1. The compound formed between element X and oxygen has the chemical formula X_2O. Which element would X **most likely** represent?

    A   Fe

    B   Zn

    C   Ag

    D   Sn

2. Which electron configuration represents a transition element?

    A $1s^2 2s^2 2p^3$

    B $1s^2 2s^2 2p^6 3s^2$

    C $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$

    D $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$

3. Given the electronic configuration of $1s^2 2s^2 2p^4$, how many electrons does this element have in its outer level?

    A   2

    B   4

    C   6

    D   8

4. Which correctly lists four atoms from smallest to largest radii?

    A   I, Br, Cl, F

    B   F, I, Br, Cl

    C   Si, P, S, Cl

    D   Cl, S, P, Si

5. Which **best** explains why cations are smaller than the atoms from which they are formed?

    A   The metallic atom gains electrons, causing a larger effective nuclear pull.

    B   The metallic atom loses electrons, resulting in loss of an entire energy level.

    C   The nonmetallic atom gains electrons, causing a larger effective nuclear pull.

    D   The nonmetallic atom loses electrons, resulting in loss of an entire energy level.

6. Which have the lowest electronegativities?

    A   alkali metals

    B   halogens

    C   rare earth elements

    D   transition metals

7. How many moles are in 59.6 grams of $BaSO_4$?

    A   0.256 mole

    B   3.91 moles

    C   13.9 moles

    D   59.6 moles

8. What is the volume of two moles of hydrogen gas at STP?

    A   44.8 L

    B   22.4 L

    C   11.2 L

    D   2.00 L

9. How many molecules are contained in 55.0 g of H_2SO_4?

    A   0.561 molecule

    B   3.93 molecules

    C 3.38×10^{23} molecules

    D 2.37×10^{24} molecules

10. If a sample of magnesium has a mass of 60. g, how many moles of magnesium does the sample contain?

    A   1.1 moles

    B   1.2 moles

    C   2.0 moles

    D   2.5 moles

11. How many grams of KCl are necessary to prepare 1.50 liters of a 0.500-M solution of KCl?

    A   224 g

    B   74.6 g

    C   56.0 g

    D   24.9 g

12. What is the molarity of a solution containing 20.0 g of sodium hydroxide dissolved in 1.00 L of solution?

    A   0.500 M

    B   0.400 M

    C   0.300 M

    D   0.200 M

13. Analysis shows a compound to be, by mass, 43.8% N, 6.2% H, and 50.0% O. Which is a possible molecular formula for the substance?

    A NH_4NO_2

    B NH_4NO_3

    C NH_3OH

    D N_2OH

14. A compound has an empirical formula of CH_2O and a molecular mass of 180 g. What is the compound's molecular formula?

    A $C_3H_6O_3$

    B $C_6H_{12}O_6$

    C $C_6H_{11}O_7$

    D $C_{12}H_{22}O_{11}$

15. What is the percent by mass of iron in the compound Fe_2O_3?
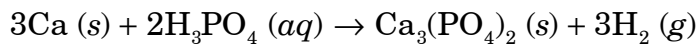
    A   70%

    B   56%

    C   48%

    D   30%

16. Metallic sodium reacts violently with water to form hydrogen and sodium hydroxide according to the balanced equation:

    $$2Na + 2H_2O \rightarrow 2NaOH + H_2$$
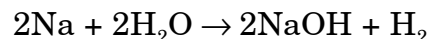
    How many moles of hydrogen gas are generated when 4.0 moles of sodium react with excess water?

    A   1.0 mole

    B   2.0 moles

    C   3.0 moles

    D   4.0 moles

17.   Consider this reaction:

$$3Ca\ (s) + 2H_3PO_4\ (aq) \rightarrow Ca_3(PO_4)_2\ (s) + 3H_2\ (g)$$

How many moles of calcium are required to produce 60.0 g of calcium phosphate?

A   0.145 mole

B   0.194 mole

C   0.387 mole

D   0.581 mole

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18.   According to the equation $2H_2O\ (l) \rightarrow 2H_2\ (g) + O_2\ (g)$, what mass of H_2O is required to yield 22.4 L of O_2 at STP?

A   12 g

B   18 g

C   24 g

D   36 g

19.   Consider this reaction:
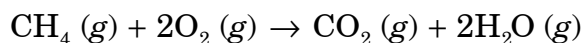
$$3Mg\,(s) + 2H_3PO_4\,(aq) \rightarrow Mg_3(PO_4)_2\,(s) + 3H_2\,(g)$$
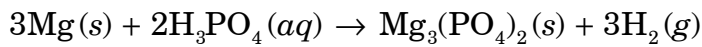
How many grams of magnesium phosphate should be produced if 5.40 grams of magnesium react with excess phosphoric acid?

A   1.80 grams

B   19.5 grams

C   58.4 grams

D   175 grams

20.   Methane (CH_4) is burned in oxygen according to this balanced chemical equation:

$$CH_4\,(g) + 2O_2\,(g) \rightarrow CO_2\,(g) + 2H_2O\,(g)$$

What volume of carbon dioxide is formed when 9.36 liters of methane are burned in excess oxygen at STP?

A   9.36 L

B   15.0 L

C   18.7 L

D   22.4 L

End of Goal 3 Sample Items

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Chemistry Goal 3
Sample Items Key Report

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1   **Objective: 3.01**
Analyze periodic trends in chemical properties and use the periodic table to predict properties of elements.
a. Groups (families), Periods, and representative elements (main group) and transition elements.
b. Electron configuration and energy levels.
c. Ionization energy, atomic and ionic radii, and/or electronegativity.
Thinking Skill: Applying   **Correct Answer:**   C

2   **Objective: 3.01**
Analyze periodic trends in chemical properties and use the periodic table to predict properties of elements.
a. Groups (families), Periods, and representative elements (main group) and transition elements.
b. Electron configuration and energy levels.
c. Ionization energy, atomic and ionic radii, and/or electronegativity.
Thinking Skill: Analyzing   **Correct Answer:**   C

3   **Objective: 3.01**
Analyze periodic trends in chemical properties and use the periodic table to predict properties of elements.
a. Groups (families), Periods, and representative elements (main group) and transition elements.
b. Electron configuration and energy levels.
c. Ionization energy, atomic and ionic radii, and/or electronegativity.
Thinking Skill: Applying   **Correct Answer:**   C

4   **Objective: 3.01**
Analyze periodic trends in chemical properties and use the periodic table to predict properties of elements.
a. Groups (families), Periods, and representative elements (main group) and transition elements.
b. Electron configuration and energy levels.
c. Ionization energy, atomic and ionic radii, and/or electronegativity.
Thinking Skill: Organizing   **Correct Answer:**   D

5   **Objective: 3.01**
Analyze periodic trends in chemical properties and use the periodic table to predict properties of elements.
a. Groups (families), Periods, and representative elements (main group) and transition elements.
b. Electron configuration and energy levels.
c. Ionization energy, atomic and ionic radii, and/or electronegativity.

| | **Thinking Skill:** | Analyzing | **Correct Answer:** | B |

6   **Objective:**   **3.01**
Analyze periodic trends in chemical properties and use the periodic table to predict properties of elements.
a. Groups (families), Periods, and representative elements (main group) and transition elements.
b. Electron configuration and energy levels.
c. Ionization energy, atomic and ionic radii, and/or electronegativity.

| | **Thinking Skill:** | Organizing | **Correct Answer:** | A |

7   **Objective:**   **3.02**
Apply the mole concept, Avogadro's number and conversion factors to chemical calculations.
a. Particles to moles, mass to moles, and/or volume of a gas to moles
b. Molarity of
c. Empirical and molecular
d. Percent composition.

| | **Thinking Skill:** | Applying | **Correct Answer:** | A |

8   **Objective:**   **3.02**
Apply the mole concept, Avogadro's number and conversion factors to chemical calculations.
a. Particles to moles, mass to moles, and/or volume of a gas to moles
b. Molarity of
c. Empirical and molecular
d. Percent composition.

| | **Thinking Skill:** | Applying | **Correct Answer:** | A |

9   **Objective:**   **3.02**
Apply the mole concept, Avogadro's number and conversion factors to chemical calculations.
a. Particles to moles, mass to moles, and/or volume of a gas to moles
b. Molarity of
c. Empirical and molecular
d. Percent composition.

| | **Thinking Skill:** | Applying | **Correct Answer:** | C |

10   **Objective:**   **3.02**
Apply the mole concept, Avogadro's number and conversion factors to chemical calculations.
a. Particles to moles, mass to moles, and/or volume of a gas to moles
b. Molarity of
c. Empirical and molecular

d. Percent composition.
Thinking Skill: Applying   **Correct Answer:**   D

11   **Objective:**   **3.02**
Apply the mole concept, Avogadro's number and conversion factors to chemical calculations.
a. Particles to moles, mass to moles, and/or volume of a gas to moles
b. Molarity of
c. Empirical and molecular
d. Percent composition.
Thinking Skill: Applying   **Correct Answer:**   C

12   **Objective:**   **3.02**
Apply the mole concept, Avogadro's number and conversion factors to chemical calculations.
a. Particles to moles, mass to moles, and/or volume of a gas to moles
b. Molarity of
c. Empirical and molecular
d. Percent composition.
Thinking Skill: Applying   **Correct Answer:**   A

13   **Objective:**   **3.02**
Apply the mole concept, Avogadro's number and conversion factors to chemical calculations.
a. Particles to moles, mass to moles, and/or volume of a gas to moles
b. Molarity of
c. Empirical and molecular
d. Percent composition.
Thinking Skill: Applying   **Correct Answer:**   A

14   **Objective:**   **3.02**
Apply the mole concept, Avogadro's number and conversion factors to chemical calculations.
a. Particles to moles, mass to moles, and/or volume of a gas to moles
b. Molarity of
c. Empirical and molecular
d. Percent composition.
Thinking Skill: Applying   **Correct Answer:**   B

15   **Objective:**   **3.02**
Apply the mole concept, Avogadro's number and conversion factors to chemical calculations.
a. Particles to moles, mass to moles, and/or volume of a gas to moles
b. Molarity of

c. Empirical and molecular
d. Percent composition.
Thinking Skill: Applying   **Correct Answer:**   A

16   **Objective:**   **3.03**
Calculate quantitative relationships in chemical reactions (stoichiometry).
a. Moles of each species in a
b. Mass of each species in a
c. Volumes of gaseous species in a reaction.
Thinking Skill: Applying   **Correct Answer:**   B

17   **Objective:**   **3.03**
Calculate quantitative relationships in chemical reactions (stoichiometry).
a. Moles of each species in a
b. Mass of each species in a
c. Volumes of gaseous species in a reaction.
Thinking Skill: Applying   **Correct Answer:**   D

18   **Objective:**   **3.03**
Calculate quantitative relationships in chemical reactions (stoichiometry).
a. Moles of each species in a
b. Mass of each species in a
c. Volumes of gaseous species in a reaction.
Thinking Skill: Applying   **Correct Answer:**   D

19   **Objective:**   **3.03**
Calculate quantitative relationships in chemical reactions (stoichiometry).
a. Moles of each species in a
b. Mass of each species in a
c. Volumes of gaseous species in a reaction.
Thinking Skill: Applying   **Correct Answer:**   B

20   **Objective:**   **3.03**
Calculate quantitative relationships in chemical reactions (stoichiometry).
a. Moles of each species in a
b. Mass of each species in a
c. Volumes of gaseous species in a reaction.
Thinking Skill: Integrating   **Correct Answer:**   A