | --- | |  | a. | 2 | |  | b. | 3 | |  | c. | 4 | |  | d. | 5 | |  | e. | 6 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | nuclear equation | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 74. The smallest amount of radioactive material that will support a self-sustained fission reaction is called the   |  |  |  | | --- | --- | --- | |  | a. | molar mass | |  | b. | moderator | |  | c. | supercritical mass | |  | d. | subcritical mass | |  | e. | critical mass |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | nuclear chemistry | nuclear fission | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 75. How much energy is released when 2.50 metric tons of 2H2 gas undergoes nuclear fusion? (1 metric ton = 1000 kg, *c* = 2.9979 × 108 m/s, 1 amu = 1.66054 × 10–27 kg) 2H + 2H → 3He + 1n   |  |  | | --- | --- | | Particle | Mass (amu) | |  | 1.008665 | |  | 2.01400 | |  | 3.01603 |   ​   |  |  |  | | --- | --- | --- | |  | a. | 3.69 × 1017J | |  | b. | 5.43 × 10–18J | |  | c. | 5.39 × 10 64 J | |  | d. | 1.84 × 1017J | |  | e. | 1.34 × 10 71J |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | nuclear chemistry | nuclear fusion | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/3/2017 5:25 AM | | *DATE MODIFIED:* | 3/31/2017 6:11 AM | |

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| 76. Which of the following is true for the fission of uranium-235?   |  |  |  | | --- | --- | --- | |  | a. | The electron is captured by the nucleus, which becomes unstable. | |  | b. | The products include neutrons. | |  | c. | The nuclides produced are individually heavier than the uranium nuclide. | |  | d. | The nuclides produced are more stable than the uranium nuclide. | |  | e. | Two of these. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | nuclear chemistry | nuclear fission | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 77. If more than one neutron from each fission event causes another fission event, the fission situation is described as   |  |  |  | | --- | --- | --- | |  | a. | critical | |  | b. | subcritical | |  | c. | supercritical | |  | d. | moderated | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | nuclear chemistry | nuclear fission | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 78. Which of the following statements (A-D) is false?   |  |  |  | | --- | --- | --- | |  | a. | The process of splitting a heavy nucleus into two nuclei with smaller mass numbers is called fission. | |  | b. | A beta particle is a particle with the same mass as the electron but opposite charge. | |  | c. | Nitrogen can be changed into oxygen by bombarding it with alpha particles. | |  | d. | Archaeologists use radioactivity to determine the age of some artifacts and rocks. | |  | e. | All of the above statements are true. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 79. Radioactivity is not useful for:   |  |  |  | | --- | --- | --- | |  | a. | Dating artifacts and rocks. | |  | b. | Producing electricity. | |  | c. | Tracing pathways in biological systems. | |  | d. | Making chemicals like sulfuric acid. | |  | e. | Radioactivity is useful for all of the above. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactivity | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 80. Which statement about fusion is incorrect?   |  |  |  | | --- | --- | --- | |  | a. | Fusion requires starting nuclides that are difficult to find on Earth, which is a problem for scientists. | |  | b. | Studying fusion is a worthwhile research endeavor because this process could be used as an alternative energy source. | |  | c. | Fusion requires a very high temperature in order to begin, which is a problem for scientists. | |  | d. | In fusion, two nuclei must be traveling fast enough to overcome the electrostatic repulsion and “fuse” the particles into a new nucleus. | |  | e. | Both A and C are incorrect. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | nuclear chemistry | nuclear fusion | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 81. What component of a nuclear reactor moderates the rate of the reaction?   |  |  |  | | --- | --- | --- | |  | a. | steam turbine | |  | b. | control rods | |  | c. | cooling water | |  | d. | containment shell | |  | e. | cyclotron |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | nuclear chemistry | nuclear fission | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 82. Which of the following is not a factor in determining the biological effects of radiation exposure?   |  |  |  | | --- | --- | --- | |  | a. | the energy of the radiation | |  | b. | the age of the organism at which the exposure occurs | |  | c. | the penetrating ability of the radiation | |  | d. | the chemical properties of the radiation source | |  | e. | the ionizing ability of the radiation |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radiation and matter | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 83. The greatest radiation exposure for Americans comes from which of the following?   |  |  |  | | --- | --- | --- | |  | a. | medical x-rays | |  | b. | nuclear power plants | |  | c. | electrical transmission wires | |  | d. | industrial waste | |  | e. | a combination of the natural causes of radiation including cosmic rays |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radiation and matter | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 84. Which unit takes into account the relative ability of radiation to cause damage?   |  |  |  | | --- | --- | --- | |  | a. | rem | |  | b. | rad | |  | c. | curie | |  | d. | becquerel | |  | e. | cpm |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radiation and matter | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 85. Which type of radiation has the lowest penetrating ability?   |  |  |  | | --- | --- | --- | |  | a. | gamma ray | |  | b. | beta particle | |  | c. | alpha particle | |  | d. | positron | |  | e. | more than one of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radiation and matter | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 86. Which of the following nuclides would be most expected to undergo α-decay?   |  |  |  | | --- | --- | --- | |  | a. | 86As | |  | b. | 127I | |  | c. | 252Es | |  | d. | 9C | |  | e. | 171Ir |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 87. Which of the following nuclides would be most expected to undergo β-decay?   |  |  |  | | --- | --- | --- | |  | a. | 200Ta | |  | b. | 209Bi | |  | c. | 257Fm | |  | d. | 18Na | |  | e. | 121Xe |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 88. Which of the following nuclides would be most expected to undergo positron emission?   |  |  |  | | --- | --- | --- | |  | a. | 86As | |  | b. | 127I | |  | c. | 252Es | |  | d. | 9C | |  | e. | 171Ir |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 89. Which of the following nuclides is most likely to be unstable?   |  |  |  | | --- | --- | --- | |  | a. | 35Cl | |  | b. | 234Th | |  | c. | 2H | |  | d. | 4He | |  | e. | 52Cr |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 90. Which of the following nuclides is most likely to be stable?   |  |  |  | | --- | --- | --- | |  | a. | 41Cl | |  | b. | 234Th | |  | c. | 3H | |  | d. | 221Pb | |  | e. | 52Cr |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 91. 232Th decays to 208Pb.  How many alpha decays are involved in this decay series?   |  |  |  | | --- | --- | --- | |  | a. | 6 | |  | b. | 1 | |  | c. | 4 | |  | d. | 2 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | decay series | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/2/2017 8:07 AM | |

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| 92. 237Np decays to 209Bi.  .  How many alpha decays are involved in this decay series?   |  |  |  | | --- | --- | --- | |  | a. | 6 | |  | b. | 7 | |  | c. | 4 | |  | d. | 2 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | decay series | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 93. 232Th decays to 208Pb.  How many beta decays are involved in this decay series?   |  |  |  | | --- | --- | --- | |  | a. | 6 | |  | b. | 1 | |  | c. | 4 | |  | d. | 2 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | decay series | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 94. 237Np decays to 209Bi.  How many beta decays are involved in this decay series?   |  |  |  | | --- | --- | --- | |  | a. | 6 | |  | b. | 1 | |  | c. | 4 | |  | d. | 2 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | decay series | general chemistry | nuclear chemistry | radioactive decay | radioactivity and nuclear bombardment reactions | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 95. An atom of 186Ta has a mass of 185.958540 amu. Calculate the mass defect (deficit) in amu/atom.   |  |  |  | | --- | --- | --- | |  | a. | 1.591 | |  | b. | 0 | |  | c. | 1482 | |  | d. | 7.97 | |  | e. | 1.442 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | mass-energy calculations | nuclear chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/4/2016 4:31 PM | |

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| 96. An atom of 131I has a mass of 130.906114 amu. Calculate the binding energy per MOLE in kJ.   |  |  |  | | --- | --- | --- | |  | a. | 1.06 × 1014 | |  | b. | 1.18 | |  | c. | 1.06 × 1017 | |  | d. | 1.06 × 1011 | |  | e. | 1097 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 19.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy of nuclear reactions | general chemistry | mass-energy calculations | nuclear chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:31 PM | | *DATE MODIFIED:* | 3/3/2017 6:24 AM | |