CHAPTER 28 TEST REVIEW

Name KEY Class _____ Date _____

28 NUCLEAR CHEMISTRY
CHAPTER TEST A

A. Matching

Match each description in Column A to the correct term in Column B. Write the letter of the correct term in the blank provided.

	Column A	Column B
A	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
G	3. an element that has an atomic number above 92	c. gamma radiation
C	4. the most penetrating radiation	d. Geiger counter
I	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
D	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
H	9. the penetrating rays emitted by a radioactive source	i. scintillation counter
B	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 in the blank.

_____ 11. Electromagnetic radiation includes:
a. alpha particles and X rays.
b. gamma rays and X-rays.
c. beta particles and gamma rays.
d. gamma rays and alpha particles

_____ 12. A radioisotope commonly used to detect thyroid problems is:
a. U-235 c. I-131
b. Co-60 d. C-14

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B 13. Which of the following is *not* true concerning an alpha particle?
a. It has a mass of 4 amu.
b. It has a 1+ charge.
c. It is a helium nucleus.
d. It contains two neutrons.

B 14. Ionizing radiation that is negatively charged is:
a. alpha radiation.
b. beta radiation.
c. gamma radiation.
d. X-rays.

A 15. Which type of ionizing radiation can be blocked by clothing?
a. alpha particle
b. gamma radiation
c. X radiation
d. beta particle

_____ 16. The production of carbon-14
a. occurs to a large extent in nuclear reactors.
b. is mostly due to fallout from nuclear explosions.
c. takes place in the upper atmosphere.
d. occurs during photosynthesis in plants.

B 17. Which of these naturally occurring radioisotopes would be most useful in dating objects thought to be millions of year old?
a. carbon-14, $t_{1/2} = 5.73 \times 10^3$ years
b. potassium-40, $t_{1/2} = 1.28 \times 10^9$ years
c. thorium-234, $t_{1/2} = 25$ days
d. radon-222, $t_{1/2} = 3.8$ days

D 18. A piece of wood found in an ancient burial mound contains one-fourth as much carbon-14 as a piece of wood cut from a living tree growing nearby. If the half-life ($t_{1/2}$) for carbon-14 is 5730 years, what is the approximate age of the ancient wood?
a. 1432.5 years
b. 2865 years
c. 5730 years
d. 11 460 years

B 19. If an isotope undergoes beta emission:
a. the mass number changes.
b. the atomic number changes.
c. the atomic number remains the same.
d. the number of neutrons remains the same.

_____ 20. Which of the following particles is needed to complete this nuclear equation?

$$^{55}_{25}Mn + ^{2}_{1}H \rightarrow \_\_\_ + 2\,^{0}_{1}n$$

a. $^{56}_{25}Mn$
b. $^{54}_{26}Fe$
c. $^{55}_{26}Fe$
d. $^{56}_{26}Fe$

A 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.

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A 22. In nuclear fission:
a. certain atoms break into fragments when struck by neutrons.
~~b. a chain reaction cannot occur.~~
~~c. energy is absorbed.~~
d. all of these

B 23. Nuclear fusion:
~~a. occurs when large nuclei fuse together.~~
b. takes place in the sun.
c. generally produces hydrogen nuclei.
d. all of these

_____ 24. What particle is needed to complete this equation?
$^{14}_{7}N + \_\_\_ \rightarrow ^{14}_{6}C + ^{1}_{1}H$
~~a. $^{1}_{0}n$~~ ~~c. $^{4}_{2}He$~~
~~b. $^{0}_{-1}e$~~ ~~d. $^{3}_{2}He$~~

oops! missed 1 that should've been crossed off!

~~_____ 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.~~ ~~c. the scintillation counter.~~
~~b. the Geiger counter.~~ ~~d. all of these~~

D. 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. $^{42}_{19}K \rightarrow \_^{0}_{-1}e + ^{\_}_{20}Ca$

$^{42}_{19}K \longrightarrow ^{0}_{-1}e + ^{42}_{20}Ca$

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

$^{235}_{92}U \longrightarrow ^{4}_{2}He + ^{231}_{90}Th$

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?

TWO WAYS

OPTION 1:

$N_t = 3g$

$N_o = 24g$

$t = 252$ days

$t_{1/2} = ?$

$k =$

$\frac{0.693}{k} = t_{1/2}$

$\frac{0.693}{0.00825}$

$\boxed{t_{1/2} = 84}$

$\ln\left(\frac{3}{24}\right) = -k(252d)$

$k = 0.00825$

OPTION 2:

$\frac{3}{24} = \frac{1}{8}$ $\quad \frac{1}{2}^{3} = \frac{1}{8}$

3 $\frac{1}{2}$ lives

$\frac{252 \text{ days}}{3} = \boxed{84 \text{ days}}$

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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.

Nuclear fusion. 4 Hydrogen atoms join together to make a helium atom and release energy.

TWO WAYS

OPTION 1

$N_t = ?$

$N_o = 4.0$ g

$t = 40$ days

$t_{1/2} = 8$ days

$k =$

$\frac{0.693}{k} = 8$ days

$k = 0.0866$

$\ln\left(\frac{x}{4.0g}\right) = -0.0866 \cdot 40$

$x = 0.125g$

OPTION 2

$\frac{40}{8} = 5$ $\quad \frac{1}{2}^{5} = \frac{1}{32}$

$4.0 \cdot \frac{1}{32} =$

0.125 g