

CHEM 101

Exam 3:

November 4, 2021

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Clearly print your name in the name section of the Scantron answer sheet.

Clearly enter the last five numbers of your student ID number in the Student ZipGrade ID portion of the Scantron answer sheet.

There is only one most correct response to each of the multiple-choice questions. Each question is worth 2.5 points. Please work through the entire exam and circle your responses to the question on your exam before transferring your responses to the Scantron sheet. Be sure to make any erasure on the Scantron sheet complete.

1) Which statement is NOT correct?

- a. The ratio of carbon to oxygen in carbon dioxide is the same as the ratio of oxygen to oxygen in carbon monoxide
- b. Even though atoms combine in whole-number ratios, their mass ratios are not necessarily whole numbers
- c. We represent a compound with a chemical formula
- d. Chemical formula indicates the elements present in the compound and the relative number of atoms of each element

2) The ----- is a specific number that allows us to count atoms or molecules by weighing them.

- a. Chemical formula
- b. Formula mass
- c. mol
- d. Mass

3) Is the following statement True or False?

The relative masses of the elements within a compound allow us to determine the empirical formula of the compound. If we know the molar mass of the compound, we can also determine its molecular formula.

- a. True
- b. False

4) Which of the following is NOT a prefix being used in naming molecular compounds?

- a. Nano
- b. Mono
- c. Deca
- d. Di

- 5) Which of the following is a polyatomic anion?
- $\text{NH}_4^+$
  - $\text{H}_2\text{CO}_3$
  - $\text{HNO}_2$
  - $\text{O}_2^{2-}$
- 6) Which of the following is NOT an example of a compound?
- Salt
  - Mercury
  - Water
  - Carbon dioxide
- 7) Which of the following statements is correct?
- Lithium (I) is the name of  $\text{Li}^+$
  - Mercury (I) is the name of  $\text{Hg}_2^{2+}$
  - Zinc (II) is the name of  $\text{Zn}^{2+}$
  - Strontium is a transition metal and has a charge of 2+

8) Is the following statement True or False?

The name of the cation in ionic compounds is usually different from the name of the metal

- True
  - False
- 9) Which of the following acid names is correct?
- carbonous acid, considering its corresponding oxyanion is carbonate
  - sulfurous acid, considering its corresponding oxyanion is sulfate
  - Hydrosulfuric acid considering its corresponding oxyanion is sulfate
  - Acetic acid considering its corresponding oxyanion is acetate
- 10) Which of the following is molecular model of a chemical compound which displays three-dimensional position of atoms?
- Ionic compound
  - Empirical formula
  - Ball-and-stick model
  - Molecular formula
- 11) Which of the following is NOT a pure substance?
- He
  - $\text{H}_2$
  - $\text{CaCl}_2$
  - All of the above are pure substances

12) Is the following statement True or False?

Only few elements exist as atomic elements; their basic units in nature are individual atoms.

- a. True
- b. False

13) Two samples said to be carbon disulfide ( $\text{CS}_2$ ) are decomposed into their constituent elements. One sample produces 8.08 g S and 1.51 g C, while the other produces 31.3 g S and 3.85 g C. Are these results consistent with the law of constant composition?

- a. Yes
- b. No
- c. This question cannot be answered with the information provided

14) Which statement is NOT correct?

- a. The number of atoms in a chemical formula not enclosed in parentheses are given directly by their subscript
- b. The number of atoms in a chemical formula within parentheses are being found by multiplying their subscript within the parentheses by their subscript outside the parentheses
- c. Most of the matter you encounter is in the form of atomic elements
- d. Caffeine is considered to be a compound

15) Write a chemical formula for the compound containing one nitrogen atom for every three hydrogen atoms:

- a.  $\text{NO}_2$
- b.  $\text{NH}_3$
- c.  $\text{NH}_4$
- d.  $\text{N}_2\text{H}_4$

16) Which of the following conversions factor is NOT correct?

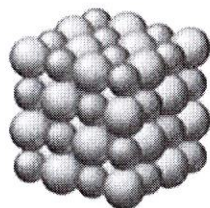
- a.  $\frac{1 \text{ mol}}{6.022 \times 10^{23} \text{ atoms}}$
- b.  $\frac{1 \text{ doz atoms}}{12 \text{ atoms}}$
- c.  $\frac{1 \text{ doz molecules}}{12 \text{ molecules}}$
- d.  $\frac{12 \text{ carbon atoms}}{6.022 \times 10^{23}}$

17) What is the charge of Cr ion in the compound  $\text{Cr}(\text{NO}_3)_2$

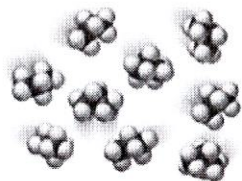
- a. 1+
- b. 2+
- c. 3+
- d. 1-

- 18) What is a binary compound?
- a. Contains only two atoms
  - b. Contains only two molecules
  - c. Contains only two ions
  - d. Contains only two different elements

19) Which image represents a molecular compound?



a.



b.

20) Which of the following is an ionic compound?

- a.  $\text{COCl}_2$
- b.  $\text{CoCl}_2$
- c.  $\text{NH}_4$
- d.  $\text{Hg}_2^{2+}$

21) Which of the following is the correct name for the given formula?

- a.  $\text{Ca}(\text{NO}_2)_2$ : calcium nitrate
- b.  $\text{K}_2\text{O}$ : dipotassium monoxide
- c.  $\text{PbCO}_3$ : lead (II) carbonate
- d.  $\text{Fe}(\text{OH})_2$ : Iron hydroxide

22) How many oxygen atoms are in five dinitrogen monoxide molecules?

- a. 5
  - b. 10
  - c.  $30.11 \times 10^{23}$
  - d.  $6.022 \times 10^{23}$
- $5 \text{ N}_2\text{O}$

23) Which of the following names is correct?

- a.  $\text{PBr}_5$ : Phosphorus (V) pentabromide
- b.  $\text{P}_2\text{O}_3$ : Phosphorus trioxide
- c.  $\text{SF}_4$ : Monosulfur hexafluoride
- d.  $\text{NF}_4$ : Nitrogen tetrafluoride

24) What is the chemical formula for chlorous acid?

- a. HCl
- b. HClO<sub>2</sub>
- c. HClO<sub>3</sub>
- d. HClO

25) What is the chemical formula for diboron tetrachloride?

- a. B<sub>2</sub>F<sub>4</sub>
- b. Br<sub>2</sub>F<sub>4</sub>
- c. Br<sub>4</sub>F<sub>2</sub>
- d. BF<sub>2</sub>

26) Is the following statement True or False?

Oxyacids are classified into two types, depending on the endings of the oxyanions that they contain.

- a. True
- b. False

$$33.56 \times 10^{-3}$$

27) What is the mass of  $5.94 \times 10^{20}$  H<sub>2</sub>O<sub>2</sub> molecules?

- a. 0.033 g
- b. 0.001 g
- c. 0.018 g
- d. 0.0594 g

$$5.94 \times 10^{20} \text{ molecules} \times \frac{1 \text{ mol}}{6.022 \times 10^{23} \text{ molecules}} \times \frac{34.02 \text{ g}}{1 \text{ mol}}$$

$$\frac{5.94 \times 34.02}{6.022} \times 10^{-3} = 0.0033 \text{ g}$$

$$H_2O_2 = \frac{1.01 \times 2}{2.02} + \frac{16 \times 2}{32.02}$$

28) Lead is found in Earth's crust as several lead compounds. What is the mass of PbCO<sub>3</sub> that contains 10 g of lead.

- a. 7.75 g
- b. 222.67 g
- c. 0.05 g
- d. 12.90 g

$$? \text{ g PbCO}_3 = 10 \text{ g Pb} \times \frac{1 \text{ mol Pb}}{207.2 \text{ g Pb}} \times \frac{1 \text{ mol PbCO}_3}{1 \text{ mol Pb}} \times \frac{267.21 \text{ g PbCO}_3}{1 \text{ mol}}$$

$$PbCO_3 = 207.2 + 12.01 + \frac{16 \times 3}{48} = 267.21 = 12.896 \text{ g}$$

29) What is the number of moles of oxygen in 3 moles of Ca(NO<sub>3</sub>)<sub>2</sub>:

- a. 6
- b. 2
- c. 18
- d. 36

$$? \text{ mol O} = 3 \text{ mol Ca(NO}_3)_2 \times \frac{6 \text{ mol O}}{1 \text{ mol Ca(NO}_3)_2}$$

30) How many molecules are in 10 g of C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>?

- a. 60
- b.  $3.34 \times 10^{22}$
- c.  $3.34 \times 10^{23}$
- d.  $2 \times 10^{23}$

$$? \text{ \# molecules} = 10 \text{ g C}_6\text{H}_{12}\text{O}_6 \times \frac{1 \text{ mol}}{180.18 \text{ g}} \times \frac{6.022 \times 10^{23} \text{ molecules}}{1 \text{ mol}}$$

$$12.01 \times 6 + 1.01 \times 12 + 16 \times 6 = 180.18$$

$$\frac{1}{3} \times 10^{23} = 3.34 \times 10^{22}$$

31) A salt crystal has a mass of  $0.12 \times 10^{-3}$  g. How many NaCl formula units does it contain?

- a.  $2.05 \times 10^6$
- b.  $1.24 \times 10^{18}$
- c.  $2.05 \times 10^{-6}$
- d.  $4.7 \times 10^{-5}$

$$0.12 \times 10^{-3} \text{ g} \times \frac{1 \text{ mol NaCl}}{22.99 + 35.45 \text{ g}} \times \frac{6.022 \times 10^{23}}{1 \text{ mol}} = 1.236 \times 10^{18}$$

32) Which is molar mass of carbon?

- a. 12.01 g/mol
- b. 12.01 g
- c. 12.01 mol
- d.  $6.02 \times 10^{23}$

$$\frac{12 \times 10^{-5}}{48} \times 6 \times 10^{23}$$

$$0.25 \times 6 \times 10^{-5} \times 10^{23}$$

$$1.50 \times 10^{18}$$

$$1.5 \times 10^{18}$$

33) Which of the following contains more than one type of charge?

- a. Strontium
- b. Cesium
- c. Oxygen
- d. Lead

34) Is the following statement True or False?

The metals that form more than one type of charge are usually transition metals.

- a. True
- b. False

35) Which of the following is a binary acid?

- a.  $\text{H}_2\text{CO}_3$
- b.  $\text{H}_2\text{S}$
- c.  $\text{H}_3\text{PO}_4$
- d.  $\text{HC}_2\text{H}_3\text{O}_2$

36) What is the formula mass of  $\text{Mg}(\text{NO}_3)_2$ ?

- a. 5993.65
- b. 86.32
- c. 178.96
- d. 148.33

$$24.31 + (14.01 \times 2) + (16 \times 6) = 148.33$$

37) What is the mass percent composition of oxygen in  $\text{N}_2\text{O}_5$ ?

- a. 74.1 %
- b. 29.6 %
- c. 25.9 %
- d. 68.6 %

$$\frac{14.01 \times 5 \times 16}{(14.01 \times 2 + 16 \times 5)} \times 100\% = 74.1\%$$

38) A compound containing selenium and fluorine is decomposed in the laboratory and produces 2.231 g of selenium and 3.221 g of fluorine. What is the empirical formula of the compound?

- a. Se<sub>3</sub>F
- b. Se<sub>2</sub>F
- c. SeF<sub>6</sub>
- d. Se<sub>6</sub>F

$$\text{Se: } 2.231 \text{ g} \times \frac{1 \text{ mol}}{78.97 \text{ g}} = 0.02825 \quad \text{Se}_{0.02825} \text{F}_{0.16953}$$

$$\text{F: } 3.221 \text{ g} \times \frac{1 \text{ mol}}{19 \text{ g}} = 0.16953 \quad \text{Se}_1 \text{F}_6$$

39) A compound containing phosphorous and oxygen has a molar mass of 219.9 g/mol and an empirical formula of P<sub>2</sub>O<sub>3</sub>. Determine its molecular formula.

- a. P<sub>2</sub>O<sub>3</sub>
- b. P<sub>4</sub>O<sub>6</sub>
- c. P<sub>6</sub>O<sub>9</sub>
- d. To molecular formula cannot be calculated from the information provided

$$\text{P}_2\text{O}_3 = (30.97 \times 2) + (16 \times 3) = 109.94 \quad \text{P}_4\text{O}_6$$

$$\frac{219.9}{109.94} = 2$$

40) Is the following statement True or False?

A mole has to be a large number because atoms are so small.

- a. True
- b. False

### Appendix 1: Some Common Polyatomic Ions

Name	Formula	Name	Formula
acetate	C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> <sup>-</sup>	hypochlorite	ClO <sup>-</sup>
carbonate	CO <sub>3</sub> <sup>2-</sup>	chlorite	ClO <sub>2</sub> <sup>-</sup>
hydrogen carbonate (or bicarbonate)	HCO <sub>3</sub> <sup>-</sup>	chlorate	ClO <sub>3</sub> <sup>-</sup>
hydroxide	OH <sup>-</sup>	perchlorate	ClO <sub>4</sub> <sup>-</sup>
nitrate	NO <sub>3</sub> <sup>-</sup>	permanganate	MnO <sub>4</sub> <sup>-</sup>
nitrite	NO <sub>2</sub> <sup>-</sup>	sulfate	SO <sub>4</sub> <sup>2-</sup>
chromate	CrO <sub>4</sub> <sup>2-</sup>	sulfite	SO <sub>3</sub> <sup>2-</sup>
dichromate	Cr <sub>2</sub> O <sub>7</sub> <sup>2-</sup>	hydrogen sulfite (or bisulfite)	HSO <sub>3</sub> <sup>-</sup>
phosphate	PO <sub>4</sub> <sup>3-</sup>	hydrogen sulfate (or bisulfate)	HSO <sub>4</sub> <sup>-</sup>
hydrogen phosphate	HPO <sub>4</sub> <sup>2-</sup>	peroxide	O <sub>2</sub> <sup>2-</sup>
ammonium	NH <sub>4</sub> <sup>+</sup>	cyanide	CN <sup>-</sup>