

Student name: \_\_\_\_\_

**TRUE/FALSE - Write 'T' if the statement is true and 'F' if the statement is false.**

1) The ripening of fruit, once picked, is an example of physical change.

- ☐ true
- ☐ false

2) An important aim in much chemical work is to use macroscopic measurements in order to gain an understanding of the microscopic world.

- ☐ true
- ☐ false

3) The potential energy of a car moving on a level road does not depend on its speed.

- ☐ true
- ☐ false

4) When a wooden match burns in air, chemical potential energy is converted to kinetic energy.

- ☐ true
- ☐ false

5) When applying the scientific method, it is important to avoid any form of hypothesis.

- ☐ true
- ☐ false

- 6) When applying the scientific method, a model or theory should be based on
- ☐ true
  - ☐ false
- 7) The numerical value of any temperature expressed in Celsius is always different from the numerical value of the same temperature in Fahrenheit.
- ☐ true
  - ☐ false
- 8) The numerical value of any temperature expressed in Celsius is always different from the numerical value of the same temperature in kelvin.
- ☐ true
  - ☐ false
- 9) The number 6.0448, rounded to 3 decimal places, becomes 6.045.
- ☐ true
  - ☐ false
- 10) The number 6.0448, rounded to 2 decimal places, becomes 6.05.
- ☐ true
  - ☐ false
- 11) The weight of a coin measured as 1.96235 g on one balance is definitely more accurate than a weight measurement of 1.95 g on another balance.
- ☐ true
  - ☐ false

**MULTIPLE CHOICE - Choose the one alternative that best completes the statement or answers the question.**

**12)** Which one of the following is a “substance” in the

- A) Air
- B) Tap water

- C) Sea water
- D) Water
- E) Toothpaste

**13)** Select the best statement.

- A) Physical changes may be reversed by changing the temperature.
- B) Physical changes alter the composition of the substances involved.
- C) Physical properties are not valid characteristics for identifying a substance.

D) Physical properties are mostly extensive in nature.

E) Physical changes are usually accompanied by chemical changes.

**14)** Select the best statement.

- A) Chemical changes provide the only valid basis for identification of a substance.
- B) Chemical changes are easily reversed by altering the temperature of the system.
- C) Chemical changes always produce substances different from the starting materials.
- D) Chemical changes are associated primarily with

extensive properties.

E) Chemical changes are accompanied by changes in the total mass of the substances involved.

**15)** Which of the following is a chemical change?

- A) Boiling of water
- B) Melting wax
- C) Broiling a steak on a grill

- D) Condensing water vapor into rainfall
- E) Carving a piece of wood

16) Water vapor is less dense than ice because

- A) molecules in the gas phase are in constant motion.
- B) molecules in the gas phase have more potential energy than in solids.
- C) molecules in the gas phase have more kinetic energy than in solids.

D) gaseous molecules have less mass.

E) molecules in the gas phase have more space between them than in solids.

17) During the swing of a frictionless pendulum, what energy form(s) remain constant?

- A) Kinetic energy only
- B) Potential energy only
- C) Both kinetic energy and potential energy

D) Kinetic plus potential energy

E) None of these choices are correct.

18) The most significant contribution to modern science made by alchemists was

- A) their fundamental work in the transmutation of the elements.
- B) their widespread acceptance of observation and experimentation.
- C) their systematic method of naming substances.

D) their understanding of the nature of chemical reactions.

E) their discovery of phlogiston.

19) Select the best statement about chemistry before 1800.

- A) Alchemy focused on objective experimentation rather than mystical explanations of processes.
- B) The phlogiston theory laid a valuable theoretical basis for modern chemistry.
- C) Lavoisier's quantitative work on the role of

oxygen in combustion was the beginning of modern chemistry.

D) The interpretation of data by alchemists was not biased

by their overall view of life.

E) Alchemists failed because they did not develop

any practical chemical methods.

**20)** Which of the following activities is not a part of good science?

A) Proposing a theory

B) Developing a hypothesis

C) Making quantitative observations

D) Designing experiments

E) Indulging in speculation

**21)** A scientist made careful measurements of the pressure and temperature of many different gases. Based on these measurements, he concluded that “the pressure of a fixed amount of gas, measured at constant volume, is directly proportional to its absolute temperature.” This statement is best described as a

A) theory.

B) hypothesis.

C) law.

D) experiment.

E) definition.

**22)** A dictionary has the following definition for a word: “A tentative explanation that accounts for a set of facts.” Which of the following words best fits that definition?

A) Theory

B) Hypothesis

C) Law

D) Experiment

E) Definition

**23)** A detailed explanation of natural phenomena that is generally accepted and has been extensively tested is called a

- A) theory.
- B) hypothesis.

- C) law.
- D) fact.
- E) postulate.

**24)** The distance between carbon atoms in ethylene is 134 picometers. Which of the following expresses that distance in meters?

- A)  $1.34 \times 10^{-13} \text{ m}$
- B)  $1.34 \times 10^{-12} \text{ m}$
- C)  $1.34 \times 10^{-10} \text{ m}$

- D)  $1.34 \times 10^{-7} \text{ m}$
- E)  $1.34 \times 10^{-6} \text{ m}$

**25)** The average distance from Earth to the Sun is 150 megameters. What is that distance in meters?

- A)  $1.5 \times 10^8 \text{ m}$
- B)  $1.5 \times 10^6 \text{ m}$
- C)  $1.5 \times 10^5 \text{ m}$

- D)  $1.5 \times 10^3 \text{ m}$
- E)  $1.5 \times 10^{-6} \text{ m}$

**26)** The mass of a sample is 550 milligrams. Which of the following expresses that mass in kilograms?

- A)  $5.5 \times 10^8 \text{ kg}$
- B)  $5.5 \times 10^5 \text{ kg}$
- C)  $5.5 \times 10^{-4} \text{ kg}$

- D)  $5.5 \times 10^{-6} \text{ kg}$
- E)  $5.5 \times 10^{-1} \text{ kg}$

**27)** A dose of medication was prescribed to be 35 microliters. Which of the following expresses that volume in centiliters?

- A)  $3.5 \times 10^5 \text{ cL}$

- B)  $3.5 \times 10^{-4}$  cL
- C) 3.5 cL
- D)  $3.5 \times 10^{-4}$  cL

E)  $3.5 \times 10^{-3}$  cL

28) Which of the following represents the largest volume?

- A) 10,000  $\mu$ L
- B) 1000 pL

- C) 100 mL
- D) 10 nL
- E) 10 cm<sup>3</sup>

29) You prepare 1000. mL of tea and transfer it to a 1.00-quart pitcher for storage. Which of the following statements is true?

- A) The pitcher will be filled to 100% of its capacity with no tea spilled.
- B) The pitcher will be filled to about 95% of its capacity.
- C) The pitcher will be filled to about 50% of its capacity.
- D) The pitcher will be completely filled and a small

amount of tea will overflow.

E) The pitcher will be completely filled and most of the tea will overflow.

30) In an average year, the American chemical industry produces more than 9.5 million metric tons of sodium carbonate. Over half of this is used in the manufacture of glass while another third is used in the production of detergents and other chemicals. How many pounds of sodium

carbonate are produced annually?

- A)  $2.1 \times 10^{10}$  lb
- B)  $4.3 \times 10^9$  lb

- C)  $1.1 \times 10^7$  lb
- D)  $2.2 \times 10^6$  lb
- E)  $2.1 \times 10^4$  lb

31) A large pizza has a diameter of 15 inches. Express this

diameter in centimeters.

- A) 38 cm
- B) 24 cm

- C) 18 cm
- D) 9.3 cm
- E) 5.9 cm

32) The average distance between the Earth and the Moon is 240,000 miles. Express this distance in kilometers.

- A)  $6.1 \times 10^{-5}$  km
- B)  $5.3 \times 10^{-5}$  km

- C)  $3.9 \times 10^{-5}$  km
- D)  $1.5 \times 10^{-5}$  km
- E)  $9.4 \times 10^{-4}$  km

33) The area of a 15-inch pizza is  $176.7 \text{ in}^2$ . Express this area in square centimeters.

- A)  $1140. \text{ cm}^2$
- B)  $448.8 \text{ cm}^2$

- C)  $96.8 \text{ cm}^2$
- D)  $69.57 \text{ cm}^2$
- E)  $27.39 \text{ cm}^2$

34) The speed needed to escape the pull of Earth's gravity is 11.3 km/s. What is this speed in mi/h?

- A) 65,500 mi/h
- B) 25,300 mi/h
- C) 18,200 mi/h

- D) 1,090 mi/h
- E)  $5.02 \times 10^{-3}$  mi/h

35) The density of mercury, the only metal to exist as a liquid at room temperature, is  $13.6 \text{ g/cm}^3$ . What is that density in pounds per cubic inch?

- A)  $849 \text{ lb/in}^3$
- B)  $491 \text{ lb/in}^3$
- C)  $376 \text{ lb/in}^3$

- D)  $0.491 \text{ lb/in}^3$
- E)  $1.83 \times 10^{-3} \text{ lb/in}^3$



**36)** Given that 1 inch = 2.54 cm, 1 cm<sup>3</sup> is equal to

- A) 16.4 in<sup>3</sup>.
- B) 6.45 in<sup>3</sup>.

- C) 0.394 in<sup>3</sup>.
- D) 0.155 in<sup>3</sup>.
- E) 0.0610 in<sup>3</sup>.

**37)** At a pressure of one billionth ( $10^{-9}$ ) of atmospheric pressure, there are about  $2.7 \times 10^{10}$  molecules in one cubic centimeter of a gas. How many molecules is this per cubic meter?

- A)  $2.7 \times 10^{16}$
- B)  $2.7 \times 10^{14}$

- C)  $2.7 \times 10^{12}$
- D)  $2.7 \times 10^8$
- E)  $2.7 \times 10^4$

**38)** If the price of gold at the morning fixing in London was \$5310 per lb, what would a kilogram of gold have cost in £ (pounds)? (Assume an exchange rate of \$1.00 = £0.545)

- A) £1310
- B) £3510

- C) £6370
- D) £10400
- E) £17100

**39)** Which of the following is not an SI base unit?

- A) Meter
- B) Ampere

- C) Second
- D) Gram
- E) Kelvin

**40)** The symbol for the SI base unit of mass is

- A) mg.

- B) g.
- C) kg.

- D) metric ton.
- E) lb.

**41)** Which of the following abbreviations of the given SI base unit is incorrect?

- A) second: s
- B) kilogram: kg

- C) kelvin: K
- D) mole: m
- E) ampere: A

**42)** Which of the following abbreviations of the given SI base unit is incorrect?

- A) second: s
- B) kilogram: kg

- C) meter: m
- D) mole: mol
- E) kelvin: k

**43)** The SI prefix mega- (M) means

- A)  $10^{-6}$ .
- B)  $10^{-3}$ .

- C)  $10^3$ .
- D)  $10^6$ .
- E)  $10^9$ .

**44)** The SI unit of speed (velocity) is

- A) km/h.
- B) km/s.
- C) m/h.

- D) m/s.
- E) None of these choices are correct.

**45)** The joule is the SI unit of energy and is equal

to  $1 \text{ kg m}^2 \text{ s}^{-2}$ . The erg is another energy unit, equal to  $1 \text{ g cm}^2 \text{ s}^{-2}$ . Use unit conversion methods to work out how many ergs are in 1 joule.

- A)  $10^{-1}$  ergs
- B) 10 ergs

- C)  $10^2$  ergs
- D)  $10^5$  ergs
- E)  $10^7$  ergs

46) Which of the following correctly shows how to convert a density of  $20.1 \text{ g cm}^{-3}$  to units of  $\text{kg m}^{-3}$ ?

- A)  $\frac{20.1 \text{ g}}{1 \text{ cm}^3} \times \frac{1000 \text{ kg}}{1 \text{ g}} \times \frac{1 \text{ cm}^3}{0.01 \text{ m}^3}$
- B)  $\frac{20.1 \text{ g}}{1 \text{ cm}^3} \times \frac{1 \text{ kg}}{1000 \text{ g}} \times \frac{1 \text{ cm}^3}{0.01 \text{ m}^3}$
- C)  $\frac{20.1 \text{ g}}{1 \text{ cm}^3} \times \frac{1 \text{ kg}}{1000 \text{ g}} \times \frac{0.01 \text{ cm}^3}{1 \text{ m}^3}$

- D)  $\frac{20.1 \text{ g}}{1 \text{ cm}^3} \times \frac{1 \text{ kg}}{1000 \text{ g}} \times \frac{(0.01 \text{ cm})^3}{(1 \text{ m})^3}$
- E)  $\frac{20.1 \text{ g}}{1 \text{ cm}^3} \times \frac{1 \text{ kg}}{1000 \text{ g}} \times \frac{(1 \text{ cm})^3}{(0.01 \text{ m})^3}$

47) If the density of a certain spherical atomic nucleus is  $1.0 \times 10^{14} \text{ g cm}^{-3}$  and its mass is  $2.0 \times 10^{-23} \text{ g}$ , what is its radius in cm?

- A)  $3.6 \times 10^{-13} \text{ cm}$
- B)  $2.0 \times 10^{-37} \text{ cm}$
- C)  $4.8 \times 10^{-38} \text{ cm}$

- D)  $2.2 \times 10^{-19} \text{ cm}$
- E) None of these choices are correct.

48) Which of the following is an extensive property of oxygen?

- A) Boiling point
- B) Temperature
- C) Average kinetic energy of molecules

- D) Density
- E) Mass

**49)** A flask has a mass of 78.23 g when empty and 593.63 g when filled with water. When the same flask is filled with concentrated sulfuric acid,  $\text{H}_2\text{SO}_4$ , its mass is 1026.57 g. What is the density of concentrated sulfuric acid? (Assume water has a density of  $1.00 \text{ g/cm}^3$  at the temperature of the measurement.)

- A)  $1.992 \text{ g/cm}^3$
- B)  $1.840 \text{ g/cm}^3$

- C)  $1.729 \text{ g/cm}^3$
- D)  $1.598 \text{ g/cm}^3$
- E)  $0.543 \text{ g/cm}^3$

**50)** Talc is a mineral that has low conductivity for heat and electricity and that is not attacked by acid. It is used as talcum powder and face powder. A sample of talc weighs 35.97 g in air and 13.65 g in mineral oil ( $d = 1.75 \text{ g/cm}^3$ ). What is the density of talc?

- A)  $4.61 \text{ g/cm}^3$
- B)  $2.82 \text{ g/cm}^3$

- C)  $2.63 \text{ g/cm}^3$
- D)  $2.44 \text{ g/cm}^3$
- E)  $1.61 \text{ g/cm}^3$

**51)** Acetone, which is used as a solvent and as a reactant in the manufacture of Plexiglas<sup>®</sup>, boils at  $56.1^\circ\text{C}$ . What is the

boiling point in degrees Fahrenheit?

- A)  $159^\circ\text{F}$
- B)  $133^\circ\text{F}$

- C)  $101^\circ\text{F}$
- D)  $69.0^\circ\text{F}$
- E)  $43.4^\circ\text{F}$

**52)** Isopropyl alcohol, commonly known as rubbing alcohol, boils at  $82.4^\circ\text{C}$ . What is the boiling point in kelvins?

- A)  $387.6 \text{ K}$
- B)  $355.6 \text{ K}$

- C)  $323.6 \text{ K}$

- D) 190.8 K
- E) -190.8 K

53) Acetic acid boils at 244.2°F. What is its boiling point in degrees Celsius?

- A) 382.0°C
- B) 167.7°C

- C) 153.4°C
- D) 117.9°C
- E) 103.7°C

54) Which one of the following numbers contains a digit or digits which is/are not significant?

- A) 970.0
- B) 502

- C) 0.300
- D) 0.0043
- E) 20.01

55) Select the answer that expresses the result of this calculation with the correct number of significant figures.

$$\frac{13.602 \times 1.90 \times 3.06}{4.2 \times 1.4097} =$$

- A) 13.3568
- B) 13.357

- C) 13.36
- D) 13.4
- E) 13

56) Select the answer that expresses the result of this calculation with the correct number of significant figures and with correct units.

$$16.18 \text{ cm} \times 9.6114 \text{ g} \div 1.4783 \text{ cm}^2 =$$

- A) 105.2 g/cm<sup>3</sup>
- B) 105.2 g/cm<sup>2</sup>

- C) 105.2 g/cm
- D) 72.13 g/cm<sup>2</sup>
- E) 72.13 g/cm

57) Which measurement is expressed to 4 significant

figures?

- A) 0.423 kg
- B) 24.049 cm

- C) 1300 K
- D) 82,306 m
- E) 62.40 g

**58)** Express 96,342 m using 2 significant figures.

- A)  $9.60 \times 10^{-4} \text{ m}$
- B)  $9.6 \times 10^{-4} \text{ m}$
- C)  $9.60 \times 10^{-4} \text{ m}$

- D)  $9.6 \times 10^{-4} \text{ m}$
- E) 96000. m

**59)** Select the answer with the correct number of decimal places for the following sum:

$$13.914 \text{ cm} + 243.1 \text{ cm} + 12.00460 \text{ cm} =$$

- A) 269.01860 cm
- B) 269.0186 cm

- C) 269.019 cm
- D) 269.02 cm
- E) 269.0 cm

**60)** The appropriate number of significant figures in the result of  $15.234 \times 15.208$  is

- A) 2.
- B) 3.

- C) 4.
- D) 5.
- E) 6.

**61)** The appropriate number of significant figures in the result of  $15.234 - 15.208$  is

- A) 1.
- B) 2.

- C) 3.
- D) 4.
- E) 5.

62) The result of  $(3.8621 \times 1.5630) - 5.98$  is properly

- A) 0.06.
- B) 0.056.

written as

- C) 0.0565.
- D) 0.05646.
- E) 0.056462.

63) As chief chemist at Superior Analytical Products (SAP) you must design an experiment to determine the density of an unknown liquid to three (3) significant figures. The density is of the order of  $1 \text{ g/cm}^3$ . You have approximately 7 mL of the liquid and only graduated cylinders and balances are available for your use. Which of

- A) Graduated cylinder with  $\pm 0.1 \text{ mL}$  uncertainty; balance with  $\pm 0.1 \text{ g}$  uncertainty
- B) Graduated cylinder with  $\pm 0.01 \text{ mL}$  uncertainty; balance with  $\pm 0.1 \text{ g}$  uncertainty
- C) Graduated cylinder with  $\pm 0.01 \text{ mL}$  uncertainty; balance with  $\pm 0.01 \text{ g}$  uncertainty
- D) Graduated cylinder with  $\pm 0.001 \text{ mL}$  uncertainty;

the following combinations of equipment will allow you to meet but not exceed your goal?

balance with  $\pm 0.001 \text{ g}$  uncertainty

- E) Graduated cylinder with  $\pm 0.1 \text{ mL}$  uncertainty; balance with  $\pm 0.001 \text{ g}$  uncertainty

64) A student makes several measurements of the density of an unknown mineral sample. She then reports the average value of these measurements. The number of significant

- A) accuracy.
- B) precision.
- C) systematic error.

figures she uses in her result should be a measure of its

- D) determinate error.
- E) human error.

65) The difference between a student's experimental measurement of the density of sodium chloride and the known density of this compound reflects the \_\_\_\_\_ of the student's result.

- A) accuracy

- B) precision
- C) random error



- D) systematic error
- E) indeterminate error

**66)** Bud N. Chemist must determine the density of a mineral sample. His four trials yield densities of  $4.77 \text{ g/cm}^3$ ,  $4.67 \text{ g/cm}^3$ ,  $4.69 \text{ g/cm}^3$ , and  $4.81 \text{ g/cm}^3$ . Independent studies found the correct density to be  $4.75 \text{ g/cm}^3$ . Which of the

- A) Bud's results have much greater accuracy than precision.
- B) Bud's results have much greater precision than accuracy.
- C) Bud's results have high accuracy and high

**67)** As part of an experiment to determine the density of a new plastic developed in her laboratory, Sara Ann Dippity measures the volume of a solid sample. Her four trials yield volumes of  $12.37 \text{ cm}^3$ ,  $12.41 \text{ cm}^3$ ,  $12.39 \text{ cm}^3$ , and  $12.38 \text{ cm}^3$ . Measurements of other scientists in the lab give an average

- A) Sara's results have low precision and high accuracy.
- B) Sara's results have high precision and high accuracy.
- C) Sara's results have greater precision than accuracy.

**68)** Which of the following correctly expresses  $52,030.2 \text{ m}$  in scientific notation?

- A)  $5.20302 \times 10^4 \text{ m}$
- B)  $5.20302 \times 10^5 \text{ m}$
- C)  $5.203 \times 10^4 \text{ m}$

following statements represents the best analysis of the data?

precision.

D) Bud's results have low accuracy and low precision.

E) Bud's equipment is faulty.

volume of  $12.49 \text{ cm}^3$ . Which of the following statements represents the best analysis of the data?

D) Sara's results have greater accuracy than precision.

E) Sara has been using a faulty instrument to measure the volume.

- D)  $5.20 \times 10^4 \text{ m}$
- E)  $5.2 \times 10^4 \text{ m}$

69) Which of the following correctly expresses 0.000007913 g in scientific notation?

- A)  $7.913 \times 10^6 \text{ g}$
- B)  $7.913 \times 10^5 \text{ g}$
- C)  $7.913 \times 10^{-5} \text{ g}$

- D)  $7.913 \times 10^{-6} \text{ g}$
- E)  $7.913 \times 10^{-9} \text{ g}$

70) Which of the following is a physical change?

- A) Milk turning sour
- B) Battery cables corroding
- C) Sugar turning brown when heated
- D) Liquid water being cooled and forming ice

- E) An egg being hard-boiled

71) Which of the following processes and concepts is not a part of the "scientific method"?

- A) Experiment
- B) Observation

- C) Model
- D) Speculation
- E) Law

## **Answer Key**

Test name: chapter 1

- 1) FALSE
- 2) TRUE
- 3) TRUE
- 4) TRUE
- 5) FALSE
- 6) TRUE
- 7) FALSE
- 8) TRUE
- 9) TRUE
- 10) FALSE
- 11) FALSE
- 12) D
- 13) A
- 14) C
- 15) C
- 16) E
- 17) D
- 18) B
- 19) C

20) E

21) C

22) B

23) A

24) C

25) A

26) C

27) E

28) C

29) D

30) A

31) A

32) C

33) A

34) B

35) D

36) E

37) A

38) C

39) D

40) C

41) D

42) E

43) D

44) D

45) E

46) E

47) A

48) E

49) B

50) B

51) B

52) B

53) D

54) D

55) E

56) C

57) E

58) B

59) E

60) D

61) B

62) A

63) C

64) B

65) A

66) A

67) C

68) A

69) D

70) D

71) D