Chemistry Comes Alive: Chapter 2, Part A

2 __________
• Anything that has _____ and occupies ______
• States of matter:
  1. ______—definite ______ and ______
  2. ______—definite volume, __________ _______
  3. ______—__________ shape and volume

3 __________
• Capacity to do _______ or put matter into _______

__________ of energy:
• ______—energy in _______
• ______—_________ (inactive) energy

4 Forms of Energy
• _______ energy—stored in _______ of chemical substances
• _______ energy—results from _______ of charged ______
• _______ energy—directly involved in _______ _______
• _______ or _______ energy—exhibits _______ properties (i.e., visible ______, ultraviolet light, and _______)

5 Energy Form Conversions
• _______ may be _______ from one _______ to another
• Conversion is _______ because some _______ is _______ as _______

6 FYI

7 __________ of Matter
• _______
  • ________ be _______ _____ by ________ chemical means
• Each has ________ properties:
  • __________I properties
    • Are ________ with our ________, or are ________
  • ____________properties
    • How atoms ________ (bond) with _____ ________

8__________ of Matter
• ________
  Unique __________ ________ for each ________
• __________ ________: one- or two-letter chemical ____________
  for each element

9 Periodic table

10 Na

11 Major __________ of the Human Body
• __________ (O)
• Carbon _____
• __________ (H)
• Nitrogen _____

12 ________ Elements of the Human Body
• About 3.9% of body mass:
  • Calcium _____ phosphorus _____ potassium _____, sulfur _____
    sodium _____ chlorine _____ magnesium _____ iodine (I), and
    iron ________

13 Trace Elements of the Human Body
• < 0.01% of body mass:
  • Part of enzymes, e.g., chromium _____ manganese _____ and
14 Atomic Structure
• _________ by _________ of subatomic _________
• _________ consists of _________ and _________

15 Atomic Structure
• _________
  • ___ charge
  • Mass = ___ _________ _________ unit (amu)
• _________
  • _________ charge
  • Mass = 1 amu

16 Atomic _________
• _________
  • _________ nucleus
  • _________ in number to _________ in atom
  • _________ charge
  • 1/2000 the mass of a proton (0 amu)

17 _________ of the Atom
• _________ model: current model used by chemists
  • Depicts _________ regions of greatest electron density (an _________ _________)
  • Useful for predicting chemical behavior of atoms

18 Models of the Atom
• _________ model—___________, outdated model
  • Incorrectly depicts _________ circular electron paths
  • Useful for _________ (as in the text)
20 Elements
• Atoms of ________ ________ contain _________ numbers of subatomic_________
  • Compare hydrogen, helium and lithium (next slide)

21 Figure 2.2 pg.27

22 Identifying Elements
• Atomic number = number of _________ in nucleus

23 Identifying Elements
• _______number = mass of the _______ and _______
  • Mass numbers of _____ of an element are ___ all _______

  • Isotopes are ________ ________of elements that differ in the number of _______ they contain

24 Identifying Elements
• _______ _______ = _______ of mass numbers of ____ isotopes

24 Figure 2.2 pg. 27 ????

26 Radioisotopes
• Spontaneous decay (___________)
• _______ chemistry to _______ isotopes
• Can be _________ with _________

27 Radioisotopes
Physio Chapter 2 part A student fill in notes Spring 2017

- Valuable _______ for biological research and medicine
- Cause __________ to living tissue:
  - __________ against localized cancers
  - Radon from uranium decay causes _____ cancer

28 Molecules and Compounds
- Most atoms __________ _________ with other atoms to form _________ and _________
  - Molecule—two or more ______ ________ _________ (e.g., H₂ or C₆H₁₂O₆)
  - Compound—two or more ______________ _________ of atoms bonded together (e.g., C₆H₁₂O₆)

29 Mixtures
- Most matter exists as mixtures
  - Two or more _______________ physically intermixed
- Three types of mixtures
  - __________
  - __________
  - __________

30 Solutions
- Homogeneous mixtures
- Usually transparent, e.g., atmospheric air or seawater
  - __________
  - Present in _____________t amount, usually a___________
- Solute(s)
  - Present in _______ amounts

31 Concentration of Solutions
- Expressed as
• ________, or parts per 100 parts
• Milligrams per deciliter (mg/dl)
• Molarity, or moles per liter (M)
  • 1 mole = the atomic weight of an element or molecular weight (sum of atomic weights) of a compound in grams
  • 1 mole of any substance contains $6.02 \times 10^{23}$ molecules (Avogadro’s number)

32 Concentrations and solutions

33 Concentrations and solutions

34 Concentrations and solutions

35 Colloids and Suspensions
• Colloids (emulsions)
  • Heterogeneous translucent mixtures, e.g., cytosol
  • _________ solute particles that ___ ______ settle out
  • Undergo sol-gel transformations
• Suspensions:
  • Heterogeneous mixtures, e.g., blood
  • Large ________ solutes tend to ________ _______

36 figure 2.4 page 29

37 Mixtures vs. Compounds
• ____________
  • ___ _______ _______ between components
  • ____ ___ _________ ____________, such as by straining or filtering
  • Heterogeneous or homogeneous
• ____________
  • Can be separated only by _________ _________
  • All are homogeneous

38 __________ _______
• _______ occupy up to seven _______ _______ (energy levels) around _______
• Octet rule: Except for the first shell which is full with two electrons, atoms interact in a manner to have _______ _________ in their ___________energy level (__________ _________)

39 Chemically ________ Elements
• ________ and __________
• _________ energy level fully occupied or contains ________ electrons

40 orbital diagram

41 Figure 2.5 page 31

42 Chemically Reactive Elements
• Outermost energy level _______ _______ _______ by electrons
• Tend to _____, _____, or _____ electrons (form ______) with other atoms to achieve _______

43  Figure 2.5  pg.31

44  Types of _________ Bonds
• _____
• _________
• _________

45  _______ Bonds
• _____ are formed by _________ of valence shell _________ between atoms
  • _______ (− charge) have _______ one or more electrons
  • _______ ( + charge) have _______ one or more electrons
  • _________ of opposite charges results in an _______ bond

46  Figure 2.6,  pg.32

47  Formation of an Ionic Bond
• Ionic compounds form _________ instead of individual molecules
  • NaCl (sodium chloride)

48  Figure 2.6  pg. 32

49.  _________ Bonds
• Formed by _________ of two or more _______ shell _________
• Allows each atom to fill its valence shell at least ______ of the time

50  Figure 2.7a , pg.33

51 Figure 2.7b , pg.33

52 Figure 2.7c , pg.33

53  Covalent Bonds
• Sharing of electrons may be _______ or _________
  • _________ sharing produces electrically _________ nonpolar molecules
    . CO₂

54  Figure 2.8, pg.34

55  Covalent Bonds
• _______ sharing by atoms with different electron-attracting abilities produces _________ molecules
  • H₂O
    • Atoms with _____ _____ _______ valence shell electrons are electronegative, e.g., oxygen
    • Atoms with ___ __ _____ valence shell electrons are ____________, e.g., sodium

56  Figure 2.8 b, pg. Figure 2.8 b, pg.4

57  Figure 2.9 pg.34
58 ___________ Bonds
• __________ _______ between _______________ hydrogen of one molecule and an __________ atom of another molecule
  • Common between dipoles such as water
  • Also act as __________ __________, holding a large molecule in a three-dimensional shape

59 Fig. 2.10a, pg.35

60 Fig. 2.10b, pg.35

61 ___________ Reactions
• Occur when _______ _____ are ________, ___________, or ____________
• Represented as chemical ____________
• Chemical equations contain:
  • __________ _______ for each reactant and product
  • Relative amounts of reactants and products, which should balance

62 Examples of Chemical Equations
H + H → H₂ (hydrogen gas)
4H + C → CH₄ (methane)

63 Patterns of Chemical Reactions
• ___________ (combination) reactions
• _______________ reactions
• ___________ reactions

64 Synthesis Reactions
• A + B → AB
  • Always involve bond __________
66 Decomposition Reactions
• AB → A + B
  • _________ synthesis reactions
  • Involve _________ of bonds
  • _________

67 Figure 2.11b, pg. 36

68 Exchange Reactions
• AB + C → AC + B
  • Also called _________ reactions
  • Bonds are both ______ and _________

68 Figure 2.11c, pg. 36

70 Oxidation-Reduction (_______) Reactions
• ____________ reactions: Reactions in which fuel is broken down for ______
• Also called exchange reactions because electrons are exchanged or shared differently
  • Electron donors ______ electrons and are _________
  • Electron acceptors _______ electrons and become _________

71 Chemical Reactions
• All chemical reactions are either exergonic or endergonic
  • ____________ reactions—_______ energy
Physio Chapter 2 part A student fill in notes Spring 2017

- Catabolic reactions
- __________ reactions—products ________ _____ ________ energy than did reactants
- Anabolic reactions

72 Chemical Reactions
- All chemical reactions are theoretically reversible
  - A + B → AB
  - AB → A + B
- Chemical __________ occurs if neither a forward _____ reverse reaction is dominant
- Many biological reactions are essentially irreversible due to
  - Energy requirements
  - Removal of products

73 Rate of Chemical Reactions
- Rate of reaction is influenced by:
  - ↑ temperature → ↑ rate
  - ↓ particle size → ↑ rate
  - ↑ concentration of reactant → ↑ rate
- Catalysts: ↑ rate without being chemically changed
  - Enzymes are biological catalysts
Physio Chapter 2 part A student fill in notes Spring 2017

![Periodic Table of Elements with Sodium (Na) highlighted](image_url)

- Atomic number
- Electrons in each energy level
- Element symbol
- Element name
- Average atomic mass

**Sodium**

11

2

8

1

22.990