Chem 51, Spring 2015 NAME_____KEY_____
Exam 2 (Chapter 2) 75 pt

Mark the answers for Questions 1-13 on your Scantron. Each Question is worth 2 pt

1) (2.1) Two atoms must represent the same element if they both have the same:
A) number of electron shells
B) atomic number
C) number of neutrons
D) atomic mass

2) (2.1) The smallest particle of an element that can be identified as that element is:
A) a proton B) a neutron C) a molecule D) an atom

3) (2.1) The neutral atom always contains:
A) the same number of protons and neutrons
B) the same number of neutrons and electrons
C) the same number of protons and electrons
D) the same number of protons, neutrons and electrons

4) (2.1) Almost all of the mass of an atom exists in its:
A) first energy level B) outermost energy level C) nucleus D) electrons

5) (2.1) Which subatomic particle contributes least to the mass of the atom?
A) Proton B) Neutron C) Electron D) All of these contribute equally.

6) (2.1) Which particle(s) are in the nucleus?
A) protons only
B) neutrons only
C) protons and neutrons
D) protons and electrons

(15 pt) (2.2) Complete the following table:

Symbol	Atomic #	Mass #	#p	#n	#e
$^{131}_{53}I$	53	131	53	78	53
$^{99}_{43}Tc$	43	99	43	56	43
$^{37}_{17}Cl$	17	37	17	20	17
$^{56}_{26}Fe^{+3}$	26	56	26	30	23

27 pt

7) (2.2) Adding one neutron to the nucleus of an atom:
A) increases the atom ic number and the mass number by one unit
B) increases its atomic mass by one unit, but does not change its atomic number
C) increases its atomic number by one unit but does not change its atomic mass
D) does not change either its atomic number or its atomic mass

8) (2.2) Isotopes have the:
A) same number of protons but different number of electrons
B) same number of protons but different number of neutrons
C) same number of neutrons but different number of electrons
D) all of the above

9) (2.3) Which of the following represents a pair of isotopes?
A) $^{14}_{6}C$, $^{14}_{7}N$ B) $^{1}_{1}H$, $^{2}_{1}H$ C) $^{32}_{16}S$, $^{32}_{16}S^{-2}$ D) O_2, O_3

10) (2.4) Of the following, the radioisotope most useful in treating disorders of the thyroid gland is:
A) C-14 B) Tc-99m C) U-238 D) I-131

11) (2.4) The form of radioactivity that penetrates matter most easily is:
A) alpha particles B) gamma rays C) beta particles D) protons

12) (2.6) The amount of a radioisotope that remains after two half-lives have passed is:
A) 98% B) 75% C) 50% D) 25%

13) (2.6) Given the following half-lives, identify which of the following radioactive nuclides would disappear first given the same initial quantities.
A) U-238 ($t_{1/2}$= 4.5x10^9 yr)
B) C-14 ($t_{1/2}$=5730 yr)
C) I-123 ($t_{1/2}$=132 min)
D) F-18 ($t_{1/2}$=110 min)

(4 pt) (2.6) Thallium-201 is a radioisotope used in brain scans. If the recommended dose is 3.0 mCi and a vial contains 60 mCi in 50 mL, how many milliliters should be injected?

? mL = 3.0 mCi

$$? \text{ mL} = 3.0 \cancel{\text{mCi}} \times \frac{50 \text{ mL}}{60 \cancel{\text{mCi}}} = 2.5 \text{ mL rounded to 1 s.f.} = 3 \text{ mL}$$

18 pt

(10 pt) (2.3) A hypothetical element contains three isotopes of mass 16.0 amu, 17.0 amu, and 18.0 amu with relative abundances of 20.0%, 50.0% and 30.0%, respectively. The average atomic mass is:

16.0 x 20.0/100 =

17.0 x 50.0/100 =

18.0 x 30.0/100 =

(9 pt) (2.5) Complete the following equations with the symbol for the atom or particle represented by the blank space. Show the mass numbers and atomic numbers of the isotopes formed or the symbols of the subatomic particles:

A) $^{210}_{84}Po \rightarrow$ $^{4}_{2}He$ + $^{206}_{82}Pb$

B) $^{234}_{91}Pa \rightarrow$ $^{234}_{92}U$ + $^{0}_{-1}e$

C) $^{240}_{94}Pu \rightarrow$ $^{236}_{92}U + ^{4}_{2}He$

(6 pt) (2.6) Krypton-81m is used for lung ventilation studies. Its half-life is 13 seconds. How long does it take the activity of this isotope to reach one-quarter of its original value? *Show your work.*

$\left(\frac{1}{2}\right)^2 = \frac{1}{4}$ (2 half lives) = 2 · 13 = 26 sec

(6 pt) (2.7) Why is a radioactive nuclide which is an alpha emitter a bad choice in medical diagnostics or imaging? *Give two reasons in a complete sentence or two.*

1. Alpha particles damage tissue because they are heavy.
2. Alpha particles are easily blocked and are not easily detected outside the body.

31 pt