

Introductory Chemistry, 5e (Tro)
Chapter 1 The Chemical World

True/False Questions

1) Chemicals make up everything around you, including your own body.

Answer: TRUE

Diff: 1 Page Ref: 1.1

Learning Outcome: 1.1

Global Outcome: G1

2) Chemists study the properties of substances and the particles that compose those substances.

Answer: TRUE

Diff: 1 Page Ref: 1.1

Learning Outcome: 1.1

Global Outcome: G1

3) When a sealed can of soda pop is opened, the carbon dioxide gas fizzes out because the pressure is released.

Answer: TRUE

Diff: 1 Page Ref: 1.1

Learning Outcome: 1.2

Global Outcome: G2

4) Different molecules can have different shapes.

Answer: TRUE

Diff: 1 Page Ref: 1.1

Global Outcome: G1

5) The properties of water do not depend on how the atoms are bonded together in the molecule.

Answer: FALSE

Diff: 1 Page Ref: 1.1

Learning Outcome: 1.2

Global Outcome: G1

6) Both carbon dioxide molecules and water molecules consist of three atoms bonded together in a straight line.

Answer: FALSE

Diff: 1 Page Ref: 1.1

Learning Outcome: 1.2

Global Outcome: G1

7) Molecules are responsible for scattering light which causes the colors of the sunset.

Answer: TRUE

Diff: 1 Page Ref: 1.2

Learning Outcome: 1.2

Global Outcome: G1

8) All things are made of atoms or molecules.

Answer: TRUE

Diff: 1 Page Ref: 1.3

Learning Outcome: 1.2

Global Outcome: G1

9) Atoms and molecules determine how matter behaves.

Answer: TRUE

Diff: 1 Page Ref: 1.3

Learning Outcome: 1.2

Global Outcome: G1

10) Chemistry is the science that seeks to understand what matter does by studying living organisms.

Answer: FALSE

Diff: 1 Page Ref: 1.3

Learning Outcome: 1.3

Global Outcome: G1

11) The scientific method emphasizes reason as the way to understand the world.

Answer: FALSE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G5

12) A hypothesis can never be proven as wrong.

Answer: FALSE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

13) A theory is always true and can never be proven as wrong.

Answer: FALSE

Diff: 1 Page Ref: 1.4

Global Outcome: G1

14) Theories can be tested and validated through experimentation.

Answer: TRUE

Diff: 1 Page Ref: 1.4

Global Outcome: G9

15) If experimental results contradict a hypothesis, the hypothesis must be either revised or discarded.

Answer: TRUE

Diff: 1 Page Ref: 1.4

Global Outcome: G1

16) The Greek philosophers used observation and experimentation to understand the world.

Answer: FALSE

Diff: 1 Page Ref: 1.4

Global Outcome: G1

17) A scientific law is a brief statement that summarizes past observations and predicts future ones.

Answer: TRUE

Diff: 1 Page Ref: 1.4

Global Outcome: G1

18) The law of conservation of mass states, "In a chemical reaction matter can be created and destroyed."

Answer: FALSE

Diff: 1 Page Ref: 1.4

Global Outcome: G1

19) Antoine Lavoisier observed that burning objects in a closed container resulted in a loss of mass.

Answer: FALSE

Diff: 1 Page Ref: 1.4

Global Outcome: G1

20) A scientific theory describes the underlying reasons for observations and laws.

Answer: TRUE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

21) The scientific method ensures that poor theories are eliminated over time and good theories remain.

Answer: TRUE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

22) A theory is the equivalent of an opinion.

Answer: FALSE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

23) Antoine Lavoisier proposed the atomic theory.

Answer: FALSE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

24) John Dalton proposed the atomic theory.

Answer: TRUE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

25) The first step in acquiring scientific knowledge is often the observation or measurement of some aspect of nature.

Answer: TRUE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

26) If a hypothesis is *falsifiable*, it means that the hypothesis was once considered true but is now considered false.

Answer: FALSE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

27) Observations from experiments are used to test theories.

Answer: TRUE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

28) A theory can only exist after many experiments have validated a hypothesis.

Answer: TRUE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

29) Scientific theories are also called *models*.

Answer: TRUE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

30) The atomic theory explains why the law of conservation of mass is true.

Answer: TRUE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G2

31) An established theory is the pinnacle of scientific understanding.

Answer: TRUE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

32) Quantification is an important tool in understanding chemistry.

Answer: TRUE

Diff: 1 Page Ref: 1.5

Learning Outcome: 1.3

Global Outcome: G1

33) Lavoisier developed the law of conservation of mass.

Answer: FALSE

Diff: 1 Page Ref: 1.5

Learning Outcome: 1.3

Global Outcome: G1

34) Combustion means burning.

Answer: TRUE

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

35) The phlogiston theory of combustion is still considered correct today.

Answer: FALSE

Diff: 1 Page Ref: 1.5

Learning Outcome: 1.3

Global Outcome: G1

36) Quantification involves measurement as part of an observation.

Answer: TRUE

Diff: 1 Page Ref: 1.5

Learning Outcome: 1.3

Global Outcome: G1

Multiple Choice Questions

1) Which of the following statements about soda pop is FALSE?

- A) Soda pop is a chemical mixture of mostly sugar, water and carbon dioxide.
- B) The molecules important to fizzing are carbon dioxide and water.
- C) The carbon dioxide is forced to mix with the water by the presence of sugars.
- D) When a can is opened, the pressure release allows carbon dioxide to form bubbles.
- E) All of the above statements are true.

Answer: C

Diff: 1 Page Ref: 1.1

Learning Outcome: 1.2

Global Outcome: G2

2) Which of the following items does NOT contain chemicals?

- A) drain cleaner
- B) organically grown vegetables
- C) air
- D) insecticides
- E) All of the above contain chemicals.

Answer: E

Diff: 1 Page Ref: 1.2

Learning Outcome: 1.2

Global Outcome: G2

3) A good definition of chemistry is:

- A) the science that seeks to understand what matter does by studying what atoms and molecules do.
- B) the science that seeks to understand what living organisms do by studying the molecules that make up the organism.
- C) the science that seeks to understand what the universe does by studying interactions of molecules with atoms.
- D) the science that seeks to understand the interactions of molecules for the sake of advancing human control over nature.
- E) none of the above

Answer: A

Diff: 1 Page Ref: 1.3

Learning Outcome: 1.3

Global Outcome: G2

4) Which statement about the scientific method is TRUE?

- A) The scientific method emphasizes reason as the way to understand the world.
- B) The scientific method emphasizes observation and reason as the way to understand the world.
- C) The scientific method emphasizes observation and experimentation as the way to understand the world.
- D) The scientific method emphasizes scientific laws as the way to understand the world.
- E) All of the above statements are false.

Answer: C

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G2

5) Which of the statements below is NOT part of the scientific method?

- A) observation and measurement
- B) formation of a hypothesis
- C) testing of a hypothesis by experimentation
- D) refinement of a hypothesis as needed
- E) All of the above steps are part of the scientific method.

Answer: E

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

6) Which statement about a hypothesis is TRUE?

- A) It is a tentative interpretation or explanation.
- B) It has the potential to be proven wrong.
- C) It can be tested by experiments.
- D) It is part of the scientific method.
- E) All of the above statements are true.

Answer: E

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

7) The definition of a scientific law is:

- A) the same as a hypothesis.
- B) a way of learning that emphasizes observation and experimentation.
- C) the underlying reason for a scientific theory.
- D) a number of similar observations generalized into a brief statement summarizing past observations and predicting new ones.
- E) none of the above

Answer: D

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

8) What term best describes a brief statement that summarizes many past observations and predicts new ones?

- A) experiment
- B) hypothesis
- C) scientific law
- D) theory
- E) none of the above

Answer: C

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G1

9) Who discovered the law of conservation of mass?

- A) John Dalton
- B) Antoine Lavoisier
- C) Nivaldo Tro
- D) John Dalton and Antoine Lavoisier
- E) none of the above

Answer: B

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.2

Global Outcome: G1

10) Which of the following is an example of a scientific law?

- A) All matter is composed of small, indestructible particles called atoms.
- B) In a chemical reaction, matter is neither created nor destroyed.
- C) When a can of soda pop is opened, a fizzing sound is heard.
- D) Flammable objects contain phlogiston.
- E) none of the above

Answer: B

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G2

11) What is the definition of a scientific theory?

- A) a brief statement that summarizes past observations and predicts future ones
- B) a model that explains the underlying reasons for observations and laws
- C) the equivalent of a scientific opinion which others may disagree with
- D) a method of learning that emphasizes reason as the way to understand the world
- E) none of the above

Answer: B

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G5

12) Who discovered the atomic theory?

- A) John Dalton
- B) Antoine Lavoisier
- C) Nivaldo Tro
- D) John Dalton and Antoine Lavoisier
- E) none of the above

Answer: A

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.2

Global Outcome: G1

13) Which of the following is an example of an observation?

- A) All matter is composed of small, indestructible particles called atoms.
- B) Reactions occur due to the transfer of electrons.
- C) When a can of soda pop is opened, a fizzing sound is heard.
- D) Flammable objects contain phlogiston.
- E) none of the above

Answer: C

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G2

14) A sample of wood with a mass of 3.0 grams was burned in an open dish. The ashes weighed 1.2 grams. What happened to the rest of the wood?

- A) The remaining mass was destroyed.
- B) The remaining 1.8 grams was converted into gaseous compounds.
- C) Nothing, the burned wood simply has a mass of 1.2 grams.
- D) The remaining 1.8 grams was converted into heat.
- E) none of the above

Answer: B

Diff: 2 Page Ref: 1.4

Learning Outcome: 1.2

Global Outcome: G9|G4

15) Which statement accurately describes the purpose of experiments?

- A) Experiments are designed to produce the results predicted by a theory.
- B) Experiments can be replaced by a simple, logical reasoning of known facts.
- C) Experiments are designed to produce unexplainable results for further investigation.
- D) Experiments look for other observable predictions of a theory.
- E) none of the above

Answer: D

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G9

16) Which of the following would be considered a theory?

- A) Glass is fragile.
- B) Hot air rises.
- C) Gasoline has a very strong odor.
- D) Helium balloons float because helium is less dense than air.

Answer: D

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G2

17) Which of the following is considered a hypothesis (as opposed to an observation)?

- A) Spiders have eight legs.
- B) Birds can fly because they have hollow bones.
- C) Fresh lava from a volcano is hot.
- D) The Washington Monument is 555 feet tall.
- E) none of the above

Answer: B

Diff: 1 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G2

18) The key to success in chemistry is:

- A) curiosity.
- B) mathematical skills.
- C) commitment.
- D) practice.
- E) all of the above

Answer: E

Diff: 1 Page Ref: 1.5

Learning Outcome: 1.3

Global Outcome: G1

19) Which statement would NOT be an example of "quantification"?

- A) The newest model of that car gets five more miles per gallon than last year's model.
- B) The price of milk went up ten cents per gallon.
- C) The average high temperature this July was two degrees higher than last year's average high temperature.
- D) The water in the swimming pool feels colder than it was yesterday.
- E) none of the above

Answer: D

Diff: 1 Page Ref: 1.5

Learning Outcome: 1.3

Global Outcome: G1

Essay Questions

1) What is chemistry?

Answer: Chemistry is branch of science that explains the properties and behavior of different forms of matter, in the broadest sense, by helping us understand the atoms and molecules that compose them.

Diff: 1 Page Ref: 1.3

Learning Outcome: 1.3

Global Outcome: G8

2) What are the important characteristics of the scientific method?

Answer: The important characteristics of the scientific method include the observation of phenomena, the formulation of a hypothesis to explain the observed phenomena, the testing of the hypothesis by experiment, and the formulation of laws and theories.

Diff: 2 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G8

3) What is the difference between a scientific law and a scientific theory?

Answer: A statement based on a number of similar observations that may predict future outcomes of similar experiments is a scientific law. Laws are subject to further experiments and may be proven wrong or be validated. Theories are models of the way nature behaves, and are the products of several well-established and tested scientific laws.

Diff: 3 Page Ref: 1.4

Learning Outcome: 1.3

Global Outcome: G8

4) Charcoal was burned in a barbecue grill. The ashes that remained weighed considerably less than the charcoal that was burned. Does this mean that the law of conservation of mass is wrong? Explain.

Answer: No. The gaseous products formed during the combustion of charcoal escaped into the air and are not accounted for. If all those products could have been collected and weighed along with the ashes, the total mass of the products would have been equal to the mass of the charcoal.

Diff: 3 Page Ref: 1.4

Learning Outcome: 1.2

Global Outcome: G8