

MULTIPLE CHOICE

1. The law of constant composition applies to _____.

- a) solutions
- b) heterogeneous mixtures
- c) compounds
- d) homogeneous mixtures
- e) solids

2. Which of the following is not a physical property of water?

- a) It is a liquid at room temperature.
- b) It can be decomposed into oxygen and hydrogen gases.
- c) It boils at 100°C.
- d) It melts at 0°C.
- e) These are all physical properties of water.

3. What is the volume of a 12.2 g piece of metal with a density of 9.43 g/cm³?

- a) 12.2 cm³
- b) 1.29 cm³
- c) 0.773 cm³
- d) 115 cm³
- e) none of these

$$\frac{12.2 \text{ g}}{9.43 \text{ g/cm}^3} = \text{cm}^3$$

4. Of the following, _____ is the greatest mass.

- a) $4.22 \times 10^8 \text{ mg} \times 10^{-3} = 4.22 \times 10^5$
- b) $6.83 \times 10^{-5} \text{ mg} \times 10^{-3} =$
- c) $9.73 \times 10^9 \text{ pg} \times 10^{-12} =$
- d) $7.73 \times 10^{-2} \text{ pg} \times 10^{-3} =$
- e) $4.23 \times 10^8 \text{ pg} \times 10^{-12} =$

5. 1 picometer = _____ centimeters

- a) 1×10^{10}
- b) 1×10^{-10}
- c) 1×10^8
- d) 1×10^{-8}
- e) 1×10^{-12}

$$\frac{1 \times 10^{-12} \text{ m}}{10^{-2}} = \text{cm}$$

6. How many significant figures should there be in the answer to the following?

$$23.1 + 0.11 + 140.3 + 52.07 = \underline{\hspace{2cm}}$$

- a) 5
- b) 1
- c) 2
- d) 3
- e) 4

$$\begin{array}{r} 23.1 \\ 0.11 \\ 140.3 \\ + 52.07 \\ \hline 215.58 \end{array}$$

Answer to the 0.1 place

7. What is the correct answer (reported to the proper number of significant figures) to the following?

$$(2115-2101) \times (5.11 \times 7.72) = \underline{\hspace{2cm}}$$

- a) 552
- b) 552.29
- c) 552.3
- d) 5.5×10^2
- e) 6×10^2

$$14 \times (5.11 \times 7.72) = 552.2888$$

2 s.f. 3 s.f. 3 s.f.

8. Osmium has a density of 22.6 g/cm^3 . The mass of a block of osmium that measures $1.01 \text{ cm} \times 0.233 \text{ cm} \times 0.648 \text{ cm}$ is _____ g.

- a) 6.75×10^{-3}
 b) 3.45
 c) 148
 d) 6.75×10^3
 e) 34.5

$$V = l \cdot w \cdot h = 0.1525 \text{ cm}^3$$

$$\frac{0.1525 \text{ cm}^3}{\text{cm}^3} \cdot 22.6 \text{ g} = \text{g}$$

9. A cube of an unknown metal measures 1.61 mm on one side. The mass of the cube is 36 mg . Which of the following is most likely the unknown metal?

metal	density g/cm^3
rhodium	12.4
copper	8.96
niobium	8.57
vanadium	6.11
zirconium	6.51

$$\frac{1.61 \times 10^{-3} \text{ mm}}{10^{-2}} = 0.161 \text{ cm}$$

$$\frac{36 \times 10^{-3} \text{ g}}{(0.161 \text{ cm})^3} = \frac{8.63 \text{ g}}{\text{cm}^3}$$

- a) copper
 b) rhodium
 c) niobium
 d) vanadium
 e) zirconium

10. Which pair of substances could be used to illustrate the law of multiple proportions?

- a) SO_2 , H_2SO_4
 b) SO , SO_2
 c) H_2O , O_2
 d) CH_4 , $\text{C}_6\text{H}_{12}\text{O}_6$
 e) NaCl , KCl

11. Different isotopes of a particular element contain the same number of _____.

- a) protons
 b) neutrons
 c) protons and neutrons
 d) protons, neutrons, and electrons
 e) subatomic particles

12. Which one of the following is a nonmetal?

- a) W
 b) Sr
 c) Os
 d) Ir
 e) Br

13. Which pair of elements below should be the most similar in chemical properties?

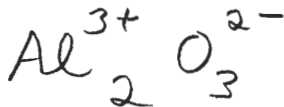
- a) C and O
 b) B and As
 c) I and Br
 d) K and Kr
 e) Cs and He

Key

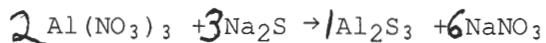
14. There are $\overset{3+35}{38}$ electrons, $\overset{77-35}{35}$ protons, and $\overset{77-35}{42}$ neutrons in the ion ${}_{35}^{77}\text{X}^{3-}$?
- a) 38, 35, 42
 b) 77, 32, 77
 c) 32, 80, 35
 d) 77, 77, 35
 e) 35, 35, 42

15. Predict the empirical formula of the ionic compound that forms from aluminum and oxygen.

- a) AlO
 b) Al₃O₂
 c) Al₂O₃
 d) AlO₂
 e) Al₂O



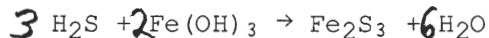
16. Consider the following reaction:



The coefficients that balance the reactions are _____.

- a) 2, 3, 1, 6
 b) 2, 1, 3, 2
 c) 1, 1, 1, 1
 d) 4, 6, 3, 2
 e) none of these

17. What is the coefficient of H₂S when the following equation is balanced?



- a) 2
 b) 3
 c) 4
 d) 5
 e) 1

18. Given the information below, calculate the weighted average atomic mass (amu) of the element X.

Isotope	Abundance (%)
²²¹ X	74.22
²²⁰ X	12.78
²¹⁸ X	13.00

Mass (amu)		
220.9	X 0.7422	= 163.95
220.0	X 0.1278	= 28.12
218.1	X 0.1300	= 28.353

- a) 219.7
 b) 220.4
 c) 22042
 d) 218.5
 e) 221.0

220.423

19. The formula weight (amu) of aluminum sulfate is _____.

- a) 342.14
- b) 123.04
- c) 59.04
- d) 150.14
- e) 273.06

$$\text{Al}_2(\text{SO}_4)_3$$

$$\left. \begin{array}{l} 12 \times 16.00 = \\ 3 \times 32.07 = \\ 2 \times 26.98 = \end{array} \right\} 342.17$$

20. Calculate the percentage by mass of chlorine in $\text{PtCl}_2(\text{NH}_3)_2$.

- a) 23.63
- b) 11.82
- c) 25.05
- d) 12.53
- e) 18.09

$$\left. \begin{array}{l} 6 \times 1.01 = \\ 2 \times 14.01 = \\ 2 \times 35.45 = 70.9 \\ 1 \times 195.1 = \end{array} \right\} 300.08$$

$$\frac{70.9}{300.08} \times 100 = 23.63\%$$

21. How many grams of oxygen are in 65 g of $\text{C}_2\text{H}_2\text{O}_2$?

- a) 18
- b) 29
- c) 9.0
- d) 36
- e) 130

molar mass = 58.036

$$\% \text{O} = \frac{32.0}{58.036} \times 100 = 55.1$$

$$65 \times 0.551 = 35.8 \text{ g O}$$

22. What is the empirical formula of a compound that contains 49.4% K, 20.3% S, and 30.3% O by mass?

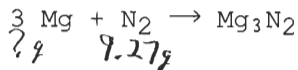
- a) KSO_2
- b) KSO_3
- c) K_2SO_4
- d) K_2SO_3
- e) KSO_4

Assume 100g

$$\begin{array}{l} \text{K: } \frac{49.4 \text{ g}}{39.10 \text{ g/mol}} = 1.26 \div 0.633 = 2 \\ \text{S: } \frac{20.3 \text{ g}}{32.07 \text{ g/mol}} = 0.633 \div 0.633 = 1 \\ \text{O: } \frac{30.3 \text{ g}}{16.0 \text{ g/mol}} = 1.894 \div 0.633 = 3 \end{array}$$

K_2SO_3

23. A sample of nitrogen (9.27 g) reacts completely with magnesium, according to the equation:

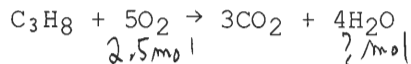


The mass of Mg consumed is _____ g.

- a) 8.04
- b) 24.1
- c) 16.1
- d) 0.92
- e) 13.9

$$\frac{9.27 \text{ g N}_2}{28.02 \text{ g N}_2} \times \frac{1 \text{ mol N}_2}{1 \text{ mol N}_2} \times \frac{3 \text{ mol Mg}}{1 \text{ mol N}_2} \times \frac{24.31 \text{ g Mg}}{1 \text{ mol Mg}} = 24.12 \text{ g Mg}$$

24. The combustion of C_3H_8 produces CO_2 and H_2O :

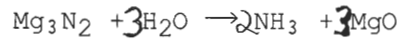


The reaction of 2.5 mol of O_2 will produce _____ mol of H_2O .

- a) 4.0
- b) 3.0
- c) 2.5
- d) 2.0
- e) 1.0

$$\frac{2.5 \text{ mol O}_2}{5 \text{ mol O}_2} \times \frac{4 \text{ mol H}_2\text{O}}{1 \text{ mol O}_2} = 2 \text{ mol H}_2\text{O}$$

25. If the reaction of 3.82 g of magnesium nitride with 7.73 g of water produced 3.60 g of magnesium oxide, what is the percent yield of this reaction? Balance the reaction.



3.82g 7.73

↳ actual yield = 3.60g

- a) 94.5
 b) 78.8
 c) 46.6
 d) 49.4
 e) 99.9

Based on: Mg_3N_2

3.82g	Mg₃N₂	mol	3 mol	MgO	=	4.576 g MgO
		100.95g	1 mol	40.31g		Theoretical yield
		Mg₃N₂	Mg₃N₂	mol		

Based on: H_2O

7.73g	H₂O	mol	3 mol	MgO	=	17.29 g MgO
		18.02g	3 mol	40.31g		
		H₂O	H₂O	mol		

$$\% \text{ yield} = \frac{3.60\text{g}}{4.576\text{g}} \times 100 = 78.7\%$$