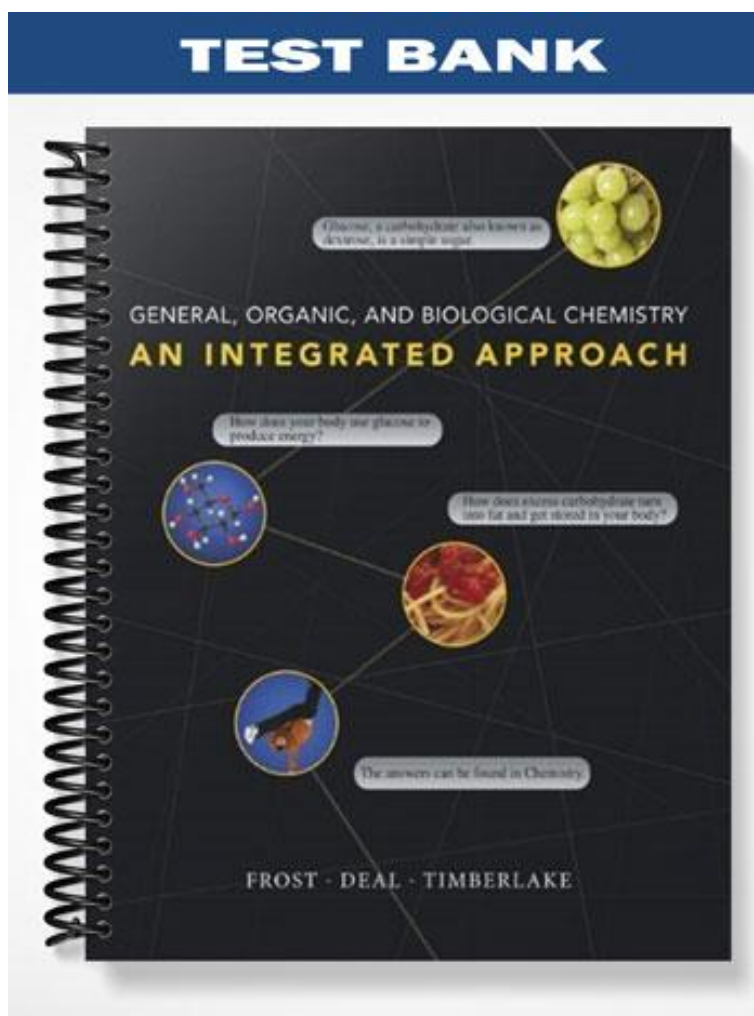


TEST BANK



General, Organic, and Biological Chemistry: An Integrated Approach (Frost)
Chapter 2 Atoms and Radioactivity

Multiple-Choice

1) Mercury-202 has how many neutrons in its nucleus?

- A) 22
- B) 102
- C) 122
- D) 202

Answer: C

Section: 2-2

2) Cobalt is element 27. Cobalt-60 is used in the medical treatment of cancer. How many neutrons and protons are contained in the nucleus of this isotope?

- A) 27 neutrons, 33 protons
- B) 33 neutrons, 27 protons
- C) 27 neutrons, 27 protons
- D) 33 neutrons, 33 protons

Answer: B

Section: 2-2

3) 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

Answer: A

Section: 2-1

4) 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

Answer: B

Section: 2-1

5) Which one of the following carries no electrical charge?

- A) An electron
- B) A proton
- C) A neutron
- D) A cation

Answer: C

Section: 2-1

6) Almost all of the mass of an atom exists in its:

- A) first energy level
- B) outermost energy level
- C) nucleus
- D) electrons

Answer: C

Section: 2-1

7) Adding one proton to the nucleus of an atom:

- A) converts it to an atom of a different element
- 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

Answer: A

Section: 2-2

8) The quantity (mass number - atomic number) provides:

- A) the number of neutrons in a nucleus
- B) the number of electrons in the first energy level
- C) the number of protons in a nucleus
- D) the combined number of all the neutrons and all the protons in a nucleus

Answer: A

Section: 2-2

9) Which subatomic particle contributes least to the mass of the atom?

- A) Proton
- B) Neutron
- C) Electron
- D) All of these contribute equally.

Answer: C

Section: 2-1

10) What are the number of neutrons in a neutral atom of Ar-40?

- A) 18
- B) 22
- C) 40
- D) 58

Answer: B

Section: 2-2

11) Which of the following represents a pair of isotopes?

- A) ${}^{14}_6\text{C}$, ${}^{14}_7\text{N}$
- B) ${}^1_1\text{H}$, ${}^2_1\text{H}$
- C) ${}^{32}_{16}\text{S}$, ${}^{32}_{16}\text{S}^{-2}$
- D) O_2 , O_3

Answer: B

Section: 2-3

12) The element rhenium (Re) exists as two stable isotopes and 18 unstable isotopes. Rhenium-185 (${}^{185}\text{Re}$) has in its nucleus:

- A) 75 protons, 75 neutrons
- B) 75 protons, 130 neutrons
- C) 130 protons, 75 neutrons
- D) 75 protons, 110 neutrons

Answer: D

Section: 2-3

13) The masses on the periodic table are expressed in what units?

- A) Grams
- B) Amu's
- C) Tons
- D) Pounds

Answer: B

Section: 2-3

14) A thimble of water contains 4.0×10^{21} molecules. The number of moles of H_2O is:

- A) 2.4×10^{45}
- B) 6.6×10^{-3}
- C) 6.6×10^{-23}
- D) 2.4×10^{23}

Answer: B

Section: 2-4

15) What is the mass of 3.61 moles of Ca?

- A) 0.090 g
- B) 144 g
- C) 40.0 g
- D) 150 g

Answer: B

Section: 2-4

16) How many electrons are in the second energy level for an atom of N?

- A) 5
- B) 6
- C) 4
- D) 8

Answer: A
Section: 2-5

17) How many electrons can be contained in the first energy level?

- A) 2
- B) 8
- C) 10
- D) 18

Answer: A
Section: 2-5

18) How many electrons can be contained in the second energy level?

- A) 2
- B) 8
- C) 10
- D) 18

Answer: B
Section: 2-5

19) An atom of phosphorous has how many valence electrons?

- A) 4
- B) 5
- C) 6
- D) 8

Answer: B
Section: 2-5

20) An atom of chlorine has how many valence electrons?

- A) 2
- B) 4
- C) 6
- D) 7

Answer: D
Section: 2-5

21) Which of the following elements contains 6 valence electrons?

- A) Si
- B) P
- C) S
- D) Cl

Answer: C
Section: 2-5

22) Which of the following elements has a filled valence shell?

- A) Ne
- B) P
- C) Se
- D) O

Answer: A

Section: 2-5

23) The element Silicon has how many electrons in each of its energy levels?

- A) 2, 8, 4
- B) 2, 6, 4
- C) 3, 5, 7
- D) 2, 8, 6

Answer: A

Section: 2-5

24) 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

Answer: D

Section: 2-6

25) Made up of helium nuclei traveling at 5-7% speed of light:

- A) alpha particles
- B) gamma rays
- C) beta particles
- D) neutrons

Answer: A

Section: 2-6

26) The form of radioactivity that penetrates matter most easily is:

- A) alpha particles
- B) gamma rays
- C) beta particles
- D) protons

Answer: B

Section: 2-6

27) Made up of electrons from the nucleus traveling at 90-95% speed of light:

- A) alpha particles
- B) gamma rays
- C) beta particles
- D) neutrons

Answer: C

Section: 2-6

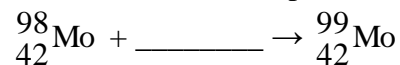
28) The radioactive particles, alpha, beta and gamma ray, are called ionizing radiation because, as they pass through an object, they:

- A) repel ions
- B) knock electrons off atoms or molecules in their path
- C) decay into ions
- D) attract ions

Answer: B

Section: 2-6

29) What radioactive particle is missing in the following nuclear reaction?

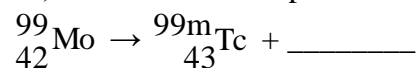


- A) ${}_{0}^{1}\text{n}$
- B) ${}_{-1}^{0}\text{e}$
- C) ${}_{2}^{4}\text{He}$
- D) ${}_{1}^{1}\text{p}$

Answer: A

Section: 2-7

30) What radioactive particle is missing in the following nuclear reaction?



- A) ${}_{0}^{1}\text{n}$
- B) ${}_{-1}^{0}\text{e}$
- C) ${}_{2}^{4}\text{He}$
- D) ${}_{1}^{1}\text{p}$

Answer: B

Section: 2-7

31) When Phosphorous-30 loses a positron what is the product of this radioactive decay?

- A) ${}_{14}^{30}\text{Si}$
- B) ${}_{16}^{30}\text{S}$
- C) ${}_{16}^{31}\text{S}$
- D) ${}_{15}^{31}\text{P}$

Answer: A

Section: 2-7

32) The amount of a radioisotope that remains after two half-lives have passed is:

- A) 98%
- B) 75%
- C) 50%
- D) 25%

Answer: D

Section: 2-8

33) The half life of a specific radionuclide is 8 days. How much of an 80 mg sample will be left after 24 days?

- A) 40 mg
- B) 20 mg
- C) 10 mg
- D) 2.7 mg

Answer: C

Section: 2-8

34) In order to have $1/16$ of a radioactive sample left how many half lives must the sample go through to reach this amount?

- A) 3
- B) 4
- C) 5
- D) 6

Answer: B

Section: 2-8

35) A fossil found in a cave was found to have a Carbon-14 ratio to carbon of $1/32$ of a live object. If the half life of Carbon-14 is 5730 yrs, how old is the object?

- A) 5730 yrs
- B) 28,650 yrs
- C) 34,480 yrs
- D) 17,190 yrs

Answer: B

Section: 2-8

Short Answer

1) Write the symbolic notation (A_ZX) for the following information.

- A) 20 protons, 20 electrons, 20 neutrons _____
 B) 16 protons, 16 electrons, 16 neutrons _____
 C) 30 protons, 30 electrons, 35 neutrons _____
 D) 92 protons, 92 electrons, 146 neutrons _____

Answer: ${}^{40}_{20}\text{Ca}$; ${}^{32}_{16}\text{S}$; ${}^{65}_{35}\text{Br}$; ${}^{238}_{92}\text{U}$

Section: 2-2

2) **Complete** the following table:

Symbol	Atomic #	Mass #	#p	#n	#e
${}^{131}_{53}\text{I}$	_____	_____	_____	_____	53
_____	43	99	43	_____	43
${}^{37}_{17}\text{Cl}$	_____	_____	17	20	_____
_____	26	56	_____	_____	23

Answer: Line 1: 53, 131, 53, 78

Line 2: ${}^{99}_{43}\text{Tc}$, 56

Line 3: 17, 37, 17

Line 4: ${}^{56}_{26}\text{Fe}$, 26, 30

Section: 2-2

3) Express the following in *exponential form*:

- A) 5765
 B) 0.000365
 C) 102,000
 D) 0.00000240
 E) 602,000,000,000
 F) 2000

Answer: A) 5.765×10^3 ; B) 3.65×10^{-4} ; C) 1.02×10^5 ; D) 2.40×10^{-6} ;

E) 6.02×10^{11} ; F) 2×10^3

Section: 2-4

4) Rewrite the following as *ordinary numbers*:

A) 6.75×10^5

B) 4.66×10^{-4}

C) 2.020×10^3

D) 1.11×10^{-2}

E) 23×10^{-5}

Answer: A) 675000; B) 0.000466; C) 2020.; D) 0.00111; E) 0.000023

Section: 2-4

5) Perform the following mathematical operations. Give the answer with the proper number of significant figures.

A) $(2.45 \times 10^5)(5.6 \times 10^4) =$

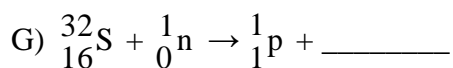
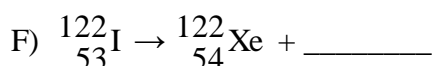
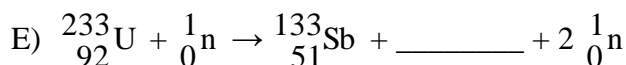
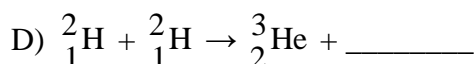
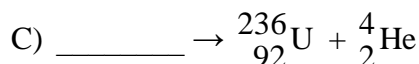
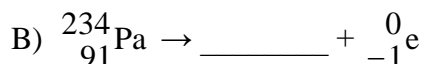
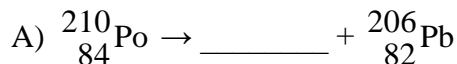
B) $(7.5 \times 10^7) \div (8.566 \times 10^5) =$

C) $(3.45 \times 10^{-9}) + (0.326 \times 10^{-9}) =$

Answer: A) 1.4×10^{10} ; B) 88; C) 3.78×10^{-9}

Section: 2-4

6) 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:



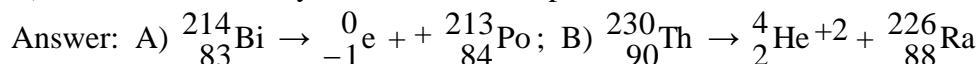
Answer: A) ${}_2^4\text{He}$; B) ${}_{92}^{234}\text{U}$; C) ${}_{94}^{240}\text{Th}$; D) ${}_0^1\text{n}$; E) ${}_{41}^{98}\text{Nb}$; F) ${}_{-1}^0\text{e}$; G) ${}_{15}^{32}\text{P}$

Section: 2-6

7) Write a nuclear equation for the following processes:

A) Bismuth-214 undergoes beta decay

B) Thorium-230 decays to a radium isotope



Section: 2-6

8) You obtain a new sample of cobalt-60, half-life 5.25 years, with a mass of 400 mg. How much cobalt-60 remains after 15.75 years?

Answer: 50 mg

Section: 2-8

9) Why can't we use Carbon-14 dating techniques to date the age of a dinosaur bone?

Answer: Because after 10 half lives there is not enough C-14 left to measure it is less than 0.1 % of the original value and dinosaurs lived over one billion years ago.

Section: 2-8

10) A 100-mg technetium-99m sample is used in a medical study. How much of the Technetium-99m sample remains after 24 hours? The half-life of Tc-99m is 6 hours.

Answer: 24 hours/6 hours = 4 half lives; 100 mg → 50 mg → 25 mg → 12.5 mg → 6.25 mg

Section: 2-8

11) 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?

Answer: $1 \rightarrow 1/2 \rightarrow 1/4$, so that is two half lives; therefore 26 secs

Section: 2-8

12) In order for a radionuclide to be used for medical diagnosis it must have certain properties. Name two and explain why.

Answer: They must have a short half life in order to disappear from the body as soon as possible and they should either be a beta or gamma ray emitter.

Section: 2-9