Project Advance Chemistry 106 Sample Questions
on Material in *General Chemistry*, Brown, LeMay, and Bursten, 6th ed.

Chapter 3. Stoichiometry: Calculations, Chemical Formulas and Equations

1. What is the coefficient on Fe_3O_4 when the following equation is correctly balanced?

$$\_\_\_\_\ Al + \_\_\_\_\ Fe_3O_4 \rightarrow \_\_\_\_\ Al_2O_3 + \_\_\_\_\ Fe$$

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

2. What is the coefficient on O_2 when the following equation is correctly balanced?

$$\_\_\_\_\ C_2H_4O + \_\_\_\_\ O_2 \rightarrow \_\_\_\_\ CO_2 + \_\_\_\_\ H_2O$$

(a) 2 (b) 3
(c) 4 (d) 5
(e) none of these.

3. Predict the missing product in the following unbalanced equation.

$$Pb(NO_3)_2 + KOH \rightarrow KNO_3 + \_\_\_\_\_$$

(a) $PbOH_2$ (b) $Pb(OH)_4$
(c) $Pb(OH)_2$ (d) PbOH
(e) None of these.

4. The formula weight in amu of potassium phosphate, K_3PO_4, is

(a) 173.17 (b) 251.37
(c) 212.27 (d) 196.27
(e) 86.07

5. The mass percentage of hydrogen in methane, CH_4, is

(a) 25.13 (b) 4.032
(c) 74.87 (d) 92.26
(e) 7.743

6. A sample of magnesium oxide was analyzed and found to contain 1.52 g of magnesium for each gram of oxygen. If a second sample of the same oxide was found to contain 13.91 g of magnesium, what mass of oxygen does the second sample contain?

(a) 0.109 g (b) 1.00 g
(c) 9.15 g (d) 21.1 g
(e) none of these.

7. An unknown mass of element A reacts completely with 1.811 g of element B and 3.613 g of element C to produce 7.124 g of a compound containing A, B, and C. What additional information will be required in order to calculate the unknown mass of A?

   (a) A balanced equation for the reaction.
   (b) The molar masses of A, B, and C.
   (c) The formula of the reaction product.
   (d) All of the above are required.
   (e) None of the above are required.

8. The ratio of the number of bismuth atoms to the number of oxygen atoms in $Bi_2(SO_4)_3$ is

   (a) 2:1 (b) 2:3
   (c) 2:7 (d) 1:6
   (e) none of these.

9. In the compound, X_2O_3, 60.00 percent of the mass is X. If the relative atomic mass of X is 50.00, calculate the relative atomic mass of oxygen.

   (a) 11.11 (b) 22.22
   (c) 33.33 (d) 66.66
   (e) None of these.

10. The following table of data concerns the extraterrestrial, naturally occurring element *xpadvancium*.

Isotope	Mass	Abundance
^{301}X	300.991	27.40
^{304}X	303.944	27.90
^{309}X	308.963	44.70

Use the data to calculate the chemical relative atomic mass of xpadvancium.

   (a) 302.8 (b) 305.4
   (c) 306.7 (d) 314.6
   (e) None of these.

11. Calculate the mass (in grams) of a single atom of ^{133}Cs which has a relative atomic mass of 132.9041 on the ^{13}C scale.

   (a) 2.206926×10^{-22} g (b) 2.208518×10^{-22} g
   (c) 4.527922×10^{-21} g (d) 4.531190×10^{-21} g
   (e) None of these.

12. Calculate the number of atoms in 2.0000 g of aluminum. Aluminum has a relative atomic mass of 26.98153 and exists naturally as one isotope.

(a) 2.2319×10^{22} atoms
(b) 4.4804×10^{23} atoms
(c) 4.4640×10^{22} atoms
(d) 8.9608×10^{23} atoms
(e) None of these.

13. What is the formula weight of $(NH_4)_2S_2O_8$.

(a) 164
(b) 178
(c) 196
(d) 228
(e) none of these.

14. How many moles of dioxane, $C_4H_8O_2$, are present in 5.80 g of dioxane?

(a) 0.0658 mol
(b) 0.0707 mol
(c) 0.0725 mol
(d) 0.0804 mol
(e) None of these.

15. How many atoms of oxygen are in 300 molecules of CH_3CO_2H?

(a) 300
(b) 600
(c) 3.01×10^{24}
(d) 3.61×10^{26}
(e) none of these.

16. How many atoms of nitrogen are in 10 g of NH_4NO_3?

(a) 3.5
(b) 1.5×10^{23}
(c) 3.0×10^{23}
(d) 1.8
(e) Not enough information given to calculate answer.

17. A binary sulfur oxide compound which contains 50.0% by mass sulfur might have which molecular formula(s)?

(a) SO
(b) SO_2
(c) S_2O
(d) S_2O_4
(e) both SO_2 and S_2O_4

18. Which hydrocarbon pair below has identical mass percentage of carbon?

(a) C_3H_4 and C_3H_6
(b) C_2H_4 and C_3H_4
(c) C_2H_4 and C_4H_2
(d) C_2H_4 and C_3H_6
(e) none of these.

19. The data in the following table was obtained from the analysis of a compound of carbon, hydrogen, and oxygen. What is the empirical formula of the compound?

Element	Percent by weight
carbon	40.0
hydrogen	6.7
oxygen	53.3

(a) CH_2O
(b) C_6HO_8
(c) $C_2H_4O_2$
(d) C_3H_6O
(e) none of these.

20. How many moles of CO_2 are produced when 2.5 moles of O_2 react according to the following equation?

$$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$$

(a) 3
(b) 5
(c) 6
(d) 1.5
(e) none of these.

21. How many grams of H_2O are required to produce 13 g of C_2H_2 according to the following equation?

$$CaC_2 + 2\ H_2O \rightarrow Ca(OH)_2 + C_2H_2$$

(a) 4.5
(b) 9.0
(c) 18
(d) 4.7×10^2
(e) none of these.

22. How many grams of PbI_2 could be made from the complete reaction of 6.5 g of KI prepared according to the following (*unbalanced*) reaction?

$$\_\_\_\_\ Pb(NO_3)_2 + \_\_\_\_\ KI \rightarrow \_\_\_\_\ PbI_2 + \_\_\_\_\ KNO_3$$

(a) 2.3
(b) 9.0
(c) 18
(d) 36
(e) none of these.

23. Given the abstract balanced reaction and the table of data below, determine the limiting reactant in the reaction: $2\ A + 4\ M + N + 3\ X + Y \rightarrow Z$

Reactant	Molecular Weight (amu)	Initial Mass (g)
A	10.0	20.0
M	20.0	30.0
N	15.0	30.0
X	30.0	40.0
Y	45.0	90.0

(a) A
(b) M
(c) N
(d) X
(e) Y

24. For the reaction: $Ru_3(CO)_{12} + 9\ AsF_3 \rightarrow 3\ Ru(C))_2(AsF_3)_3 + 6\ CO$, how many millimoles of $Ru(CO)_2(AsF_3)_3$ can form from a mixture of 2.0 mmol $Ru_3(CO)_{12}$ and 24 mmol AsF_3?

(a) 12
(b) 8.0
(c) 6.0
(d) 54
(e) 2.0

25. The reaction of 11.9 g of chloroform, $CHCl_3$, with excess chlorine produced 12.6 g of carbon tetrachloride, CCl_4, according to

$$2CHCl_3 + 2\ Cl_2 \rightarrow 2\ CCl_4 + 2\ HCl$$

What is the percent yield?

(a) 100%
(b) 27.4%
(c) 82.2%
(d) 113%
(e) 46.2%

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