

Test bank chapter (3)

Choose the correct answer

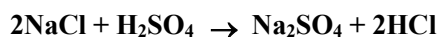
1. What is the mass, in grams, of one copper atom?
 - a) 1.055×10^{-22} g
 - b) 63.55 g
 - c) 20 g
 - d) 1.66×10^{-24} g
2. Determine the number of moles of aluminum in 96.7 g of Al?
 - a) 0.279 mol
 - b) 3.58 mol
 - c) 7.43 mol
 - d) 4.21 mol
3. Which of the following samples contains the greatest number of atoms?
 - a) 100 g of Pb
 - b) 2.0 mole of Ar
 - c) 0.1 mole of Fe
 - d) 5 g of He
4. How many molecules are there in 0.11 g of formaldehyde (CH₂O)?
 - a) 6.1×10^{-27}
 - b) 3.7×10^{-3}
 - c) 4×10^{22}
 - d) 2.2×10^{21}
5. How many sulfur atoms are present in 25.6 g of Al₂(S₂O₃)₃?
 - a) 0.393
 - b) 6×10^{-5}
 - c) 3.95×10^{22}
 - d) 2.37×10^{23}
6. The percent composition by mass of a compound is 76.0% C, 12.8% H, and 11.2% O. The molar mass of this compound is 284.5 g/mol. What is the molecular formula of the compound?
 - a) C₁₀H₆O
 - b) C₉H₁₈O
 - c) C₁₆H₂₈O₄
 - d) C₁₈H₃₆O₂

Mass relationships in chemical reactions

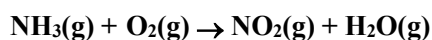
7. What is the coefficient of H_2O when the following equation is properly balanced with the smallest set of whole numbers?



- a) 3
b) 4
c) 6
d) 12
8. When 22.0 g NaCl and 21.0 g H_2SO_4 are mixed and react according to the equation below, which is the limiting reagent?



- a) H_2SO_4
b) Na_2SO_4
c) HCl
d) NaCl
9. What are the coefficients, when the following equation is balanced?



- a) 1, 1, 1, 1
b) 2, 3, 2, 3
c) 4, 7, 4, 6
d) 1, 3, 1, 2
10. How many moles of carbon atoms are in 4 moles of dimethyl sulfoxide ($\text{C}_2\text{H}_6\text{SO}$)?
- a) 2
b) 6
c) 8
d) 4

Explanation: This is based on reading the formula and correctly extracting information from it. The formula $\text{C}_2\text{H}_6\text{SO}$ indicates that every mole of this compound has 2 moles of carbon atoms in it. Thus 4 moles of the compound would have $4 \times 2 = 8$ moles of C atoms.

11. How many sulfur atoms are in 25 molecules of $\text{C}_4\text{H}_4\text{S}_2$?
- a) 20
b) 4.8×10^{25}
c) 3.0×10^{23}
d) 50

Explanation: The molecular formula indicates that every molecule of $\text{C}_4\text{H}_4\text{S}_2$ has 2 sulfur atoms per molecule and hence 25 molecules of this compound will have $25 \times 2 = 50$ atoms of sulfur.

12. Calculate hydrogen atoms in 25 molecules of $C_4H_4S_2$.

- a) 25
- b) 3.8×10^{24}
- c) 6.0×10^{25}
- d) 100

Explanation: The formula of $C_4H_4S_2$ indicates that there are 4 hydrogen atoms per molecule and hence 100 hydrogen atoms in 25 molecules of $C_4H_4S_2$.

13. How many grams of oxygen are in 65.0 g of $C_2H_2O_2$?

- a) 18
- b) 29
- c) 9.5
- d) 35.8

Explanation: This question uses the mole to mole ratio between oxygen and $C_2H_2O_2$ and needs the following steps.

$$\frac{65.0 \text{ g } C_2H_2O_2}{58.0 \text{ g} \cdot \text{mol}^{-1}} \times \frac{2 \text{ moles O}}{1 \text{ mole } C_2H_2O_2} \times \frac{15.99 \text{ g O}}{1 \text{ mole of O}} = 35.8 \text{ g of O}$$

14. How many moles of carbon dioxide are there in 52.06 g of carbon dioxide?

- a) 0.8452
- b) 1.183
- c) 1.183×10^{23}
- d) 8.648×10^2

Explanation: This is a straight-forward conversion from grams to moles of CO_2 which is done as follows:

$$52.06 \text{ g } CO_2 \times \frac{1 \text{ mole } CO_2}{43.99 \text{ g } CO_2} = 1.183 \text{ moles of } CO_2$$

15. How many moles of magnesium nitrate, $Mg(NO_3)_2$, are in a 2.35 g of this compound?

- a) 38.4
- b) 65.8
- c) 0.0158
- d) 0.0261

Explanation: This is a straight-forward conversion from grams to moles of $Mg(NO_3)_2$ which is done as follows:

$$2.35 \text{ g } Mg(NO_3)_2 \times \frac{1 \text{ mole } Mg(NO_3)_2}{148.3148 \text{ g}} = 0.0158 \text{ moles}$$

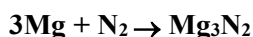
16. How many moles of ammonium ions are there in 25.5 g of ammonium carbonate?

- a) 0.468
- b) 0.288
- c) **0.531**
- d) 2.00

Explanation: Realize that the formula for ammonium carbonate is $(\text{NH}_4)_2\text{CO}_3$ and calculate the molar mass (96.0856 g/mol). Convert grams to moles and then using the stoichiometric ratio find the # of moles of ammonium ions.

$$25.5 \text{ g } (\text{NH}_4)_2\text{CO}_3 \times \frac{1 \text{ mol } (\text{NH}_4)_2\text{CO}_3}{96.0856 \text{ g}} \times \frac{2 \text{ moles NH}_4^+}{1 \text{ mol } (\text{NH}_4)_2\text{CO}_3} = 0.531 \text{ moles}$$

17. Magnesium and nitrogen react in a combination reaction to produce magnesium nitride:



In a particular experiment, 5.47 g sample of N_2 reacts completely. How many grams of Mg are needed for this reaction?

- a) **14.2 g**
- b) 24.1 g
- c) 16.1 g
- d) 0.92 g

Explanation: Ensure that the equation is balanced. The grams of N_2 must be converted to moles of N_2 and then using the stoichiometric ratio between the Mg and N_2 , the grams of Mg can be calculated.

$$5.47 \text{ g N}_2 \times \frac{1 \text{ mole N}_2}{28.0134 \text{ g}} \times \frac{3 \text{ mole Mg}}{1 \text{ mole N}_2} \times \frac{24.3050 \text{ g Mg}}{1 \text{ mole Mg}} = 14.2 \text{ g Mg}$$

18. What information would you need to calculate the average atomic mass of an element?

- a) The number of neutrons in the element.
- b) The atomic number of the element.
- c) **The mass and abundance of each isotope of the element.**
- d) The position in the periodic table of the element.

19. The atomic masses of ^{35}Cl (75.53 %) and ^{37}Cl (24.47 %) are 34.968 amu and 36.956 amu, respectively. Calculate the average atomic mass of chlorine.

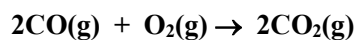
- a) 35.96 amu
- b) **35.45 amu**
- c) 36.47 amu
- d) 71.92 amu

Mass relationships in chemical reactions

20. How many atoms are there in 5.10 moles of sulfur (${}_{16}\text{S} = 32 \text{ amu}$)?
- 3.07×10^{24}
 - 9.59×10^{22}
 - 6.02×10^{23}
 - 9.82×10^{25}
21. Iodine has two isotopes ${}^{126}\text{I}$ and ${}^{127}\text{I}$, with the equal abundance. Calculate the average atomic mass of Iodine (${}_{53}\text{I}$).
- 126.5 amu
 - 35.45 amu
 - 1.265 amu
 - 71.92 amu
22. The atomic masses of ${}^6\text{Li}$ and ${}^7\text{Li}$ are 6.0151 amu and 7.0160 amu, respectively. Calculate the natural abundance of these two isotopes. The average atomic mass of Lithium ($\text{Li} = 6.941 \text{ amu}$).
- ${}^6\text{Li} = 7.49\%$, ${}^7\text{Li} = 92.51\%$
 - ${}^7\text{Li} = 7.49\%$, ${}^6\text{Li} = 92.51\%$
 - ${}^6\text{Li} = 8.49\%$, ${}^7\text{Li} = 95.51\%$
 - ${}^7\text{Li} = 7.22\%$, ${}^6\text{Li} = 82.51\%$
23. How many atoms are present in 3.14 g of copper (Cu)?
- 2.98×10^{22}
 - 1.92×10^{23}
 - 1.89×10^{24}
 - 6.02×10^{23}
24. How many moles of NO_2 can be produced by the reaction of 0.886 mole of NO with 0.503 mole of O_2 according to the following chemical equation? (Note: First determine which is the limiting reagent).
- $$2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}_2(\text{g})$$
- 0.886 mol
 - 0.503 mol
 - 1.01 mol
 - 1.77 mol
25. How many kilograms of NH_3 are needed to produce $1.00 \times 10^5 \text{ kg}$ of $(\text{NH}_4)_2\text{SO}_4$ according to the following chemical equation?
- $$2\text{NH}_3(\text{g}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow (\text{NH}_4)_2\text{SO}_4(\text{aq})$$
- $1.70 \times 10^4 \text{ kg}$
 - $3.22 \times 10^3 \text{ kg}$
 - $2.58 \times 10^4 \text{ kg}$
 - $7.42 \times 10^4 \text{ kg}$

Mass
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reactions

26. When 3.60 moles of CO mixed with excess oxygen gas and CO₂ is formed. Calculate no. of moles of CO₂ produced.



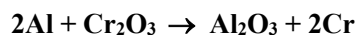
- a) 7.20 mol
- b) 44.0 mol
- c) 3.60 mol
- d) 1.80 mol

27. How many grams of N₂O are formed if 0.46 mole of NH₄NO₃ is used in the following chemical reaction?



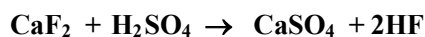
- a) 2.0 g
- b) 3.7×10^1 g
- c) 2.0×10^1 g
- d) 4.6×10^{-1} g

28. What is the theoretical yield of chromium that can be produced by the reaction of 40.0 g of Cr₂O₃ with 8.00 g of aluminum according to the chemical equation below?



- a) 7.7 g
- b) 15.4 g
- c) 27.3 g
- d) 30.8 g

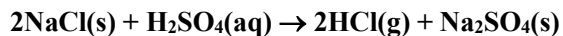
29. What is the percent yield of HF that can be produced by the reaction of 6.00 kg of CaF₂ with an excess of H₂SO₄ which yield 2.86 kg of HF according to the following chemical equation?



- a) 93.0 %
- b) 95.3 %
- c) 47.6 %
- d) 62.5 %

Mass
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reactions

30. Hydrochloric acid can be prepared by the following reaction:



How many grams of HCl can be prepared from 2.00 moles of H_2SO_4 and 150 g of NaCl?

- a) 7.30 g
- b) 93.5 g
- c) 146 g
- d) 150 g

31. Calculate the molar mass of Li_2CO_3 .

- a) 73.89 g
- b) 66.95 g
- c) 41.89 g
- d) 96.02 g

32. How many molecules of ethane (C_2H_6) are present in 0.334 g of C_2H_6 ?

- a) 2.01×10^{23}
- b) 6.69×10^{21}
- c) 4.96×10^{22}
- d) 8.89×10^{20}

33. Out of these, which is the richest source of nitrogen on a mass percentage basis?

- a) Urea, $(\text{NH}_2)_2\text{CO}$
- b) Ammonium nitrate, NH_4NO_3
- c) Guanidine, $\text{HNC}(\text{NH}_2)_2$
- d) Ammonia, NH_3

34. An analysis of Allicin (molar mass ≈ 162 g/mol) gives C: 44.4 percent; H: 6.21 percent; S: 39.5 percent; O: 9.86 percent. What is its molecular formula?

- a) $\text{C}_{12}\text{H}_{20}\text{S}_4\text{O}_2$
- b) $\text{C}_7\text{H}_{14}\text{SO}$
- c) $\text{C}_6\text{H}_{10}\text{S}_2\text{O}$
- d) $\text{C}_5\text{H}_{12}\text{S}_2\text{O}_2$

Mass relationships in chemical reactions

35. How many moles of Fe are present in 24.6 g of Fe_2O_3 ?
- a) 2.13 mol
 - b) 0.456 mol
 - c) 0.154 mol
 - d) **0.308 mol**
36. How many grams of sulfur (S) are needed to react completely with 246 g of mercury (Hg) to form HgS ?
- a) **39.3 g**
 - b) 24.6 g
 - c) 9.66×10^3 g
 - d) 201 g
37. What is the mass of F (fluoride) in 24.6 g of Tin (II) fluoride (SnF_2)?
- a) 18.6 g
 - b) 24.3 g
 - c) **5.97 g**
 - d) 75.7 g
38. What is the empirical formula of the compound with the following composition? 2.1 percent H, 65.3 percent O, 32.6 percent S.
- a) **H_2SO_4**
 - b) H_2SO_3
 - c) $\text{H}_2\text{S}_2\text{O}_3$
 - d) HSO_3
39. Which of the following equations is balanced?
- a) $2\text{C} + \text{O}_2 \rightarrow \text{CO}$
 - b) **$2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2$**
 - c) $\text{H}_2 + \text{Br}_2 \rightarrow \text{HBr}$
 - d) $2\text{K} + \text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$