Chapter 2: Matter and Energy

MULTIPLE CHOICE

1. Which of the following correctly matches each sample with its classification as macroscopic, microscopic, or particulate?

	Macroscopic	Microscopic	Particulate
a.	protein molecule	cat hair	plant cell
b.	protein molecule	plant cell	cat hair
c.	plant cell	cat hair	protein molecule
d.	cat hair	plant cell	protein molecule
e.	cat hair	protein molecule	plant cell

ANS: D
Analysis:
A. Incorrect. See Section 2.1, Goal 1.
B. Incorrect. See Section 2.1, Goal 1.
C. Incorrect. See Section 2.1, Goal 1.
D. Correct
E. Incorrect. See Section 2.1, Goal 1.

PTS: 1

2. Which of the following is *not* a particulate sample of matter?
   a. An oxygen molecule
   b. A human egg cell
   c. An electron
   d. A nickel atom
   e. A hemoglobin molecule

ANS: B
Analysis:
A. Incorrect. See Section 2.1, Goal 1.
B. Correct.
C. Incorrect. See Section 2.1, Goal 1.
D. Incorrect. See Section 2.1, Goal 1.
E. Incorrect. See Section 2.1, Goal 1.

PTS: 1

3. Which is the best definition of the term *model,* as it is used in chemistry?
   a. A product from a kit from which molecules can be constructed
   b. A computer image of a molecule
   c. A representation of something else
   d. A person who is photographed for scientific journals
   e. A graph that shows the relationship between two variables

ANS: C
Analysis:
A. Incorrect. See Section 2.1, Goal 2.
B. Incorrect. See Section 2.1, Goal 2.
C. Correct.

D. Incorrect. See Section 2.1, Goal 2.
E. Incorrect. See Section 2.1, Goal 2.

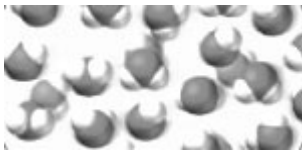
PTS: 1

4. Why do chemists use models of atoms and molecules?
   a. Use of models is more convenient and less expensive than using photographs from microscopes
   b. Matter at the particulate level is too small to be seen
   c. Chemists follow the tradition established by Watson and Crick
   d. High-powered electron microscopes create computerized models of atoms and molecules
   e. To illustrate textbooks and scientific reports with more color than black-and-white photographs of the atoms and molecules

   ANS: B
   Analysis:
   A. Incorrect. See Section 2.1, Goal 2.
   B. Correct.
   C. Incorrect. See Section 2.1, Goal 2.
   D. Incorrect. See Section 2.1, Goal 2.
   E. Incorrect. See Section 2.1, Goal 2.

   PTS: 1

5. Which state of matter is illustrated below?



   a. Gas
   b. Liquid
   c. Solid
   d. Both gas and solid
   e. Both liquid and solid

   ANS: B
   Analysis:
   A. Incorrect. See Section 2.2, Goal 3.
   B. Correct.
   C. Incorrect. See Section 2.2, Goal 3.
   D. Incorrect. See Section 2.2, Goal 3.
   E. Incorrect. See Section 2.2, Goal 3.

   PTS: 1

6. Which of the following does *not* describe the gaseous state?
   a. Same shape as a closed container
   b. Same volume of a closed container
   c. Random, independent particle movement
   d. Easily compressed
   e. All describe the gaseous state

ANS: E
Analysis:
A. Incorrect. See Section 2.2, Goal 3.
B. Incorrect. See Section 2.2, Goal 3.
C. Incorrect. See Section 2.2, Goal 3.
D. Incorrect. See Section 2.2, Goal 3.
E. Correct.

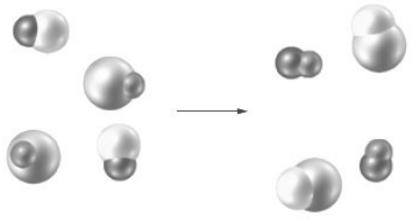
PTS: 1

7. Which of the following does *not* describe the liquid state?
   a. Independent particle movement below the surface
   b. Same shape as the bottom of the container
   c. Constant volume
   d. Pourable
   e. All describe the liquid state

ANS: E
Analysis:
A. Incorrect. See Section 2.2, Goal 3.
B. Incorrect. See Section 2.2, Goal 3.
C. Incorrect. See Section 2.2, Goal 3.
D. Incorrect. See Section 2.2, Goal 3.
E. Correct..

PTS: 1

8. Examine the following particulate-level representation.



This change might be shown symbolically as which of the following?

a. $H_2O_2 \longrightarrow H_2 + O_2$

b. $NaCl + AgNO_3 \longrightarrow AgCl + NaNO_3$

c. $AgCl + NaI \longrightarrow AgI + NaCl$

d. $CO_2 \longrightarrow C + O_2$

e. $Ca + Cl_2 \longrightarrow CaCl_2$

ANS: C
Analysis:
A. Incorrect. See Section 2.8, Goal 13.
B. Incorrect. See Section 2.8, Goal 13.
C. Correct.
D. Incorrect. See Section 2.8, Goal 13.
E. Incorrect. See Section 2.8, Goal 13.

PTS: 1

9. Which of the following properties is/are classified as physical?
i. The odor of glass cleaning solution
ii. The color of chlorine gas
iii. The electrical conductivity of copper wire
iv. The ability of milk to sour
v. A compound does not react with bromine
a. i only
b. ii only
c. i and ii
d. i, ii, and iii
e. iv and v

ANS: D
Analysis:
A. Incorrect. See Section 2.3, Goal 4.
B. Incorrect. See Section 2.3, Goal 4.
C. Incorrect. See Section 2.3, Goal 4.
D. Correct.
E. Incorrect. See Section 2.3, Goal 4.

PTS: 1

10. Which of the following properties is/are classified as chemical?
i. The taste of honey
ii. The ability of hair to stretch
iii. The corrosive character of hydrochloric acid
iv. The combustibility of ethanol
v. The softness of talc
a. i and ii
b. i, ii, and v
c. iii only
d. iv only
e. iii and iv

ANS: E
Analysis:
A. Incorrect. See Section 2.3, Goal 4.
B. Incorrect. See Section 2.3, Goal 4.
C. Incorrect. See Section 2.3, Goal 4.
D. Incorrect. See Section 2.3, Goal 4.
E. Correct.

PTS: 1

11. Which of the following is a chemical property?
a. Combustibility
b. Boiling point
c. Density
d. Color
e. Shape

ANS: A
Analysis:
A. Correct.
B. Incorrect. See Section 2.3, Goal 4.

C. Incorrect. See Section 2.3, Goal 4.
D. Incorrect. See Section 2.3, Goal 4.
E. Incorrect. See Section 2.3, Goal 4.

PTS: 1

12. Which of the following changes is/are classified as chemical?
i. Dissolving vinegar in water
ii. Evaporation of rubbing alcohol
iii. Crushing rock
iv. Fermenting apple juice
v. Softening a glass tube by heating it
a. i only
b. iv only
c. i and iv
d. i and ii
e. i, iv, and v

ANS: B
Analysis:
A. Incorrect. See Section 2.3, Goal 5.
B. Correct.
C. Incorrect. See Section 2.3, Goal 5.
D. Incorrect. See Section 2.3, Goal 5.
E. Incorrect. See Section 2.3, Goal 5.

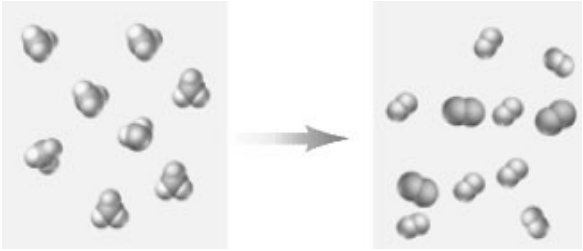
PTS: 1

13. Which of the following changes is/are classified as physical?
i. Carving a block of ice into a sculpture
ii. Burning wood
iii. Souring of cream
iv. Rusting of steel
v. Dissolving salt in water
a. i only
b. v only
c. i and v
d. ii, iii, and iv
e. ii, iii, iv, and v

ANS: C
Analysis:
A. Incorrect. See Section 2.3, Goal 5.
B. Incorrect. See Section 2.3, Goal 5.
C. Correct.
D. Incorrect. See Section 2.3, Goal 5.
E. Incorrect. See Section 2.3, Goal 5.

PTS: 1

14. Consider the following image.



Which of the following most accurately describes the change represented in the image?
a. A chemical change which follows conservation of mass.
b. A physical change which does not follow conservation of mass.
c. A physical change which follows conservation of mass.
d. A chemical change which does not follow conservation of mass.

ANS: D
Analysis:
A. Incorrect. See Section 2.3, Goal 5 and Section 2.9, Goal 16.
B. Incorrect. See Section 2.3, Goal 5 and Section 2.9, Goal 16.
C. Incorrect. See Section 2.3, Goal 5 and Section 2.9, Goal 16.
D. Correct.

PTS: 1

15. Which of the following can be a pure substance?
i. Gold
ii. Air
iii. Homogenized milk
iv. Sugar completely dissolved in water
v. Ice
a. ii and iv
b. ii and iii
c. i and iii
d. i and v
e. ii, iii, and iv

ANS: D
Analysis:
A. Incorrect. See Section 2.4, Goal 6.
B. Incorrect. See Section 2.4, Goal 6.
C. Incorrect. See Section 2.4, Goal 6.
D. Correct.
E. Incorrect. See Section 2.4, Goal 6.

PTS: 1

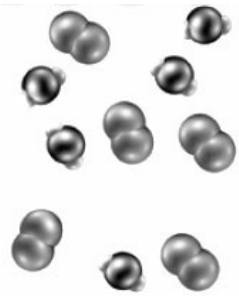
16. Which of the following would be classified is a mixture of an element and a compound?
a.

b.

c.

d.

e.



ANS: E
Analysis:
A. Incorrect. See Section 2.4, Goal 6.
B. Incorrect. See Section 2.4, Goal 6.
C. Incorrect. See Section 2.4, Goal 6.
D. Incorrect. See Section 2.4, Goal 6.

E. Correct.

PTS: 1

17. Which of the following does *not* describe a mixture?
    a. Two or more pure substances
    b. Distinct set of physical and chemical properties
    c. Components can be separated by physical changes
    d. Boiling temperature of a solution will increase with time
    e. All of the above describe a mixture

    ANS: B
    Analysis:
    A. Incorrect. See Section 2.4, Goal 6.
    B. Correct.
    C. Incorrect. See Section 2.4, Goal 6.
    D. Incorrect. See Section 2.4, Goal 6.
    E. Incorrect. See Section 2.4, Goal 6.

    PTS: 1

18. Which of the following correctly describes a homogeneous sample?
    a. Uniform appearance and composition throughout
    b. Visibly different parts or phases
    c. A mixture of diamond and graphite, which are both forms of carbon
    d. Reacts with all elements
    e. Reacts with all natural elements

    ANS: A
    Analysis:
    A. Correct.
    B. Incorrect. See Section 2.4, Goal 7.
    C. Incorrect. See Section 2.4, Goal 7.
    D. Incorrect. See Section 2.4, Goal 7.
    E. Incorrect. See Section 2.4, Goal 7.

    PTS: 1

19. Which of the following substances is/are homogeneous?
    i. Mineral oil
    ii. A plant leaf
    iii. Sausage
    iv. Sugar
    v. Freshly squeezed lemonade
    a. ii and iv
    b. i and iii
    c. ii and iii
    d. i and iv
    e. i, iv, and v

    ANS: D
    Analysis:
    A. Incorrect. See Section 2.4, Goal 7.
    B. Incorrect. See Section 2.4, Goal 7.
    C. Incorrect. See Section 2.4, Goal 7.

D. Correct.
E. Incorrect. See Section 2.4, Goal 7.

PTS: 1

20. Which of the following substances is/are heterogeneous?
i. Gasoline
ii. A gold bar
iii. A freshly opened can of cola
iv. Potato chips
v. A bacon strip
a. i and ii
b. iii, iv, and v
c. i, iv, and v
d. i, ii, and iv
e. ii, iii, and v

ANS: B
Analysis:
A. Incorrect. See Section 2.4, Goal 7.
B. Correct.
C. Incorrect. See Section 2.4, Goal 7.
D. Incorrect. See Section 2.4, Goal 7.
E. Incorrect. See Section 2.4, Goal 7.

PTS: 1

21. Most methods for separating mixtures into their components depend on which of the following?
a. Differing physical properties among the components
b. Differing chemical properties among the components
c. Differing electromagnetic properties among the components
d. Differing normalized properties among the components
e. Differing spectroscopic properties among the components.

ANS: A
Analysis:
A. Correct.
B. Incorrect. See Section 2.5, Goal 8.
C. Incorrect. See Section 2.5, Goal 8.
D. Incorrect. See Section 2.5, Goal 8.
E. Incorrect. See Section 2.5, Goal 8.

PTS: 1

22. Which of the following properties is *distillation* based upon?
a. Pore size of the filtration device
b. Relative densities
c. Inhomogeneity of the viscosities
d. Boiling points
e. Melting points

ANS: D
Analysis:
A. Incorrect. See Section 2.5, Goal 8.
B. Incorrect. See Section 2.5, Goal 8.

C. Incorrect. See Section 2.5, Goal 8.
D. Correct.
E. Incorrect. See Section 2.5, Goal 8.

PTS: 1

23. Which of the following statements is *false*?
    a. Both elements and compounds are pure substances
    b. The properties of a compound vary
    c. An element cannot be decomposed chemically into other pure substances
    d. A compound can be separated into other substances by chemical means
    e. All of the above are true; none is false

    ANS: B
    Analysis:
    A. Incorrect. See Section 2.6, Goal 9.
    B. Correct.
    C. Incorrect. See Section 2.6, Goal 9.
    D. Incorrect. See Section 2.6, Goal 9.
    E. Incorrect. See Section 2.6, Goal 9.

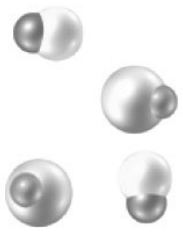
    PTS: 1

24. Which of the following are elements?
    i. KOH
    ii. Ne
    iii. CO
    iv. Carbon tetrachloride
    v. Calcium
    a. i, ii, and iii
    b. iv and v
    c. ii and iii
    d. ii and v
    e. ii, iii, and v

    ANS: D
    Analysis:
    A. Incorrect. See Section 2.6, Goal 9.
    B. Incorrect. See Section 2.6, Goal 9.
    C. Incorrect. See Section 2.6, Goal 9.
    D. Correct.
    E. Incorrect. See Section 2.6, Goal 9.

    PTS: 1

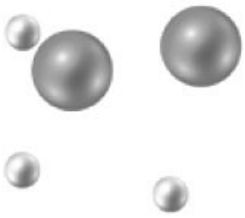
25. Which of the following particulate-level picture might be associated with the name “silver”?
    a.



b.

c.

d.



e.

ANS: B
Analysis:
A. Incorrect. See Section 2.6, Goal 9 and 10.
B. Correct.
C. Incorrect. See Section 2.6, Goal 9 and 10.
D. Incorrect. See Section 2.6, Goal 9 and 10.
E. Incorrect. See Section 2.6, Goal 9 an d10.

PTS: 1

26. What type of pure substance can be decomposed chemically into other pure substances?
    a. A compound
    b. An element
    c. A mixture
    d. A solution
    e. Heterogeneous matter

    ANS: A
    Analysis:
    A. Correct.
    B. Incorrect. See Section 2.6, Goal 9.
    C. Incorrect. See Section 2.6, Goal 9.
    D. Incorrect. See Section 2.6, Goal 9.

E. Incorrect. See Section 2.6, Goal 9.

PTS: 1

27. Which of the following are compounds?
i. Carbon dioxide
ii. Silicon
iii. Sodium carbonate
iv. I_2
v. Cr
a. i, ii, and iii
b. iv and v
c. i and iii
d. i, iii, and iv
e. ii and v

ANS: C
Analysis:
A. Incorrect. See Section 2.6, Goal 9.
B. Incorrect. See Section 2.6, Goal 9.
C. Correct.
D. Incorrect. See Section 2.6, Goal 9.
E. Incorrect. See Section 2.6, Goal 9.

PTS: 1

28. Which of the following is *false*?
a. IF is the formula of a compound
b. An elemental symbol is a capital letter, sometimes followed by a small letter
c. If there is only one atom of an element in a formula unit, it is indicated with a subscript "1"
d. H_2 is the formula of an element
e. The properties of compounds are always different from the properties of the elements from which they are formed

ANS: C
Analysis:
A. Incorrect. See Section 2.6, Goal 10.
B. Incorrect. See Section 2.6, Goal 10.
C. Correct.
D. Incorrect. See Section 2.6, Goal 10.
E. Incorrect. See Section 2.6, Goal 10.

PTS: 1

29. Consider the particulate-level illustration:

Which is the best classification of this particle?
a. Atom
b. Crystalline solid
c. Molecule

d. Mixture
e. Heterogeneous mixture

ANS: C
Analysis:
A. Incorrect. See Section 2.6, Goal 11.
B. Incorrect. See Section 2.6, Goal 11.
C. Correct.
D. Incorrect. See Section 2.6, Goal 11.
E. Incorrect. See Section 2.6, Goal 11.

PTS: 1

30. Consider the particulate-level illustration:

Which is the best classification of this particle-level illustration?
a. Molecule
b. Element
c. Solid
d. Crystalline solid
e. Atom

ANS: D
Analysis:
A. Incorrect. See Section 2.6, Goal 11.
B. Incorrect. See Section 2.6, Goal 11.
C. Incorrect. See Section 2.6, Goal 11.
D.Correct
E. Incorrect. See Section 2.6, Goal 11.

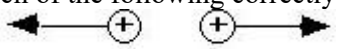
PTS: 1

31. The formula of most elements is the same as the symbol of the element. This indicates that the element is stable as a single __(i)__, the smallest unit particle of the element. Other elements exist as stable, distinct, and independent __(ii)__, which are made up of two or more atoms.
a. (i) molecule; (ii) particles
b. (i) molecule; (ii) crystalline solids
c. (i) crystalline solid; (ii) molecules
d. (i) atom; (ii) mixtures
e. (i) atom; (ii) molecules

ANS: E
Analysis:
A. Incorrect. See Section 2.6, Goal 11.
B. Incorrect. See Section 2.6, Goal 11.
C. Incorrect. See Section 2.6, Goal 11.
D. Incorrect. See Section 2.6, Goal 11.

E. Correct.

PTS: 1

32. Which of the following correctly represents electrostatic forces?
    a. 
    b. 
    c. 
    d. 
    e. All of the above are correct.

ANS: A

Analysis:
A. Correct.
B. Incorrect. See Section 2.7, Goal 12.
C. Incorrect. See Section 2.7, Goal 12.
D. Incorrect. See Section 2.7, Goal 12.
E. Incorrect. See Section 2.7, Goal 12.

PTS: 1

33. Which of the following is *false*?
    a. Two objects, both having positive charge, repel each other
    b. Two objects having unlike charges attract each other
    c. Electrostatic forces are responsible for the energy absorbed or released in chemical changes
    d. The region in space where magnetic or electrostatic forces are effective is called a force field
    e. All of the above are true

ANS: E
Analysis:
A. Incorrect. See Section 2.7, Goal 12.
B. Incorrect. See Section 2.7, Goal 12.
C. Incorrect. See Section 2.7, Goal 12.
D. Incorrect. See Section 2.7, Goal 12.
E. Correct.

PTS: 1

34. In which of the following pairs of substances will there be a net attractive electrostatic force?
    a. Two positively charged table tennis balls
    b. A negatively charged piece of dust and a positively charged piece of dust
    c. A positively charged sodium ion and a positively charged potassium ion
    d. A negatively charged chloride ion and a negatively charged bromide ion
    e. Two negatively charged pith balls

ANS: B
Analysis:
A. Incorrect. See Section 2.7, Goal 12.

B. Correct.
C. Incorrect. See Section 2.7, Goal 12.
D. Incorrect. See Section 2.7, Goal 12.
E. Incorrect. See Section 2.7, Goal 12.

PTS: 1

35. Identify the reactants and the products in the equation $H_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2\ HCl$.
    a. Reactants: H_2SO_4 and HCl Products: $BaCl_2$ and $BaSO_4$
    b. Reactants: $BaCl_2$ and $BaSO_4$ Products: H_2SO_4 and HCl
    c. Reactants: $BaSO_4$ and HCl Products: H_2SO_4 and $BaCl_2$
    d. Reactants: H_2SO_4 and $BaCl_2$ Products: $BaSO_4$ and HCl
    e. Reactants: H and Ba Products: SO_4 and Cl

ANS: D
Analysis:
A. Incorrect. See Section 2.8, Goal 13.
B. Incorrect. See Section 2.8, Goal 13.
C. Incorrect. See Section 2.8, Goal 13.
D. Correct.
E. Incorrect. See Section 2.8, Goal 13.

PTS: 1

36. Examine the apparatus shown in the following image.

This apparatus would useful in which of the following separations?
    a. oxygen from nitrogen dioxide
    b. sand from a mixture of sand and water
    c. rubbing alcohol from a mixture of rubbing alcohol and water
    d. iron filings from cereal
    e. hydrogen and oxygen from water

ANS: C
Analysis:
A. Incorrect. See Section 2.5, Goal 8
B. Incorrect. See Section 2.5, Goal 8.
C. Correct.
D. Incorrect. See Section 2.5, Goal 8.
E. Incorrect. See Section 2.5, Goal 8.

PTS: 1

37. Identify the product(s) that is/are (a) compound(s) in the equation $Zn + CoCl_2 \rightarrow ZnCl_2 + Co$.
    a. $CoCl_2$
    b. $ZnCl_2$
    c. $CoCl_2$ and $ZnCl_2$
    d. $ZnCl_2$ and Co
    e. Zn and $CoCl_2$

    ANS: B
    Analysis:
    A. Incorrect. See Section 2.8, Goal 13.
    B. Correct.
    C. Incorrect. See Section 2.8, Goal 13.
    D. Incorrect. See Section 2.8, Goal 13.
    E. Incorrect. See Section 2.8, Goal 13.

    PTS: 1

38. Which of the following changes is/are endothermic for the underlined object?
    i. baking a potato
    ii. a person being burned by a pan
    iii. a wood log burning
    iv. a lit light bulb shining
    v. a person digesting food
    a. iii only
    b. iii and iv
    c. iii and iv
    d. i and iv
    e. i and ii

    ANS: E
    Analysis:
    A. Incorrect. See Section 2.8, Goal 14.
    B. Incorrect. See Section 2.8, Goal 14.
    C. Incorrect. See Section 2.8, Goal 14.
    D. Incorrect. See Section 2.8, Goal 14.
    E. Correct.

    PTS: 1

39. Which of the following changes is/are exothermic for the underlined object?
    i. ice melts
    ii. hot french fries cool
    iii. a beaker warms as chemicals react within it
    iv. a hot plate warms a beaker of water
    v. water evaporates off of skin
    a. iii and iv
    b. i and v
    c. ii only
    d. All are exothermic
    e. None is exothermic

    ANS: C
    Analysis:
    A. Incorrect. See Section 2.8, Goal 14.

B. Incorrect. See Section 2.8, Goal 14.
C. Correct.
D. Incorrect. See Section 2.8, Goal 14.
E. Incorrect. See Section 2.8, Goal 14.

PTS: 1

40. Which of the following statements is *false*?
    a. A chemical change that releases energy to its surroundings is called an exothermic reaction
    b. A chemical change that absorbs energy from its surroundings is called an endothermic reaction
    c. "Sodium + Fluorine $\rightarrow$ Sodium fluoride + Energy" is an example of an exothermic reaction
    d. "2 A_2B + Energy $\rightarrow$ 2 A_2 + B_2" is an example of an exothermic reaction
    e. All of the above are true.

ANS: D
Analysis:
A. Incorrect. See Section 2.8, Goal 14.
B. Incorrect. See Section 2.8, Goal 14.
C. Incorrect. See Section 2.8, Goal 14.
D. Correct.
E. Incorrect. See Section 2.8, Goal 14.

PTS: 1

41. A book is pushed off a table, and it falls to the floor. Which of the following statements about the book is *false*?
    a. Its potential energy is at a maximum just as it leaves the table
    b. Its kinetic energy is at a maximum just before it hits the floor
    c. Its kinetic energy is equal to its potential energy at a point halfway between the table and the floor
    d. Its potential energy is reduced
    e. All of the above are true

ANS: E
Analysis:
A. Incorrect. See Section 2.8, Goal 15.
B. Incorrect. See Section 2.8, Goal 15.
C. Incorrect. See Section 2.8, Goal 15.
D. Incorrect. See Section 2.8, Goal 15.
E. Correct.

PTS: 1

42. Which of the following statements is *false*?
    a. As a positively charged object moves toward a negatively charged object, their potential energy increases
    b. As a positively charged object moves toward another positively charged object, their potential energy increases
    c. As a negatively charged object moves toward another negatively charged object, their potential energy increases
    d. Increasing the distance between two electrically charged objects may raise or lower their potential energy

e. All of the above are true

ANS: A
Analysis:
A. Correct.
B. Incorrect. See Section 2.8, Goal 15.
C. Incorrect. See Section 2.8, Goal 15.
D. Incorrect. See Section 2.8, Goal 15.
E. Incorrect. See Section 2.8, Goal 15.

PTS: 1

43. Which of the following statements is *false*?
    a. The potential energy of an object depends on its position in a field where forces of attraction and/or repulsion are present
    b. Any moving object has kinetic energy
    c. Minimization of energy is one of the driving forces that cause chemical reactions to occur
    d. Kinetic energy is always greater than potential energy for an object
    e. Most of what we call "mechanical energy" is kinetic energy

    ANS: D
    Analysis:
    A. Incorrect. See Section 2.8, Goal 15.
    B. Incorrect. See Section 2.8, Goal 15.
    C. Incorrect. See Section 2.8, Goal 15.
    D. Correct.
    E. Incorrect. See Section 2.8, Goal 15.

    PTS: 1

44. When freshly cut sodium metal is exposed to air, the mass of the substance increases. Which of the following is the best explanation for this apparent violation of the Law of Conservation of Mass?
    a. The air "pushes down" on the metal, causing the balance to display a falsely high mass
    b. The sodium atoms move closer to one another, causing the sample to gain mass
    c. The sodium reacts with a component of the air, and the total mass of the reactants is equal to the total mass of the products
    d. Thermal energy of the air is converted into the additional mass
    e. The Law of Conservation of Mass does not apply to metals

    ANS: C
    Analysis:
    A. Incorrect. See Section 2.9, Goal 16.
    B. Incorrect. See Section 2.9, Goal 16.
    C. Correct.
    D. Incorrect. See Section 2.9, Goal 16.
    E. Incorrect. See Section 2.9, Goal 16.

    PTS: 1

45. When paper is burned, the mass of the remaining ash is less than the mass of the original paper. Which of the following is the best explanation for this apparent violation of the Law of Conservation of Mass?
    a. Some of the mass is converted into the heat energy evolved from burning
    b. When invisible substances are taken into account, the total mass of the reactants is equal to the total mass of the products

c. The ash is more dense than the paper
d. The different molecular structure of the ash causes it to appear to have less mass until it is compacted
e. The mass of the ash cannot be accurately determined

ANS: B
Analysis:
A. Incorrect. See Section 2.9, Goal 16.
B. Correct.
C. Incorrect. See Section 2.9, Goal 16.
D. Incorrect. See Section 2.9, Goal 16.
E. Incorrect. See Section 2.9, Goal 16.

PTS: 1

46. Which of the following is the best statement of the Law of Conservation of Mass?
a. In any non-nuclear change, energy is conserved
b. In a chemical change, the mass of the reactants is always greater than or equal to the mass of the products
c. In a chemical change, the mass of the products is always greater than or equal to the mass of the reactants
d. For endothermic chemical reactions, the mass of the products is greater than the mass of the reactants, and for exothermic chemical reactions, the mass of the products is less than the mass of the reactants
e. In a chemical change, mass is neither created nor destroyed

ANS: E
Analysis:
A. Incorrect. See Section 2.9, Goal 16.
B. Incorrect. See Section 2.9, Goal 16.
C. Incorrect. See Section 2.9, Goal 16.
D. Incorrect. See Section 2.9, Goal 16.
E. Correct.

PTS: 1

47. When coasting on a bicycle on a level street, the bicycle will eventually come to a stop. Which of the following is the best explanation for this apparent violation of the Law of Conservation of Energy?
a. The kinetic energy is converted into an equal amount of energy in other forms
b. The rubber in the tires is converted into energy
c. If there was no air resistance, the bicycle would continue moving indefinitely
d. The street must actually be slightly angled uphill
e. This is not a chemical reaction, so it does not obey the Law of Conservation of Energy

ANS: A
Analysis:
A. Correct.
B. Incorrect. See Section 2.9, Goal 17.
C. Incorrect. See Section 2.9, Goal 17.
D. Incorrect. See Section 2.9, Goal 17.
E. Incorrect. See Section 2.9, Goal 17.

PTS: 1

48. When room temperature solutions of vinegar and drain cleaner are combined, the temperature of the resulting solution is greater than room temperature. Which of the following is the best explanation for this apparent violation of the Law of Conservation of Energy?
    a. Some of the mass of the room temperature solutions is converted into heat energy
    b. The total energy of the original solutions is equal to the total energy of the resulting solution plus the heat energy
    c. An ordinary chemical reaction occurs, so the Law of Conservation of Energy does not apply
    d. The thermometer used to measure the temperature of the solutions must be faulty
    e. The Law of Conservation of Energy does not apply to heat energy

    ANS: B
    Analysis:
    A. Incorrect. See Section 2.9, Goal 17.
    B. Correct.
    C. Incorrect. See Section 2.9, Goal 17.
    D. Incorrect. See Section 2.9, Goal 17.
    E. Incorrect. See Section 2.9, Goal 17.

    PTS: 1

49. Which of the following is the best statement of the Law of Conservation of Energy?
    a. Kinetic energy cannot be converted into potential energy
    b. Kinetic energy cannot be converted into chemical energy
    c. Potential energy cannot be converted into chemical energy
    d. Energy is neither created nor destroyed in an ordinary change
    e. The total energy of the products of a chemical reaction is greater than or equal to the total energy of the reactants

    ANS: D
    Analysis:
    A. Incorrect. See Section 2.9, Goal 17.
    B. Incorrect. See Section 2.9, Goal 17.
    C. Incorrect. See Section 2.9, Goal 17.
    D. Correct.
    E. Incorrect. See Section 2.9, Goal 17.

    PTS: 1

50. Under what condition is the Law of Conservation of Energy not obeyed?
    a. Digestion of food
    b. Human (and some animal) metabolism of sports drinks
    c. High speed travel, such as in military jets and the space shuttle
    d. Nuclear changes
    e. The Law of Conservation of Energy is always obeyed

    ANS: D
    Analysis:
    A. Incorrect. See Section 2.9, Goal 17.
    B. Incorrect. See Section 2.9, Goal 17.
    C. Incorrect. See Section 2.9, Goal 17.
    D. Correct.
    E. Incorrect. See Section 2.9, Goal 17.

    PTS: 1