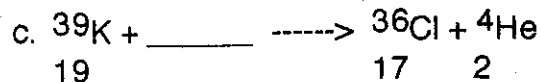
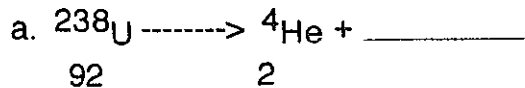


COLLEGE-PREP CHEMISTRY  
Review Packet - Chap. 16 - Radiation

1. Complete the following nuclear equations:

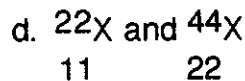
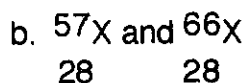
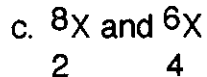
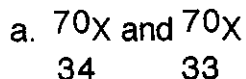


2. One atom of element 109 with a mass number of 266 was produced in 1982 by bombarding a target of bismuth-209 with iron-58 nuclei for 1 week. How many neutrons were released in the process?



3. Plutonium is especially hazardous when inhaled or ingested because it emits alpha particles. Why would alpha particles cause more damage to tissue than beta particles?

4. Which of the following represents isotopes?



5. Lead-209 undergoes beta decay. Write a balanced equation for this reaction.

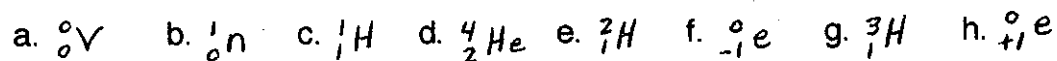
6. Explain why some atoms are stable and others are unstable.

7. Differentiate between the strong nuclear force and the electrical force within the nucleus of an atom.

8. What is "nuclear glue"?

9. Calculate the binding energy per mole of fluorine-19 atoms that have a mass of 18.99840 amu per atom.

10. Identify the following nuclear particles or rays:



11. Define the following terms:

- a. transmutation
- b. radioactivity
- c. strong nuclear force
- d. binding energy
- e. mass defect
- f. Geiger counter
- g. nuclear fusion
- h. nuclear fission
- i. critical mass
- j. chain reaction
- k. half life

12. A fossil bone contains one-sixteenth as much carbon-14 as a living organism contains. How old is the fossil?

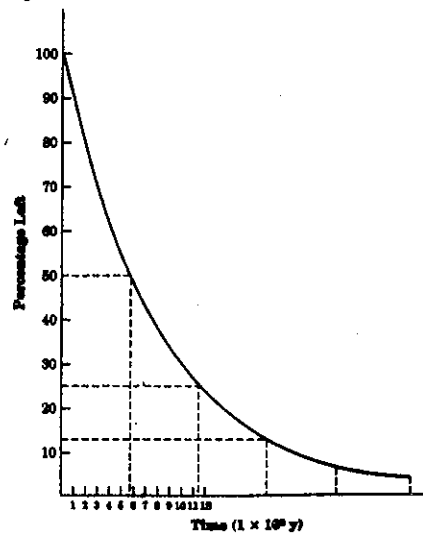
$t_{1/2} = 1.28 \times 10^9 \text{ years}$

13. If a rock contained 1.2 kg of potassium-40 when it formed, how many grams remain after 2.6 billion years?

14. Explain how carbon-14 is used to determine the age of an object.

15. A sample of bone has been removed from the ice in Greenland. Use the following graph to determine the age of the bone if only 43% of the original level of carbon-14 is left.

Figure 16-2 The Half-Life of Carbon-14



16. Explain how a nuclear reactor works. How is a nuclear reactor different from a nuclear bomb?

## QUIZ - Nuclear Chemistry

WRITE YOUR ANSWERS ON A SEPARATE SHEET OF PAPER.

1. Which of the following is an incorrect symbol?

- a)  ${}^1_6\text{C}$       b)  ${}^{14}_7\text{N}$       c)  ${}^{13}_6\text{C}$       d)  ${}^{13}_7\text{N}$       e)  ${}^{13}_7\text{C}$

2. Beta particles are

- a) electrons from the nucleus  
b) electrons from outside the nucleus  
c) neutrons  
d) helium nuclei  
e) protons

3. Use the following unidentified isotopes to answer the questions below. (There is more than one possible answer. Put all correct answers.)



- a) Which are isotopes of the same element?  
b) Which have the same number of neutrons?  
c) Which have the same mass number?  
d) Rewrite each of the isotopes using the correct symbol in place of X.

4. What is the correct nuclear symbol for

- a) an alpha particle  
b) a beta particle

5. What is the correct Greek symbol for

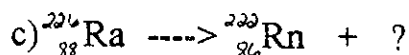
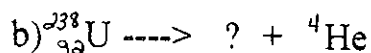
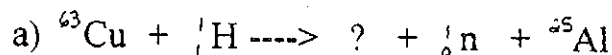
- a) an alpha particle  
b) a beta particle  
c) a gamma particle

6. A student stand 5 ft. from a radioactive source and detects 50 c/m with a Geiger counter. If the student steps back so s/he is now 10 ft. from the source, how many counts per minute would be registered on the Geiger counter?

7. A student obtains an unidentified radioactive sample. In trying to identify the type of radiation being given off by the sample, the student uses a Geiger counter to first detect the counts per minute emitted. The student then places his t-shirt over the sample and notes that the counts per minute do not change. What type of radiation is being emitted by the sample?

- a) alpha only  
 b) alpha or gamma  
 c) beta only  
 d) beta or gamma  
 e) alpha or beta

8. Rewrite each of the following equations onto your answer sheet. Identify the missing particle.

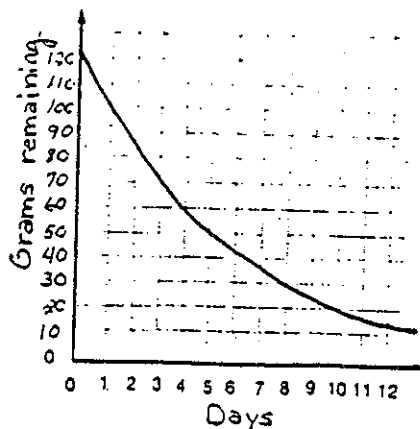


9. A research institute requests 1.00 grams of bismuth-214, which has a half-life of 20.0 minutes. If one gram was shipped and it takes an hour to get it to the institute, how much bismuth-214 would be left when it arrived at the research institute?

BONUS QUESTIONS: Refer to problem #9. How much bismuth-214 should be shipped so that there is one gram left when it reaches the research institute?

10. Plutonium-239 undergoes alpha decay. What new element is formed?  
 (Hint: Write a balanced nuclear equation.)

Use the graph below to answer questions 11 and 12.



11. What is the half-life of the substance shown on the graph?  
 12. How much of the substance remains after three half-lives?