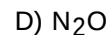
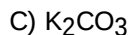
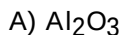


Name _____

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

1) Which of the following has the lowest % (w/w) oxygen composition?



Answer: C

2) Choose the INCORRECT statement.

A) A natural law is a generalization of natural phenomena.

B) An experiment is a test of conclusions about natural law.

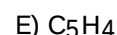
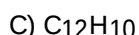
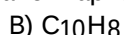
C) The scientific method is the combination of observations, experimentation, and the formulation of laws, hypothesis and theories.

D) A hypothesis is a conclusion that must follow logically from observations of nature.

E) A theory is a model of nature that can be used to describe natural phenomena.

Answer: D

3) Naphthalene, commonly found in mothballs, is 93.75% carbon and 6.25% hydrogen by mass. The molar mass is 128 u. What is the formula for naphthalene?



Answer: B

4) When an egg is fried, what type of process is happening?

A) a physical change

B) condensation

C) a chemical change

D) melting

E) evaporation

Answer: C

5) Which is the chemical change in the following list?

A) digestion of bread

B) grinding of wheat to make flour

C) using modeling clay to make a toy horse

D) drying clothes in the sunshine

E) mixing sand and water to make mud

Answer: A

6) Which of the following contains the greatest number of atoms?

A) 1 mole of S_8 moleculesB) 2 moles of P_4 molecules

C) 4 moles of chlorine molecules

D) 8 moles of H atoms

E) All of these contain the same number of atoms.

Answer: E

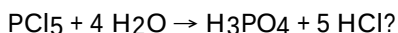
7) A species which differs in charge from the atom of the same element:

- I) is called an isotope
- II) has more or less neutrons
- III) has lost or gained electrons
- IV) is called an ion
- V) has the same number of protons of the atom

A) I and II B) I and III C) II and IV D) III and IV E) III, IV, V

Answer: E

8) How many moles of H_3PO_4 are produced when 20.0 g of HCl are produced by the reaction



A) $(20.0/36.5)/5$ B) $(20.0/36.5)$ C) $(20.0/98.0)$ D) $(20.0/98.0)/5$ E) $(20.0/35.5)/5$

Answer: A

9) A nugget of gold with a mass of 521 g is added to 50.0 mL of water. The water level rises to a volume of 77.0 mL. What is the density of the gold?

A) 10.4 g/mL B) 6.77 g/mL C) 0.0518 g/mL D) 1.00 g/mL E) 19.3 g/mL

Answer: E

10) Which one of the following would be classified as a heterogeneous mixture?

- A) brass
- B) coke
- C) copper nitrate solution
- D) salt water
- E) air

Answer: E

11) Which of the following compounds has its oxygen composition equal to 50.0% (w/w) ?

A) $\text{C}_{10}\text{H}_{20}\text{ONS}$ B) CH_2O_2 C) $(\text{NH}_4)_2\text{CO}_3$ D) $\text{C}_2\text{H}_3\text{NO}_2$

Answer: C

12) Isotopes are atoms of the same element that have _____.

- A) the same atomic mass but different numbers of protons
- B) different atomic numbers
- C) the same atomic number but different numbers of neutrons
- D) the same atomic numbers but different numbers of electrons
- E) the same atomic numbers but different numbers of protons

Answer: C

13) The production of rust from iron requires what chemical?

A) chlorine B) hydrogen C) nitrogen D) oxygen E) mercury

Answer: D

14) Nitroglycerin, $\text{C}_3\text{H}_5\text{N}_3\text{O}_3$:

- A) has less 50% (w/w) O by weight
- B) has the same weight percent of C and N
- C) none of these
- D) has equal amounts of C and N by weight
- E) has the same proportion of N to H atoms as does NH_3

Answer: A

15) How many significant figures should the answer to the following calculation have?

$$(1.4312 - 1.1 \times 10^{-2}) \div (1.0712 \times 10^{-4})$$

A) 4

B) 2

C) 5

D) 3

Answer: A

16) According to the Atomic Theory,

A) all atoms are different.

B) atoms of different element combine to form compounds.

C) atoms are created and destroyed during a chemical reaction.

D) a compound can contain different numbers of atoms as long as it has the same kinds of atoms.

E) all matter is made up of tiny particles called electrons.

Answer: B

17) Choose the INCORRECT name/formula combination.

A) NaClO_4 sodium chlorate

B) $\text{Sr}(\text{IO}_3)_2$ strontium iodate

C) NaClO sodium hypochlorite

D) SCl_4 sulfur tetrachloride

E) NaClO_2 sodium chlorite

Answer: A

18) The Rutherford gold foil experiment demonstrated that atoms

A) consist of an almost empty nucleus surrounded by a dense cloud of electrons.

B) consist of a single type of subatomic particle.

C) are visible to the naked eye.

D) consist of a dense nucleus surrounded by mostly empty space.

E) are homogeneous.

Answer: D

19) Arrange the following in order of increasing oxidation state of chlorine:

NaClO , NaClO_3 , NaClO_2 and NaClO_4 .

A) NaClO_4 , NaClO_3 , NaClO_2 , NaClO

B) NaClO , NaClO_2 , NaClO_3 , NaClO_4

C) NaClO_3 , NaClO_2 , NaClO , NaClO_4

D) NaClO , NaClO_3 , NaClO_2 , NaClO_4

E) NaClO_4 , NaClO , NaClO_3 , NaClO_2

Answer: B

20) The trinitrotoluene, TNT, $\text{C}_6\text{H}_3\text{N}_3\text{O}_6$, has the same atomic proportion of:

A) N to H atoms as does NH_3

B) C to O atoms as does CO_2

C) H to O atoms as does H_2O

D) C to H atoms as does C_6H_6

E) N to O atoms as does NO_2

Answer: E

21) Nitrogen forms at least three stable oxides: N_2O , NO , and NO_2 . How many grams of nitrogen forms with 32 grams of oxygen in NO ?

- A) 14 grams B) 16 grams C) 28 grams D) 8 grams E) 32 grams

Answer: C

22) What mass of MgCl_2 in grams must be added to 250.0 mL of a 0.25 M MgCl_2 solution to produce a 0.40 M solution assuming no change of volume upon addition?

- A) 2.2 g B) 3.6 g C) 19 g D) 6.0 g E) 9.5 g

Answer: B

23) When gold is melted and formed in a mold to make a piece of jewelry, what type of change is taking place?

- A) evaporation
B) a change of size
C) a chemical change
D) boiling
E) a physical change

Answer: E

24) What is the answer, with the correct number of significant figures, for this problem?

$$4.392 \text{ g} + 102.40 \text{ g} + 2.51 \text{ g} =$$

- A) 109.302 g B) 109.30 g C) 110 g D) 109.3 g E) 109 g

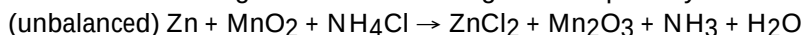
Answer: B

25) 3.22 g of $\text{Na}_2\text{SO}_4 \cdot x\text{H}_2\text{O}$ produce 1.42 g Na_2SO_4 , upon strong heating. The empirical formula of the compound is _____.

- A) $\text{Na}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ B) $\text{Na}_2\text{SO}_4 \cdot 5\text{H}_2\text{O}$ C) $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ D) $\text{Na}_2\text{SO}_4 \cdot \text{H}_2\text{O}$

Answer: C

26) The chemical reaction during low current discharge of a simple "dry cell" involves:



What is the coefficient for zinc in the balanced equation, and what is the limiting reagent for a process in which equal masses of reactants are mixed?

- A) 2/Zn B) 1/Zn C) 2/ MnO_2 D) 2/ NH_4Cl E) 1/ MnO_2

Answer: E

27) Which of the following numbers contains the designated CORRECT number of significant figures?

- A) 0.00302 2 significant figures
B) 1.04 2 significant figures
C) 1.56×10^3 3 significant figures
D) 3.0650 4 significant figures
E) 0.04300 5 significant figures

Answer: C

28) Which of the following descriptions of a subatomic particle is correct?

- A) A proton has a positive charge and a negligible mass.
- B) A neutron has a positive charge and a mass of approximately 1 amu.
- C) A proton has a positive charge and a mass of approximately 1 amu.
- D) An electron has a negative charge and a mass of approximately 1 amu.
- E) A neutron has no charge and its mass is negligible.

Answer: C

29) How many mL of 0.024 M solution can be produced from 14.1 mL of 3.0 M solution?

- A) $(14.1/0.024)/3.0$
- B) $14.1(0.024/3.0)$
- C) $(14.1)(0.024)(3.0)$
- D) $14.1(3.0/0.024)$
- E) none of these

Answer: D

30) How many atoms of sulfur are in 280 g of a 50% H_2SO_4 solution?

- A) 8.6×10^{25} atoms
- B) 8.0×10^{23} atoms
- C) 8.6×10^{23} atoms
- D) 8.0×10^{25} atoms
- E) 2.8×10^{29} atoms

Answer: C

31) Choose the INCORRECT name formula combination.

- A) NH_4ClO_3 ammonium chlorate
- B) SiO_2 silicon oxide
- C) CaH_2 calcium hydride
- D) H_2SO_3 sulfurous acid
- E) Fe_2O_3 iron(III) oxide

Answer: B

32) Which of the following examples illustrates a number that is correctly rounded to three significant figures?

- A) 109 526 grams to 109 500 grams
- B) 20.0332 grams to 20.0 grams
- C) 0.03954 grams to 0.040 grams
- D) 4.05438 grams to 4.054 grams
- E) 103.692 grams to 103.7 grams

Answer: B

33) Choose the INCORRECT statement.

- A) The mass number is the number of protons plus neutrons.
- B) The atomic number is the proton number.
- C) Protons and neutrons are found in the nucleus.
- D) Gamma rays are bent by magnetic fields as a ray of positive charges.
- E) Protons and neutrons are close to the same mass.

Answer: D

- 34) Complete combustion of a 0.500 g sample of a pure hydrocarbon yielded 0.973 g CO₂ and 0.323 g H₂O. The empirical formula of this hydrocarbon is:

A) C₃H₅ B) C₆H₉ C) C₅H₈ D) C₂H₃ E) C₄H₆

Answer: C

- 35) Silver possesses two stable forms: ¹⁰⁷Ag (106.90 u) and ¹⁰⁹Ag (108.90 u). If the average atomic mass of Ag is 107.87 u, what is the % (w/w) abundance of ¹⁰⁷Ag?

A) 53.8% B) 48.5% C) 50.0% D) 46.3% E) 51.5%

Answer: E

- 36) A 25 g sample of sugar is found to contain 51.4% oxygen by mass. Another 250 g sample of the same sugar is also 51.4% oxygen by mass. This is consistent with the:

A) law of conservation of mass.
B) second assumption of Dalton's theory.
C) first assumption of Dalton's atomic theory.
D) law of multiple proportions.
E) law of constant composition.

Answer: E

- 37) Which of the following represents a 1.00 M aqueous solution of glucose (C₆H₁₂O₆)?

A) 0.100 g glucose per mL solution
B) 10.0 g glucose per 10.0 mL water
C) 0.180 g glucose per mL solution
D) 90.0 g glucose per 500 mL water
E) 4.5 g glucose per 4.5 g water

Answer: C

- 38) Significant figures are important because they indicate _____.

A) the accuracy of the conversion factor
B) the number of digits in a measurement
C) the number of digits on a calculator
D) a counted number
E) the number of measurements

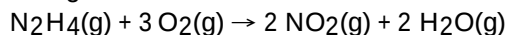
Answer: B

- 39) When you observe the formation of fog on a cool, humid day, what type of event are you observing?

A) a chemical change in oxygen
B) a chemical change in water
C) a combination of nitrogen and oxygen
D) a physical change in water
E) a physical change in air

Answer: D

- 40) Consider the gaseous reaction:



If the above reaction has a percent yield of 98.5%, what mass in grams of oxygen is needed to produce 49.0 g of NO₂(g)?

A) 50.4 g B) 25.9 g C) 23.1 g D) 51.9 g E) 11.5 g

Answer: D

- 41) A student measuring the density of a solution ($d = 1.233 \text{ g/mol}$) reported the following results: 1.285, 1.287, 1.284, 1.279. Which of the following is the best description of the student's data?
- A) precise, inaccurate
 - B) not precise, inaccurate
 - C) precise, accurate
 - D) precise, but with a systematic error
 - E) not precise, accurate

Answer: D

- 42) Which of the following is NOT true for the atoms ^{13}N , ^{14}N , and ^{15}N ?
- A) They all have 7 electrons.
 - B) They are isotopes.
 - C) They all have 7 protons.
 - D) They all have the same mass number.
 - E) They all have the same atomic number.

Answer: D

- 43) When decomposed chemically, 73.0 grams of a sample of HCl produce 71.0 g of Cl_2 and 2.0 g of H_2 , while 34.0 g of a sample of H_2S produce 32.0 g of S and 2.0 g of H_2 . This is an example of the Law:
- A) of Conservation of Mass
 - B) $E = mc^2$
 - C) of Multiple Proportions
 - D) of Definite Proportions
 - E) none of these

Answer: A

- 44) Dalton's atomic theory is based on several assumptions which are listed below. Which of these assumptions is strictly correct?
- I) All atoms of the same element are identical.
 - II) Atoms are indivisible and unchangeable.
 - III) Chemical changes are the result of the combination, separation, and rearrangement of atoms.
- A) III is correct.
 - B) I, II, and III are correct.
 - C) I and II are correct.
 - D) I and III are correct.
 - E) II and III are correct.

Answer: A

- 45) The number of significant figures in the measurement of 45.030 mm is _____.
A) none B) five C) four D) three E) six

Answer: B

Use the equation $\text{C}_2\text{H}_6\text{O} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ to answer the following question(s).

- 46) The balanced equation involves the corresponding coefficients _____.
A) 1: 2: 2: 3 B) 2: 7: 4: 6 C) 1: 3: 2: 3 D) 2: 9: 4: 6

Answer: C

47) The theoretical number of carbon dioxide moles produced from 3 moles $\text{C}_2\text{H}_6\text{O}$ is _____.

A) 3

B) 6

C) 9

D) 4

Answer: B

48) The theoretical number of moles of water produced from 2 moles $\text{C}_2\text{H}_6\text{O}$ is _____.

A) 2

B) 9

C) 6

D) 3

Answer: C

49) What is the theoretical mass of carbon dioxide produced from one mole of $\text{C}_2\text{H}_6\text{O}$?

A) 44 g

B) 176 g

C) 88 g

D) 6 g

Answer: C

50) The % yield of an experiment in which 1 mole $\text{C}_2\text{H}_6\text{O}$ was used and 22g carbon dioxide was isolated is _____.

A) 50%

B) 25%

C) 37.5%

D) 100%

Answer: B