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- 1) The primary substances of which all other things are composed are
- A) molecules.
  - B) compounds.
  - C) elements.
  - D) electrons.
  - E) protons.

Answer: C

- 2) Au is the symbol for
- A) gold.
  - B) silver.
  - C) argon.
  - D) aluminum.
  - E) sodium.

Answer: A

- 3) Al is the symbol for
- A) Al
  - B) Am
  - C) Au
  - D) Sn
  - E) Ag

Answer: A

- 4) The symbol for iron is
- A) Ir
  - B) Fs
  - C) Fe
  - D) In
  - E) FE

Answer: C

- 5) The symbol for sodium is
- A) So
  - B) Na
  - C) No
  - D) Sm
  - E) Au

Answer: B

- 6) The symbol for potassium is
- A) P
  - B) Po
  - C) Pt

- D) K
- E) Ko

Answer: D

7) The symbol for silver is

- A) S
- B) Si
- C) Ag
- D) Au
- E) AG

Answer: C

8) The symbol for mercury is

- A) Mc
- B) Au
- C) Ag
- D) Hg
- E) Pb

Answer: D

9) Which of the following elements is a metal?

- A) nitrogen
- B) fluorine
- C) argon
- D) strontium
- E) phosphorus

Answer: D

10) Which of the following elements is a nonmetal?

- A) nitrogen
- B) sodium
- C) iron
- D) silver
- E) calcium

Answer: A

11) Which of the following elements is a noble gas?

- A) oxygen
- B) chlorine
- C) bromine
- D) argon
- E) nitrogen

Answer: D

- 12) The smallest particle of an element that retains the characteristics of the element is a(n)
- A) electron.
  - B) neutron.
  - C) proton.
  - D) atom.
  - E) nucleus.

Answer: D

- 13) The atomic number of an atom is equal to the number of
- A) nuclei.
  - B) neutrons.
  - C) neutrons plus protons.
  - D) electrons plus protons.
  - E) protons.

Answer: E

- 14) In an atom, the nucleus contains
- A) an equal number of protons and electrons.
  - B) all the protons and neutrons.
  - C) all the protons and electrons.
  - D) only neutrons.
  - E) only protons.

Answer: B

- 15) The number of neutrons in an atom is equal to
- A) the atomic number.
  - B) the mass number.
  - C) the mass number + the atomic number.
  - D) the mass number - the atomic number.
  - E) the number of protons.

Answer: D

- 16) What is the mass number of an atom of potassium that has 20 neutrons?
- A) 15
  - B) 19
  - C) 35
  - D) 39
  - E) 59

Answer: D

- 17) The atomic mass of an element is equal to
- A) its mass number.
  - B) its atomic number.
  - C) one-twelfth of the mass of a carbon-12 atom.
  - D) a weighted average mass of all of the naturally occurring isotopes of the element.

E) the average mass of all of the naturally occurring isotopes of the element.

Answer: D

18) The electron configuration of an atom shows

- A) the number of isotopes possible.
- B) a description of the shape of each energy level.
- C) the number of electrons in each energy level and sublevel.
- D) a diagram of an atomic nucleus.
- E) the maximum number of electrons each energy level can hold.

Answer: C

19) The number of electrons in the outer energy level of a neutral atom of boron (atomic number 5) is

- A) 2.
- B) 3.
- C) 5.
- D) 8.
- E) 10.

Answer: B

20) The number of valence electrons found in an atom of a Group A element is equal to

- A) its atomic number.
- B) its mass number.
- C) its group number.
- D) eight.
- E) eight minus the group number.

Answer: C

21) A liquid has a volume of 34.6 mL and a mass of 46.0 g. What is the density of the liquid?

- A) 1.00 g/mL
- B) 1.33 g/mL
- C) 0.752 g/mL
- D) 1330 g/mL
- E) 0.663 g/mL

Answer: B

22) What is the mass of 53 mL of ethanol, which has a density of 0.79 g/mL?

- A) 67.1 g
- B) 41.9 g
- C) 42 g
- D) 67 g
- E) 53 g

Answer: C

23) Select the correct prefix to complete the equality.

- A)  $1 \times 10^{12}$
- B) 1
- C) 100
- D)  $1 \times 10^{-12}$
- E) 10
- F) 0.001
- G) 0.01
- H) 0.1
- I) 1000

A)  $1 \text{ g} = \text{_____ kg}$

B)  $1 \text{ m} = \text{_____ mm}$

C)  $1 \text{ cm} = \text{_____ mm}$

D)  $1 \text{ dL} = \text{_____ mL}$

E)  $1 \text{ kg} = \text{_____ g}$

F)  $1 \text{ pg} = \text{_____ g}$

G)  $1 \text{ g} = \text{_____ pg}$

H)  $1 \text{ mL} = \text{_____ cc}$

Answers: A) F B) I C) E D) C E) I F) D G) A H) B

24) A chemical equation is balanced when

- A) the total number of molecules is the same in reactants and products.
- B) the total number of ions is the same in reactants and products.
- C) the sum of the coefficients of the reactants is equal to the sum of the coefficients of the products.

- D) the number of atoms of each element is the same in reactants and products.  
E) the charge on each atom is the same in reactants and products.

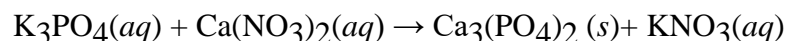
Answer: D

25) In any balanced chemical equation, the number of each type of atom on both sides of the equation is

- A) doubled.  
B) the same.  
C) decreased by one.  
D) increased by one.  
E) dependent on the temperature.

Answer: B

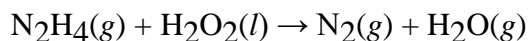
26) Which of the following gives the balanced equation for this reaction?



- A)  $\text{KPO}_4 + \text{CaNO}_3 + \text{KNO}_3$   
B)  $\text{K}_3\text{PO}_4 + \text{Ca}(\text{NO}_3)_2 \rightarrow \text{Ca}_3(\text{PO}_4)_2(s) + 3\text{KNO}_3$   
C)  $2\text{K}_3\text{PO}_4 + \text{Ca}(\text{NO}_3)_2 \rightarrow \text{Ca}_3(\text{PO}_4)_2(s) + 6\text{KNO}_3$   
D)  $2\text{K}_3\text{PO}_4 + 3\text{Ca}(\text{NO}_3)_2 \rightarrow \text{Ca}_3(\text{PO}_4)_2(s) + 6\text{KNO}_3$   
E)  $\text{K}_3\text{PO}_4 + \text{Ca}(\text{NO}_3)_2 \rightarrow \text{Ca}_3(\text{PO}_4)_2(s) + \text{KNO}_3$

Answer: D

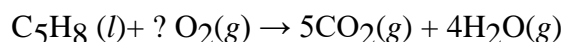
27) Which of the following correctly gives the correct coefficients for the reaction below?



- A) 1, 1, 1, 1  
B) 1, 2, 1, 4  
C) 2, 4, 2, 8  
D) 1, 4, 1, 4  
E) 2, 4, 2, 4

Answer: B

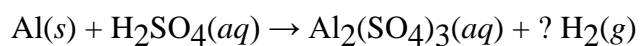
28) What coefficient is placed in front of  $\text{O}_2$  to complete the balancing of the following equation?



- A) 1  
B) 3  
C) 5  
D) 7  
E) 9

Answer: D

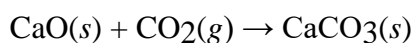
29) What is the coefficient of hydrogen,  $\text{H}_2$ , when the following equation is balanced?



- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

Answer: C

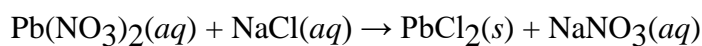
30) In this reaction, when the equation is correctly balanced, what is the correct coefficient for calcium oxide?



- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

Answer: A

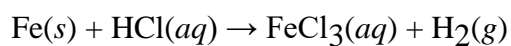
31) In the following reaction, when the equation is correctly balanced, what is the correct coefficient for sodium chloride?



- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

Answer: B

32) In the following reaction, when the equation is correctly balanced, what is the correct coefficient for H<sub>2</sub>?



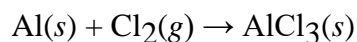
- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

Answer: C

33) In the following reaction, when the equation is correctly balanced, what is the correct



coefficient for aluminum chloride?



- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

Answer: B

34) How many moles of iron are present in  $3.15 \times 10^{24}$  atoms of iron?

- A) 5.23 moles
- B) 1.90 moles
- C) 292 moles
- D) 0.523 moles
- E)  $1.90 \times 10^{48}$  moles

Answer: A

35) How many atoms of neon are present in 1.30 moles of neon?

- A)  $3.15 \times 10^{23}$  atoms
- B)  $4.63 \times 10^{23}$  atoms
- C)  $7.83 \times 10^{23}$  atoms
- D)  $6.02 \times 10^{23}$  atoms
- E)  $7.83 \times 10^{24}$  atoms

Answer: C

36) One mole of particles of any substance contains how many particles?

- A)  $10^6$
- B)  $3 \times 10^{-10}$
- C)  $3 \times 10^{10}$
- D)  $6.02 \times 10^{23}$
- E)  $6.02 \times 10^{-23}$

Answer: D

37) How many moles of carbon are there in 0.500 mole of  $\text{C}_2\text{H}_6$ ?

- A) 0.500 moles
- B) 1.00 moles
- C) 3.00 moles
- D)  $6.02 \times 10^{23}$  moles

E) 4.00 moles

Answer: B

38) Calculate the molar mass of potassium chloride, KCl.

A) 74.6 g

B) 54.5 g

C) 6.74 g

D) 67.4 g

E) 19.0 g

Answer: A

39) What is the molar mass of copper(II) sulfate,  $\text{CuSO}_4$ ?

A) 16.0 g

B) 63.6 g

C) 111.6 g

D) 159.6 g

E) 319.2 g

Answer: D

40) Calculate the molar mass of magnesium chloride,  $\text{MgCl}_2$ .

A) 24.3 g

B) 95.2 g

C) 125.9 g

D) 59.8 g

E) 70.0 g

Answer: B

41) What is the molar mass of sucrose ( $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ )?

A) 29.0 g

B) 50.2 g

C) 210 g

D) 342 g

E) 182 g

Answer: D

42) How many moles of water,  $\text{H}_2\text{O}$ , are present in 75.0 g of  $\text{H}_2\text{O}$ ?

A) 4.41 moles

B) 4.16 moles

C) 75.0 moles

D) 7.50 moles

E)  $1.35 \times 10^3$  moles

Answer: B

43) How many moles of  $K_2SO_4$  are in 15.0 g of  $K_2SO_4$ ?

- A) 0.172 moles
- B)  $2.61 \times 10^3$  moles
- C) 0.111 moles
- D) 0.0861 moles
- E) 0.119 moles

Answer: D

44) Which of the following is an example of a physical change?

- A) grinding coffee beans
- B) baking a cake
- C) converting water to hydrogen and oxygen
- D) digesting a cheeseburger
- E) burning coal

Answer: A

45) Which of the following would NOT be a physical change?

- A) freezing water to make ice cubes
- B) tearing a piece of aluminum foil
- C) boiling water for soup
- D) burning gasoline in a lawnmower
- E) melting gold to make jewelry

Answer: D

46) Which of the following is a chemical change?

- A) cutting a rope
- B) bending a steel rod
- C) making a snowman
- D) burning sugar
- E) melting gold

Answer: D

47) Which of the following is a physical change?

- A) baking a cake
- B) dry ice subliming
- C) fermenting grapes to produce wine
- D) digesting a meal
- E) a tomato ripening

Answer: B

48) If the temperature is  $-55\text{ }^\circ\text{C}$ , what is the corresponding temperature on the Kelvin scale?

- A) 225 K
- B) 218 K
- C) 55 K
- D) 273 K
- E) 328 K

Answer: B

49) The temperature of liquid nitrogen is  $-196\text{ }^{\circ}\text{C}$ . What is the corresponding reading on the Kelvin scale?

- A) 77 K
- B)  $-127\text{ K}$
- C)  $-91\text{ K}$
- D) 48 K
- E) 146 K

Answer: A

50) The energy associated with the motion of particles in a substance is called

- A) temperature.
- B) electrical energy.
- C) heat.
- D) chemical energy.
- E) potential energy.

Answer: C

51) An example of kinetic energy is

- A) a coiled spring.
- B) running water.
- C) a tree.
- D) natural gas.
- E) chemical energy.

Answer: B

52) Which of the following is an example of potential energy?

- A) chewing food
- B) water stored in a reservoir
- C) burning wood
- D) a fan blade turning
- E) riding an exercise bike

Answer: B

53) The energy stored in the chemical bonds of a carbohydrate molecule is

- A) specific heat.
- B) kinetic energy.
- C) potential energy.
- D) work.
- E) a calorie.

Answer: C

54) In which of the following would the particles move most rapidly?

- A) ice at  $-20\text{ }^{\circ}\text{C}$

- B) water at 20 °C
- C) steam at 110 °C
- D) boiling water
- E) ice at 0 °C

Answer: C

- 55) The physical state(s) present when a substance is melting is (are)
- A) solid.
  - B) liquid.
  - C) gas.
  - D) solid + liquid.
  - E) liquid + gas.

Answer: D

- 56) The formation of a gas resulting from the escape of high-energy particles from the surface of a liquid is known as
- A) evaporation.
  - B) deposition.
  - C) boiling.
  - D) melting.
  - E) sublimation.

Answer: A

- 57) When a solid is converted directly to a gas, the change of state is called
- A) freezing.
  - B) melting.
  - C) boiling.
  - D) condensation.
  - E) sublimation.

Answer: E

- 58) Which of the following does NOT involve a change of state?
- A) melting ice
  - B) freezing water
  - C) vaporization of alcohol
  - D) sublimation of dry ice
  - E) pouring water into a vacuum-insulated bottle

Answer: E

- 59) In a solution, the solvent
- A) is a liquid.
  - B) can be a liquid or gas.
  - C) can be a solid, liquid, or gas.
  - D) is never a solid.

E) is the substance present in the smallest concentration.

Answer: C

60) A solution is prepared by dissolving 2 g of KCl in 100 g of H<sub>2</sub>O. In this solution, H<sub>2</sub>O is the

- A) solute.
- B) solvent.
- C) solution.
- D) solid.
- E) ionic compound.

Answer: B

61) Oil does not dissolve in water because

- A) oil is polar.
- B) oil is nonpolar.
- C) water is nonpolar.
- D) water is saturated.
- E) oil is hydrated.

Answer: B

62) When KCl dissolves in water,

- A) the Cl<sup>-</sup> ions are attracted to dissolved K<sup>+</sup> ions.
- B) the Cl<sup>-</sup> ions are attracted to the partially negative oxygen atoms of the water molecule.
- C) the K<sup>+</sup> ions are attracted to Cl<sup>-</sup> ions on the KCl crystal.
- D) the K<sup>+</sup> ions are attracted to the partially negative oxygen atoms of the water molecule.
- E) the K<sup>+</sup> ions are attracted to the partially positive hydrogen atoms of the water molecule.

Answer: D

63) What is the mass/volume percent (m/v) of a solution prepared from 50.0 g NaCl and 150.0 g of water?

- A) 0.250%
- B) 33.3%
- C) 40.0%
- D) 25.0%
- E) 3.00%

Answer: D

64) What is the mass/volume percent (m/v) of a solution prepared from 50. g NaCl and 2.5 L of water?

- A) 5.0%
- B) 2.0%
- C) 0.020%

- D) 0.050%
- E) 20.%

Answer: B

65) How many grams of glucose are needed to prepare 400. mL of a 2.0% (m/v) glucose solution?

- A) 800. g
- B) 0.0050 g
- C) 8.0 g
- D) 2.0 g
- E) 200. g

Answer: C

66) What volume (mL) of a 15% (m/v) NaOH solution contains 120 g NaOH?

- A) 18 mL
- B) 0.13 mL
- C) 13 mL
- D) 120 mL
- E)  $8.0 \times 10^2$  mL

Answer: E

67) How many milliliters of a 25% (m/v) NaOH solution would contain 75 g of NaOH?

- A) 25 mL
- B) 75 mL
- C) 33 mL
- D) 19 mL
- E)  $3.0 \times 10^2$  mL

Answer: E

68) What is the molarity of a solution that contains 17 g of  $\text{NH}_3$  in 0.50 L of solution?

- A) 34 M
- B) 2.0 M
- C) 0.50 M
- D) 0.029 M
- E) 1.0 M

Answer: B

69) What is the molarity of a solution that contains 3.25 moles of  $\text{NaNO}_3$  in 250. mL of solution?

- A) 3.25 M
- B) 6.50 M
- C) 0.0130 M
- D) 13.0 M
- E) 2.60 M

Answer: D

70) What is the molarity of a solution containing 5.0 moles of KCl in 2.0 L of solution?

- A) 2.5 M
- B) 1.0 M
- C) 5.0 M
- D) 10. M
- E) 2.0 M

Answer: A

71) What is the molarity of a solution which contains 58.5 g of sodium chloride dissolved in 0.500 L of solution?

- A) 0.500 M
- B) 1.00 M
- C) 1.50 M
- D) 2.00 M
- E) 4.00 M

Answer: D

72) How many moles of  $\text{CaCl}_2$  are in 250 mL of a 3.0 M of  $\text{CaCl}_2$  solution?

- A) 750 moles
- B) 1.3 moles
- C) 83 moles
- D) 0.75 mole
- E) 3.0 moles

Answer: D

73) What is the molarity of a KCl solution made by diluting 75.0 mL of a 0.200 M solution to a final volume of 100. mL?

- A) 0.267 M
- B) 0.150 M
- C) 0.200 M
- D) 6.67 M
- E) 0.100 M

Answer: B

74) What volume of 0.10 M NaOH can be prepared from 250. mL of 0.30 M NaOH?

- A) 0.075 L
- B) 0.25 L
- C) 0.75 L
- D) 0.083 L
- E) 750 L

Answer: C

75) What volume of a 2.00 M KCl solution is required to prepare 500. mL of a 0.100 M KCl solution?

- A) 0.0400 mL
- B) 25.0 mL



- C) 2.00 mL
- D)  $1.00 \times 10^4$  mL
- E)  $5.00 \times 10^2$  mL

Answer: B

- 76) In the process known as osmosis, \_\_\_\_\_ moves through a semipermeable membrane into an area of \_\_\_\_\_ concentration.
- A) solute; lower solute
  - B) solute; higher solute
  - C) solvent; lower solute
  - D) solvent; lower solvent
  - E) solvent; higher solvent

Answer: D

- 77) A solution with the same osmotic pressure as the blood is
- A) isotonic to the blood.
  - B) hypotonic to the blood.
  - C) hypertonic to the blood.
  - D) nontonic to the blood.
  - E) molar to the blood.

Answer: A

- 78) A solution that has an osmotic pressure less than that of red blood cells is called
- A) saturated.
  - B) hypertonic.
  - C) isotonic.
  - D) hypotonic.
  - E) unsaturated.

Answer: D

- 79) NaCl can be classified as a \_\_\_\_\_.
- A) gas
  - B) liquid
  - C) weak electrolyte
  - D) strong electrolyte
  - E) nonelectrolyte

Answer: D

- 80) Methanol, CH<sub>3</sub>OH, can be classified as a \_\_\_\_\_.
- A) gas
  - B) solid
  - C) weak electrolyte
  - D) strong electrolyte
  - E) nonelectrolyte

Answer: E

