Practice Questions

NUCLEAR CHEMISTRY

A. Matching

Match each term in Column B to the correct description in Column A. Write the letter of the correct term on the line.

Column A	Column B
1. a fast-moving electron formed by the decomposition of a neutron	a. beta particle
2. uses a phosphor to detect radiation	b. half-life
3. an element that has an atomic number above 92	c. gamma radiation
4. the most penetrating radiation	d. Geiger counter
5. a particle that has two protons and two neutrons	e. film badge
6. several layers of photographic film covered with black light-proof paper encased in a plastic or metal holder	f. ionizing radiation
7. uses a gas-filled metal tube to detect radiation	g. transuranium element
8. knocks electrons off some atoms of the bombarded substance to produce ions	h. radiation
9. the penetrating rays emitted by a radioactive source	i. scintillation counter
10. the time required for one-half of the atoms of a radioisotope to emit radiation and to decay to products	j. alpha particle

B. Multiple Choice

Choose the best answer and write its letter on the line.

	 11. Electromagnetic radiation inclu a. alpha particles and X-rays. b. gamma rays and X-rays. c. beta particles and gamma ray d. gamma rays and alpha particles 	ides s. les
	12. A radioisotope commonly used a. U-235.	to detect thyroid problems is c. I-131.
	b. Co-60.	d. C-14.
	13. Which of the following is <i>not</i> true of a. It has a mass of 4 amu.	concerning an alpha particle? c. It is a helium nucleus.
	b. It has a 1+ charge.	d. It contains two neutrons.
-	14. Ionizing radiation that is negatively	v charged is
	a. alpha radiation.	c. gamma radiation.
	b. beta radiation.	d. X-rays.
	15. Which type of ionizing radiation ca	an be blocked by clothing?
	a. alpha particle	c. X-radiation
	b. gamma radiation	d. beta particle
-	16. The production of carbon-14	
	a. occurs to a large extent in nuclea	ar reactors.
	b. is mostly due to fallout from nuc	clear explosions.
	c. takes place in the upper atmosph	ere.
	u. occurs during photosynthesis in	plants.
=	17. Which of these naturally occurring millions of year old?	radioisotopes would be most useful in dating objects thought to be
	a. carbon-14, $t_{1/2} = 5.75 \times 10^{-9}$ years b. potassium-40, $t_{1/2} = 1.28 \times 10^{9}$ y	ears
	c. thorium-234, $t_{1/2} = 25$ days	
	d. radon-222, $t_{1/2} = 3.8$ days	
	18. A piece of wood found in an ancier wood cut from a living tree growing approximate age of the ancient wood the ancient	It burial mound contains one-fourth as much carbon-14 as a piece of g nearby. If the half-life $(t_{1/2})$ for carbon-14 is 5730 years, what is the od?
	a. 1432.5 years	c. 5730 years
	b. 2865 years	d. 11,460 years
	19 If an isotone undergoes beta emissi	on
·	a. the mass number changes.	
	b. the atomic number changes.	
	c. the atomic number remains the s	ame.
	u . the number of neurons remains	the same.
2	20. Which of the following particles is	needed to complete this nuclear equation?
	${}^{55}_{25}\mathrm{Mn} + {}^{2}_{1}\mathrm{H} \rightarrow \underline{?}$	$-+2\frac{1}{0}n$
	a ⁵⁶ Co	55 _{Fe}
	27	26-2
	b. $\frac{5}{26}$ Fe	d. $\frac{58}{24}$ Cr
		_ ·

- 21. Which of the following statements is correct?
 - a. Water is used to moderate (slow down) neutrons in a nuclear reactor.
 - b. Carbon control rods are used to absorb neutrons in a nuclear fission reaction.
 - c. A very high temperature is required to initiate a nuclear fission reaction.
 - d. The energy released from the sun is the result of nuclear fission reactions.
- 22. In nuclear fission
 - a. certain atoms break into fragments when struck by neutrons.
 - **b.** a chain reaction cannot occur.
 - **c.** energy is absorbed.
 - $\boldsymbol{d}\boldsymbol{.}$ all of the above
- 23. Nuclear fusion
 - a. occurs when large nuclei fuse together.
 - **b.** takes place in the sun.
 - **c.** generally produces hydrogen nuclei.
 - **d.** all of the above
- 24. What particle is needed to complete this equation?

$${}^{14}_{7}\text{N} + \underline{?} \rightarrow {}^{14}_{6}\text{C} + {}^{1}_{1}\text{H}$$

a. ${}^{0}_{0}n$ **c.** ${}^{4}_{2}\text{He}$
b. ${}^{0}_{-1}e$ **d.** ${}^{0}_{+1}e$

- **25.** Radioisotopes taken internally for medical reasons **a.** must be eliminated from the body slowly.
 - **b.** should be fissionable isotopes.
 - **c.** should have stable nuclei.
 - **d.** should have a short half-life.
- **26.** A device that is used primarily for the detection of beta radiation is
 - **a.** the film badge.**b.** the Geiger counter.

c. the scintillation counter.d. all of the above

C. Problems

Solve the following problems in the space provided. Show your work.

27. Complete the following nuclear reactions by filling in the blanks with the correct numbers.

a. $\frac{42}{\underline{?}}$ K $\rightarrow \frac{0}{-1}e + \frac{2}{\underline{?}}$ Ca

b. ${}_{92}^{?}U \rightarrow {}_{2}^{4}He + {}^{231}_{?}Th$

28. After 252 days, a 24-g sample of scandium-42 contains only 3.0 g of the isotope. What is the half-life of scandium?

29. Iodine-131, a radioisotope, has a half-life of 8 days. If the amount of iodine-131 in a sample is 4.0 g, how much iodine-131 will remain after 40 days?

D. Essay

Write a short essay for the following.

30. Explain how the sun produces its energy.