

- 1) What is the most common means for a heavy, unstable nucleus to become stable?

- 2) Which of the following have the same net effect?
 - A) Gamma emission and positron emission
 - B) Alpha decay and beta⁻ decay
 - C) Electron capture and positron emission
 - D) Beta⁻ decay and electron capture
 - E) Alpha decay and positron emission

- 3) Which of the following nuclides would you predict to be stable and which radioactive: (a) $^{18}_{10}\text{Ne}$; (b) $^{32}_{16}\text{S}$; (c) $^{236}_{90}\text{Th}$; (d) $^{123}_{56}\text{Ba}$? Give a brief explanation for your answer to be eligible to partial credit.

- 4) Use the atomic mass of the element to predict the mode(s) of decay of the following radioactive nuclides: (a) $^{12}_5\text{B}$; (b) $^{234}_{92}\text{U}$; (c) $^{81}_{33}\text{As}$; (d) $^{127}_{57}\text{La}$

- 5) True or false: All radioactive emissions cause ionization which can form free radicals.

- 6) Why is it assumed that mass is conserved for chemical reactions?
 - A) Because mass cannot be created or destroyed
 - B) Because mass and energy have no relation to one another
 - C) Because the chemical reactions we study are only theoretical
 - D) Because the change in energy from breaking and forming bonds is so small
 - E) It is not assumed that mass is conserved for chemical reactions

- 7) ^{237}Np is the parent nuclide of a decay series that starts with alpha emission, followed by beta⁻ decay, and then two more alpha emissions. Write a balanced nuclear equation for each step.

- 8) What is the specific activity (in Ci/g) if 1.65 mg of an isotope emits 1.56×10^6 alpha particles per second? Show your work to be eligible for partial credit.

- 9) If 1.00×10^{-12} mol of ^{135}Cs emits 1.39×10^5 beta⁻ particles in 1.00 yr, what is the decay constant? Include units in your answer and show your work to be eligible for partial credit.

- 10) The isotope $^{212}_{83}\text{Bi}$ has a half-life of 1.01 yr. What mass (in mg) of a 2.00-mg sample will remain after 3.75×10^3 h? Show your work to be eligible for partial credit.

11) Which compounds exhibit geometric isomerism? Draw and name the two isomers in each case:
 (a) propene (b) 3-hexene (c) 1,1-dichloroethene

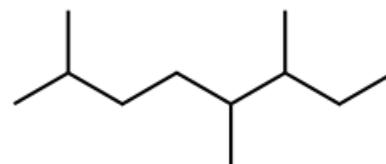
12) How many of the following is/are named correctly?



1-methyl-2-bromocyclohexane



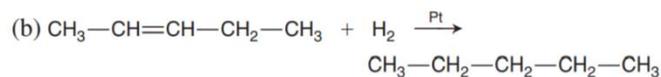
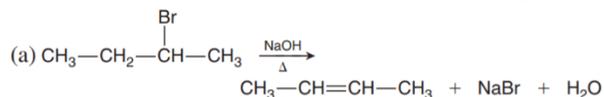
1,1,2-trimethylpentane



3,4,7-trimethyloctane

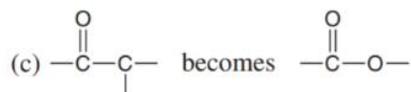
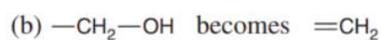
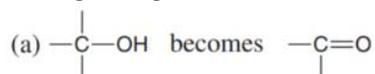
A) Zero B) One C) Two D) Three

13) Determine the type of each of the following reactions:



- A) Hydrogenation; Addition
- B) Addition; Elimination
- C) Substitution; Elimination
- D) Elimination; Addition
- E) Hydrogenation; Substitution

14) Based on the number of bonds and the nature of the bonded atoms, state whether each of the following changes is an oxidation or a reduction:



15) Draw the following functional groups: (a) ketone (b) amide (c) aldehyde (d) amine