

(1) What is the definition of a scientific theory? (1 points)

- 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

(2) The definition of a scientific law is: (1 point)

- 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

(3) The distance between the two hydrogen atoms in a molecule of water is 0.000000000172 m. Express this distance in scientific notation. (1 point)

- A) 1.72×10^{-9} m
- B) 1.72×10^{-10} m
- C) 0.172×10^{-10} m
- D) 17.2×10^9 m
- E) 1.72×10^{10} m

(4) In the number 48.93, which digit is estimated? (1 point)

- A) 4
- B) 8
- C) 9
- D) 3

(5) The correct number of significant figures in the number 1.250100 is: (1 point)

- A) 5
- B) 7
- C) 4
- D) ambiguous
- E) none of the above

(6) Determine the answer to the following equation with correct number of significant figures: (1 point)

$$13.96 - 4.9102 + 71.5 = \underline{\hspace{2cm}}$$

- A) 80.5498
- B) 81
- C) 80.5
- D) 80.55
- E) none of the above

(7) How many significant figures should be reported in the answer to the following calculation? (1 point)

$$(8.50) \times (29.0) \times (1.0947) =$$

- A) 3
- B) 2
- C) 4
- D) 5
- E) none of the above

(8) Which of the following is NOT an example of *matter*? (1 point)

- A) a pencil eraser
- B) a balloon full of helium
- C) a dust particle
- D) heat from a burning candle
- E) none of the above

(9) Which state of matter has atomic spacing that is close together and indefinite shape? (1 point)

- A) liquid
- B) solid
- C) gas
- D) plasma
- E) none of the above

(10) How would you classify salt water? (1 point)

- A) pure substance-compound
- B) mixture-heterogeneous
- C) pure substance-element
- D) mixture-homogeneous
- E) none of the above

(11) Which of the following statements about physical and chemical changes is FALSE? (1 point)

- A) In a chemical change, matter changes its composition.
- B) In a physical change, matter does not change its composition.
- C) Phase changes are always physical changes.
- D) Chemical reactions are chemical changes.
- E) All of the above statements are true.

(12) Which type of energy is associated with motion? (1 point)

- A) chemical
- B) electrical
- C) potential
- D) kinetic
- E) none of the above

(13) Which of the following items is NOT a common unit of energy? (1 point)

- A) joule
- B) torr
- C) calorie
- D) kilowatt-hour
- E) none of the above

(14) The boiling point of water is (1 point)

- (1) 212 °F (2) 0°C (3) 373 K

- A) 1 and 2 only
- B) 2 and 3 only
- C) 1 and 3 only
- D) all of 1, 2, and 3
- E) none of 1, 2, and 3

(15) How many Calories are in 575.0 calories? (1 point)

- A) 575,000
- B) 0.5750
- C) 137.6
- D) 2,404
- E) none of the above

(16) Metals are located where on the periodic table? (1 point)

- A) left side
- B) right side
- C) middle
- D) zig-zag diagonal line
- E) none of the above

(17) Nonmetals are located where on the periodic table? (1 point)

- A) left side
- B) right side
- C) middle
- D) zig-zag diagonal line
- E) none of the above

(18) When an atom loses an electron, the resulting particle is called (1 point)

- A) a proton.
- B) an anion.
- C) a cation.
- D) an isotope.
- E) none of the above

(19) When an atom gains an electron, the resulting particle is called (1 point)

- A) a proton.
- B) an anion.
- C) a cation.
- D) an isotope.
- E) none of the above

(20) What is the charge on the ion formed by aluminum? (1 point)

- A) 5-
- B) 3-
- C) 13+
- D) 3+
- E) none of the above

(21) What is the charge on the cesium ion? (1 point)

- A) 1-
- B) 2-
- C) 1+
- D) 2+
- E) none of the above

(22) How many neutrons are present in Ne-22? (1 point)

- A) 12
- B) 10
- C) 22
- D) 32
- E) none of the above

(23) When elements combine to form compounds, (1 point)

- A) their properties are an average of all elements in the compound.
- B) their properties change completely.
- C) their properties do not change.
- D) they always turn purple
- E) none of the above

(24) The law of constant composition states: (1 point)

- A) Matter cannot be either created or destroyed in a chemical reaction.
- B) The nucleus is a dense region of positive charge that always contains protons and neutrons.
- C) All samples of a given compound have the same proportions of their constituent elements.
- D) All atoms of a given element have a constant composition and are different than atoms of any other element.
- E) none of the above

(25) Which of the following statements about chemical formulas is FALSE? (1 point)

- A) The subscripts represent the relative number of each type of atom in the compound.
- B) The subscripts represent the relative mass of each type of atom in the compound.
- C) The subscripts do not change for a given compound.
- D) Different compounds made of the same elements have different subscripts.
- E) All of the statements are true.

(26) How many total atoms are in the formula $\text{Al}_2(\text{CO}_3)_3$? (1 point)

- A) 8
- B) 9
- C) 12
- D) 14
- E) none of the above

(27) How many of each type of atom are there in the formula $(\text{NH}_4)_2\text{HPO}_4$? (1 point)

- A) N = 2, H = 9, P = 1, O = 4
- B) N = 1, H = 5, P = 1, O = 4
- C) N = 2, H = 5, P = 1, O = 4
- D) N = 2, H = 8, P = 1, O = 4

(28) Carbon monoxide is considered which of the following? (1 point)

- A) atomic element
- B) molecular element
- C) molecular compound
- D) ionic compound
- E) none of the above

(29) Fluorine (F_2) is considered which of the following? (1 point)

- A) atomic element
- B) molecular element
- C) molecular compound
- D) ionic compound
- E) none of the above

(30) The ionic compound that forms between potassium and oxygen is (1 point)

- A) K_2O .
- B) KO .
- C) KO_2 .
- D) K_2O_2 .
- E) none of the above

(31) In your own words, briefly describe the scientific method. How does it differ from philosophy? (4 points)

(32) A fictional element has two naturally occurring isotopes with the natural abundances shown here: (3 points)

ISOTOPE	ABUNDANCE
18.0123 amu	40.000%
20.1046 amu	60.000%

Calculate the atomic mass of the isotope. Show all your work. Be sure to use units in your equations and report your answer with the correct number of significant figures.