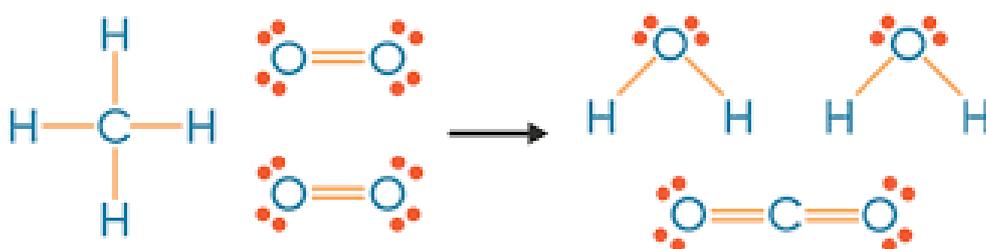


UNIT 1 CHEMISTRY

KEEP YOUR CHEMISTRY SKILLS ALIVE!

AOS-1: WRITING EQUATIONS, IONIC EQUATIONS, MOLE CALCULATIONS

WRITING CHEMICAL EQUATIONS



WRITING CHEMICAL EQUATIONS

During a chemical reaction, bonds between atoms are broken through energetic collisions, enabling the atoms to recombine to form new species.

The Law of Mass Conservation states that no change in mass occurs during a chemical reaction. This means that there will be no change in the number of atoms of each element or the total mass of each element during a reaction.

WRITING BALANCED CHEMICAL EQUATIONS

Before writing chemical equations, one must first identify the type of reaction that is occurring. This vital step is required so as to determine the manner in which equations are written.

- If the reaction describes a redox process, equations must be written by constructing half equations.
- If the reaction describes a precipitation or acid/base process, equations are written by adding cations and anions.

SOLUBILITY PROPERTIES OF COMMON IONIC SUBSTANCES

To correctly assign states, the solubility properties of common ionic substances must be known.

High Solubility in Water	Low Solubility in Water
Compounds containing: Na^+ , K^+ , NH_4^+ , NO_3^- , CH_3COO^- . Most salts containing Cl^- , Br^- , I^- are soluble, unless combined with Pb^{2+} or Ag^+ Most SO_4^{2-} salts are soluble, except $PbSO_4$ and $BaSO_4$. Note: Ag_2SO_4 and $CaSO_4$ are slightly soluble when concentrations are low i.e. $< 0.05 M$.	Most compounds containing CO_3^{2-} , PO_4^{3-} , S^{2-} are insoluble, unless combined with Na^+ , K^+ or NH_4^+ . Most salts containing OH^- are insoluble, unless combined with Ba^{2+} or Sr^{2+} . Note: $Ca(OH)_2$ is slightly soluble when concentrations are low i.e. $< 0.05 M$.

IN DETAIL:

- All Group I salts are soluble.
- All ammonium (NH_4^+) salts are soluble.
- All nitrate (NO_3^-) salts are soluble.
- Group I, ammonium, aluminium, and silver fluorides are soluble, all other fluorides are insoluble.
- Most chlorides, bromides and iodides (*except* those of silver, lead and mercury) are soluble. Nevertheless, SnI_2 is also insoluble.
- Group I hydroxides (OH^-) are soluble, all others are insoluble. Note:

There is no such species as ammonium hydroxide – ammonia is insufficiently hydrolysed. Ammonia solution is the recognised name.

Barium hydroxide is soluble.

Calcium hydroxide is marginally soluble.

- Group I and ammonium carbonates and sulfides are soluble, all others are insoluble.
- All hydrogen carbonates are soluble.
- Most sulfate salts (SO_4^{2-}) are soluble. Exceptions include calcium, barium and lead sulfates.
- Silver orthophosphate, silver chromate and barium sulfite are insoluble.
- PO_4^{3-} salts are only slightly soluble.

ADDING CATIONS AND ANIONS

Step 1: Write the chemical formulae of the reactants on the left hand side of an arrow.

Step 2: Swap the cations and anions of the reactants to form the products.
Write the chemical formulae of the products on the right hand side of an arrow.

Step 3: Balance the equation by inserting coefficients in front of the chemical formulae.

The total number of each atom must be the same on both sides of the equation, as mass is conserved during normal chemical reactions.

Step 4: Indicate the physical state of each reactant and product, taking into account the specified conditions (eg. temperature).

(l) For substances that exist in a liquid state at the given conditions.

(g) For substances that exist in a gaseous state at the given conditions.

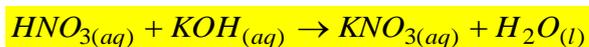
(aq) For substances that are present dissolved in an aqueous medium.

(s) For substances that are present as solids under the given conditions.

QUESTION 1

Write balanced chemical equations to illustrate the following reactions:

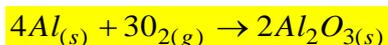
(a) Solutions of nitric acid and potassium hydroxide are mixed.



(b) Solid copper(II) oxide reacts with dilute sulphuric acid.



(c) Aluminum foil is combusted.



(d) Solutions of iron(II) sulfate and sodium hydroxide are mixed to produce a green precipitate of iron(II) hydroxide and a solution of sodium sulphate.



Word Equations

Write the word equations below as chemical equations and balance:

- 1) Zinc and lead (II) nitrate react to form zinc nitrate and lead.
- 2) Aluminum bromide and chlorine gas react to form aluminum chloride and bromine gas.
- 3) Sodium phosphate and calcium chloride react to form calcium phosphate and sodium chloride.
- 4) Potassium metal and chlorine gas combine to form potassium chloride.
- 5) Aluminum and hydrochloric acid react to form aluminum chloride and hydrogen gas.
- 6) Calcium hydroxide and phosphoric acid react to form calcium phosphate and water.
- 7) Copper and sulfuric acid react to form copper (II) sulfate and water and sulfur dioxide.
- 8) Hydrogen gas and nitrogen monoxide react to form water and nitrogen gas.

Word Equations - Answer Key

- 1) Zinc and lead (II) nitrate react to form zinc nitrate and lead.



- 2) Aluminum bromide and chlorine gas react to form aluminum chloride and bromine gas.



- 3) Sodium phosphate and calcium chloride react to form calcium phosphate and sodium chloride.



- 4) Potassium metal and chlorine gas combine to form potassium chloride.



- 5) Aluminum and hydrochloric acid react to form aluminum chloride and hydrogen gas.



- 6) Calcium hydroxide and phosphoric acid react to form calcium phosphate and water.



- 7) Copper and sulfuric acid react to form copper (II) sulfate and water and sulfur dioxide.



- 8) Hydrogen gas and nitrogen monoxide react to form water and nitrogen gas.



WRITING CHEMICAL FORMULAE AND EQUATIONS – TOPIC TEST 1

QUESTION 1

The chemical formulae for lead (II) oxide and lead (IV) oxide are:

- A PbO and Pb₂O, respectively.
- B Pb₂O and Pb₄O, respectively.
- C PbO and (Pb)₂O, respectively.
- D (Pb)₂O and (Pb)₄O, respectively.

QUESTION 2

What is the chemical formula for ammonium carbonate?

Solution

QUESTION 3

What is the chemical formula for copper (II) sulphate pentahydrate?

Solution

QUESTION 4

The following chemical equation represents a reaction between phosphoric acid and sodium hydroxide. What numerical values of x and y are required to balance the equation?



- A 2 and 2
- B 3 and 3
- C 2 and 3, respectively
- D 3 and 2, respectively

QUESTION 5

Write a balanced chemical equation for the reaction between nitric acid and magnesium metal.

Solution

QUESTION 6

Write a balanced chemical equation for the reaction between hydrochloric acid and aluminium oxide.

Solution

QUESTION 7

Write a balanced chemical equation for the combustion of liquid butane, C₄H₁₀.

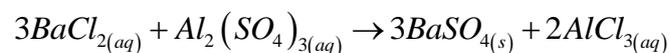
Solution

QUESTION 8

A reaction between iron (III) chloride and sodium hydroxide forms the precipitate iron (III) hydroxide. Which of the following is an ionic equation that correctly shows this reaction?

**QUESTION 9**

Write a balanced ionic equation for the following:



Solution

ANSWERS

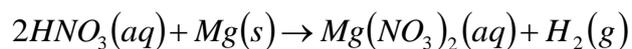
QUESTION 1 Answer is A

QUESTION 2 $(\text{NH}_4)_2\text{CO}_3$

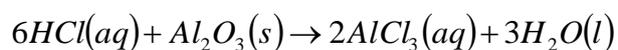
QUESTION 3 $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

QUESTION 4 Answer is B

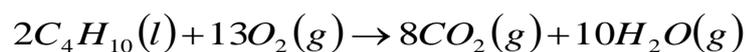
QUESTION 5



QUESTION 6

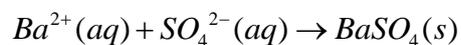


QUESTION 7

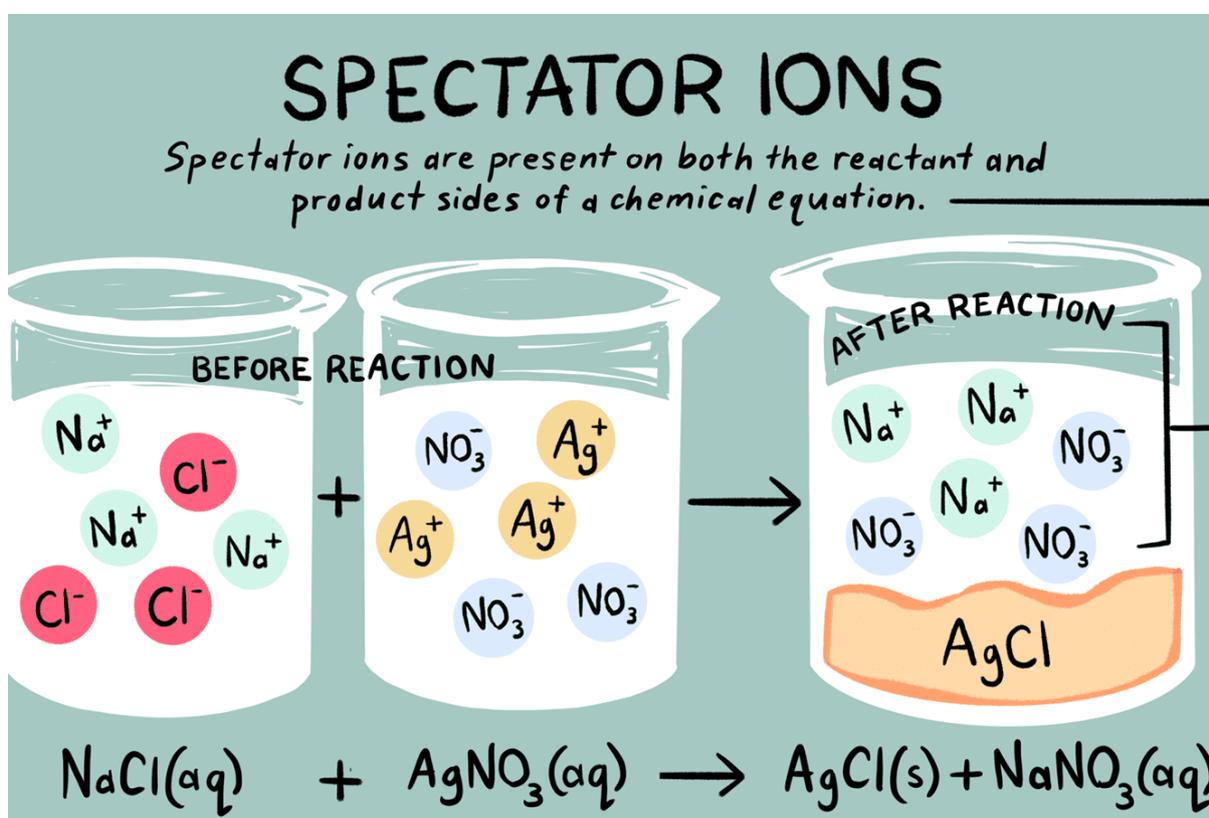


QUESTION 8 Answer is D

QUESTION 9



WRITING IONIC EQUATIONS



IONIC EQUATIONS

The equation: $Na_2SO_{4(aq)} + BaCl_{2(aq)} \rightarrow 2NaCl_{(aq)} + BaSO_{4(s)}$

could also be written as: $2Na_{(aq)}^+ + SO_{4(aq)}^{2-} + Ba_{(aq)}^{2+} + 2Cl_{(aq)}^- \rightarrow 2Na_{(aq)}^+ + 2Cl_{(aq)}^- + BaSO_{4(s)}$

As you can see, the Na^+ and Cl^- ions do not take part in the reaction; they do not change state or charge. They are called **spectator ions**.

Ionic equations describe the chemical changes that occur during a chemical reaction.

Ionic equations do not take spectator ions (ions that remain in solution in an unchanged form) into consideration.

The ionic equation for the above reaction therefore becomes: $Ba_{(aq)}^{2+} + SO_{4(aq)}^{2-} \rightarrow BaSO_{4(s)}$



METHOD:

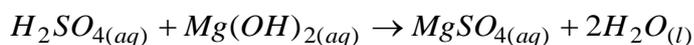
Step 1: Re-write aqueous species as positive and negative ions.
Do **NOT** dissociate species that are present in the liquid, solid or gaseous state.

Step 2: Cross out those species that have not changed state or charge.
These species are known as spectator ions.

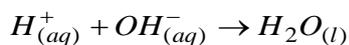
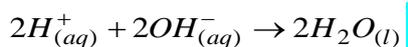
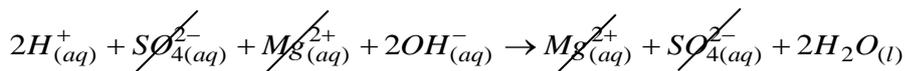
Step 3: Re-write the equation, excluding the spectator ions.

QUESTION 1

Write an ionic equation for the following reaction process:



Solution



IONIC EQUATIONS

An ionic equation is a balanced chemical equation that has all spectator ions omitted. Spectator ions are those ions that are present but do not take part in the reaction.

When two solutions are mixed and a solid forms, the solid is called a 'precipitate'. The reaction itself is called a 'precipitation reaction', and the equation is often written as an ionic equation. The ionic equation shows only the ions that form the precipitate and the precipitate itself.

Often, information about the precipitate is given in the question. In this case, to write an ionic equation:

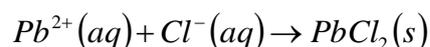
1. Identify the insoluble product, which is called the precipitate.
2. Write the ions that form the precipitate as the reactants of the ionic equation, and the precipitate itself as the only product.
3. Balance the ionic equation using the smallest coefficients, and check that all states are included.

EXAMPLE 1

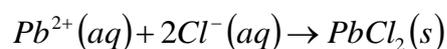
When solutions of lead (II) nitrate and sodium chloride are mixed, a precipitate of lead (II) chloride forms at the bottom of the beaker. Write an ionic equation for the reaction between lead (II) nitrate and sodium chloride.

Solution

1. Note that the precipitate is lead (II) chloride, $PbCl_2$.
2. Write the ions that form the precipitate as the reactants of the ionic equation, and the precipitate itself as the only product.



3. Balance the ionic equation and check that all states are included.



When the precipitate is not given, a longer method needs to be used to write the ionic equation.

1. Write a balanced chemical equation, showing all species that are present. If necessary, consult a Table of Solubility Rules to determine states.
2. Re-write species that are solid, liquids and gases as they are. But write all aqueous substances as the positive and negative ions that make them up.
3. Cross out the species that exist in the same form as reactants and products. Do not cross out a species that has changed state or charge.
4. Re-write the equation, leaving out the species that have not changed.

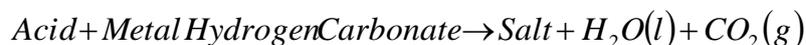
EXAMPLE 2

An excess of hydrochloric acid in the stomach can cause discomfort. A common remedy is to take an antacid, which is primarily 'sodium bicarbonate' or sodium hydrogen carbonate.

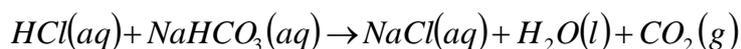
Write an ionic equation to represent the reaction between hydrochloric acid and sodium hydrogen carbonate.

Solution

1. Write the reactants on the left, and the products on the right:

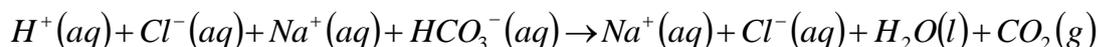


2. Check that the equation is balanced and add the states:



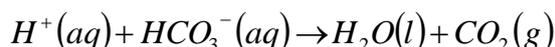
3. Re-write species that are solid, liquids and gases as they are.

But write all aqueous substances as the positive and negative ions that make them up.

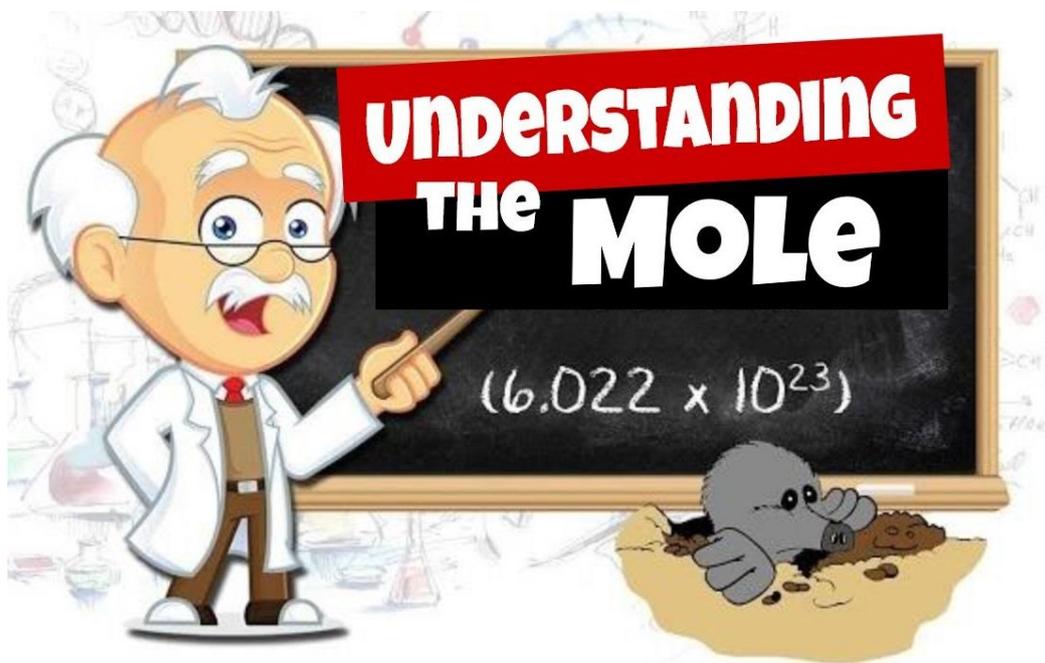


4. Cross out the species that exist in the same form as reactants and products.

Do not cross out a species that has changed state or charge. And re-write the equation leaving out the species that have not changed.



MOLE CALCULATIONS



THE MOLE

Since atoms are so small, any sensible laboratory quantity of substance must contain a huge number of atoms:

1 litre of water contains 3.3×10^{25} molecules.

1 gram of magnesium contains 2.5×10^{22} atoms.

100 cm³ of oxygen contains 2.5×10^{21} molecules.

Such numbers are not convenient to work with, so it is necessary to find a unit of "amount" which corresponds better to the sort of quantities of substance normally being measured. The unit chosen for this purpose is the **mole**. The number is chosen so that 1 mole of a substance corresponds to its relative atomic/molecular/formula mass measured in grams. A mole is thus defined as follows:

A mole of a substance is the amount of that substance that contains the same number of elementary particles as there are carbon atoms in 12.00000 grams of carbon-12.

One mole of carbon-12 has a mass of 12.0g.

One mole of hydrogen atoms has a mass of 1.0g.

One mole of hydrogen molecules has a mass of 2.0g.

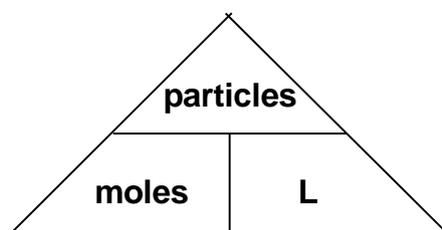
One mole of sodium chloride has a mass of 58.5g.

The number of particles in one mole of a substance is 6.02×10^{23} . This is known as **Avogadro's number, L**.

Thus when we need to know the number of particles of a substance, we usually count the number of moles. It is much easier than counting the number of particles.

The number of particles can be calculated by multiplying the number of moles by Avogadro's number. The number of moles can be calculated by dividing the number of particles by Avogadro's number.

$$\text{(Number of particles)} = \text{(number of moles)} \times L$$



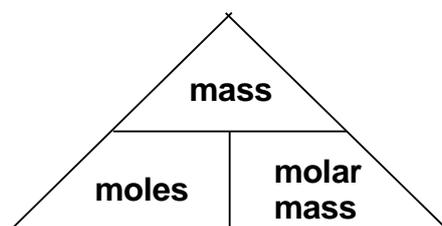
The mass of one mole of a substance is known as its **molar mass**, and has units of gmol^{-1} . It must be distinguished from relative atomic/molecular/formula mass, which is a ratio and hence has no units, although both have the same numerical value.

The symbol for molar mass of compounds or molecular elements is m_r . The symbol for molar mass of atoms is a_r .

Mass (m), molar mass (m_r or a_r) and number of moles (n) are thus related by the following equation:

$$\text{MASS} = \text{MOLAR MASS} \times \text{NUMBER OF MOLES}$$
$$\text{or } m = m_r \times n$$

Mass must be measured in grams and molar mass in g mol^{-1} .



Molar Mass Worksheet

Calculate the molar masses of the following chemicals:

- 1) Cl_2
- 2) KOH
- 3) BeCl_2
- 4) FeCl_3
- 5) BF_3
- 6) CCl_2F_2
- 7) $\text{Mg}(\text{OH})_2$
- 8) UF_6
- 9) SO_2
- 10) H_3PO_4
- 11) $(\text{NH}_4)_2\text{SO}_4$
- 12) CH_3COOH
- 13) $\text{Pb}(\text{NO}_3)_2$
- 14) $\text{Ga}_2(\text{SO}_3)_3$

Molar Mass Worksheet – Answers

Calculate the molar masses of the following chemicals:

- 1) Cl_2 **71 g/mol**
- 2) KOH **56.1 g/mol**
- 3) BeCl_2 **80 g/mol**
- 4) FeCl_3 **162.3 g/mol**
- 5) BF_3 **67.8 g/mol**
- 6) CCl_2F_2 **121 g/mol**
- 7) $\text{Mg}(\text{OH})_2$ **58.3 g/mol**
- 8) UF_6 **352 g/mol**
- 9) SO_2 **64.1 g/mol**
- 10) H_3PO_4 **98 g/mol**
- 11) $(\text{NH}_4)_2\text{SO}_4$ **132.1 g/mol**
- 12) CH_3COOH **60 g/mol**
- 13) $\text{Pb}(\text{NO}_3)_2$ **331.2 g/mol**
- 14) $\text{Ga}_2(\text{SO}_3)_3$ **379.7 g/mol**

Avogadro's Number and the Mole

- 1) How many moles of water does 6.02×10^{23} molecules represent?
- 2) Convert 3.01×10^{23} molecules of C_2H_6 to moles
- 3) How many moles of glucose does 1.2×10^{24} molecules represent?
- 4) How many moles of $CaCl_2$ does 2.41×10^{24} formula units represent
- 5) How many atoms does 2.0 moles of He represent?
- 6) How many sodium ions are in 3.0 moles of NaCl?
- 7) How many molecules are in 0.25 moles of CH_4 ?
- 8) How many total atoms are in 1.0 moles of H_2O ?

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Mass and the Mole

- 1) How many moles are in 15 grams of lithium?
- 2) How many grams are in 2.4 moles of sulfur?
- 3) How many moles are in 22 grams of argon?
- 4) How many grams are in 88.1 moles of magnesium?
- 5) How many moles are in 2.3 grams of phosphorus?
- 6) How many grams are in 11.9 moles of chromium?
- 7) How many moles are in 9.8 grams of calcium?
- 8) How many grams are in 238 moles of arsenic?

What are the molecular weights of the following compounds?

- | | |
|-----------------------|---|
| 9) NaOH | 12) H ₃ PO ₄ |
| 10) H ₂ O | 13) Mn ₂ Se ₇ |
| 11) MgCl ₂ | 14) (NH ₄) ₂ SO ₄ |
- 15) How many grams are in 4.5 moles of sodium fluoride, NaF?
 - 16) How many moles are in 98.3 grams of aluminum hydroxide, Al(OH)₃?
 - 17) How many grams are in 0.02 moles of beryllium iodide, BeI₂?
 - 18) How many moles are in 68 grams of copper (II) hydroxide, Cu(OH)₂?
 - 19) How many grams are in 3.3 moles of potassium sulfide, K₂S?
 - 20) How many moles are in 1.2×10^3 grams of ammonia, NH₃?
 - 21) How many grams are in 2.3×10^{-4} moles of calcium phosphate, Ca₃(PO₃)₂?
 - 22) How many moles are in 3.4×10^{-7} grams of silicon dioxide, SiO₂?
 - 23) How many grams are in 1.11 moles of manganese sulfate, Mn₃(SO₄)₇?

Mass and the Mole – Answers

- 1) How many moles are in 15 grams of lithium? **0.46 moles**
- 2) How many grams are in 2.4 moles of sulfur? **77.0 grams**
- 3) How many moles are in 22 grams of argon? **0.55 moles**
- 4) How many grams are in 88.1 moles of magnesium? **2141 grams**
- 5) How many moles are in 2.3 grams of phosphorus? **0.074 moles**
- 6) How many grams are in 11.9 moles of chromium? **618.8 grams**
- 7) How many moles are in 9.8 grams of calcium? **0.24 moles**
- 8) How many grams are in 238 moles of arsenic? **17,826 grams**

What are the molecular weights of the following compounds?

- 9) NaOH **40.1 grams**
- 10) H₂O **18.0 grams**
- 11) MgCl₂ **95.3 grams**
- 12) H₃PO₄ **98.0 grams**
- 13) Mn₂Se₇ **663.0 grams**
- 14) (NH₄)₂SO₄ **132.1 grams**
- 15) How many grams are in 4.5 moles of sodium fluoride, NaF? **189 grams**
- 16) How many moles are in 98.3 grams of aluminum hydroxide, Al(OH)₃?
1.26 moles
- 17) How many grams are in 0.02 moles of beryllium iodide, BeI₂? **5.2 grams**
- 18) How many moles are in 68 grams of copper (II) hydroxide, Cu(OH)₂?
0.70 moles
- 19) How many grams are in 3.3 moles of potassium sulfide, K₂S? **364.0 grams**
- 20) How many moles are in 1.2 x 10³ grams of ammonia, NH₃? **70.6 moles**
- 21) How many grams are in 2.3 x 10⁻⁴ moles of calcium phosphate, Ca₃(PO₃)₂? **0.064 grams**
- 22) How many moles are in 3.4 x 10⁻⁷ grams of silicon dioxide, SiO₂?
5.66 x 10⁻⁹ moles
- 23) How many grams are in 1.11 moles of manganese sulfate, Mn₃(SO₄)₇?
929.5 grams

Combined Mole Calculations

- 1) How many molecules are there in 24 grams of FeF_3 ?
- 2) How many molecules are there in 450 grams of Na_2SO_4 ?
- 3) How many grams are there in 2.3×10^{24} atoms of silver?
- 4) How many grams are there in 7.4×10^{23} molecules of AgNO_3 ?
- 5) How many grams are there in 7.5×10^{23} molecules of H_2SO_4 ?
- 6) How many molecules are there in 122 grams of $\text{Cu}(\text{NO}_3)_2$?
- 7) How many grams are there in 9.4×10^{25} molecules of H_2 ?
- 8) How many molecules are there in 230 grams of CoCl_2 ?
- 9) How many molecules are there in 2.3 grams of NH_4SO_2 ?
- 10) How many grams are there in 3.3×10^{23} molecules of N_2I_6 ?
- 11) How many molecules are there in 200 grams of CCl_4 ?
- 12) How many grams are there in 1×10^{24} molecules of BCl_3 ?
- 13) How many grams are there in 4.5×10^{22} molecules of $\text{Ba}(\text{NO}_2)_2$?
- 14) How many molecules are there in 9.34 grams of LiCl ?
- 15) How many grams do 4.3×10^{21} molecules of UF_6 weigh?
- 16) How many molecules are there in 230 grams of NH_4OH ?

Combined Mole Calculations – Answers

- 1) How many molecules are there in 24 grams of FeF_3 ? **1.28×10^{23} molecules**
- 2) How many molecules are there in 450 grams of Na_2SO_4 ? **1.91×10^{24} molecules**
- 3) How many grams are there in 2.3×10^{24} atoms of silver? **421 grams**
- 4) How many grams are there in 7.4×10^{23} molecules of AgNO_3 ? **209 grams**
- 5) How many grams are there in 7.5×10^{23} molecules of H_2SO_4 ? **122 grams**
- 6) How many molecules are there in 122 grams of $\text{Cu}(\text{NO}_3)_2$? **3.92×10^{23} molecules**
- 7) How many grams are there in 9.4×10^{25} molecules of H_2 ? **312 grams**
- 8) How many molecules are there in 230 grams of CoCl_2 ? **1.07×10^{24} molecules**
- 9) How many molecules are there in 2.3 grams of NH_4SO_2 ? **1.69×10^{22} molecules**
- 10) How many grams are there in 3.3×10^{23} molecules of N_2I_6 ? **430 grams**
- 11) How many molecules are there in 200 grams of CCl_4 ? **7.82×10^{23} molecules**
- 12) How many grams are there in 1×10^{24} molecules of BCl_3 ? **195 grams**
- 13) How many grams are there in 4.5×10^{22} molecules of $\text{Ba}(\text{NO}_2)_2$? **17.1 grams**
- 14) How many molecules are there in 9.34 grams of LiCl ? **1.33×10^{23} molecules**
- 15) How many grams do 4.3×10^{21} molecules of UF_6 weigh? **2.51 grams**
- 16) How many molecules are there in 230 grams of NH_4OH ? **3.96×10^{24} molecules**

The Mole Review

- 1) Define "mole".
- 2) How many moles are present in 34 grams of $\text{Cu}(\text{OH})_2$?
- 3) How many moles are present in 2.45×10^{23} molecules of CH_4 ?
- 4) How many grams are there in 3.4×10^{24} molecules of NH_3 ?
- 5) How much does 4.2 moles of $\text{Ca}(\text{NO}_3)_2$ weigh?
- 6) What is the molar mass of MgO ?
- 7) How are the terms "molar mass" and "atomic mass" different from one another?
- 8) Which is a better unit for expressing molar mass, "amu" or "grams/mole"?

The Mole Review (Solutions)

- 1) Define "mole".
 6.02×10^{23} of anything, usually atoms or molecules.
- 2) How many moles are present in 34 grams of $\text{Cu}(\text{OH})_2$?
0.35 moles
- 3) How many moles are present in 2.45×10^{23} molecules of CH_4 ?
0.41 moles
- 4) How many grams are there in 3.4×10^{24} molecules of NH_3 ?
96 grams
- 5) How much does 4.2 moles of $\text{Ca}(\text{NO}_3)_2$ weigh?
689 grams
- 6) What is the molar mass of MgO ?
40.3 grams/mole
- 7) How are the terms "molar mass" and "atomic mass" different from one another?
"Molar mass" is used to describe the mass of one mole of a chemical compound, while "atomic mass" is used to describe the mass of one mole of an element or the mass of one atom of an element.
- 8) Which is a better unit for expressing molar mass, "amu" or "grams/mole"?
"Grams/mole" is better, because any macroscopic amount of a substance is better expressed in grams than amu.

More Combined Mole Calculations

1. Calculate the mass of 1.000 mole of CaCl_2 .
2. Calculate grams in 3.0000 moles of CO_2 .
3. Calculate number of moles in 32.0 g of CH_4 .
4. Determine mass in grams of 40.0 moles of Na_2CO_3 .
5. Calculate moles in 168.0 g of HgS .
6. Calculate moles in 510.0 g of Al_2S_3 .
7. How many moles are in 27.00 g of H_2O .
8. Determine the mass in grams of Avogadro number of $\text{C}_{12}\text{H}_{22}\text{O}_{11}$.
9. Find mass in grams of 9.03 moles of H_2S .
10. Determine grams in 1.204 mole of NH_3 .

Consider the molecule CuNH_4Cl_3 as your answer 11 - 20.

11. Name the elements present.
12. How many atoms form the molecule?
13. How many of each atom in the molecule?
14. How many hydrogen atoms in one mole of molecules?
15. How many chlorine atoms in six moles of molecules?
16. What is the molar mass of this molecule?
17. What is the mass in grams of one molecule?
18. How many moles would be in 6.84 g of this substance?
19. You need 0.0100 mole of lead (II) chromate.
How much should you weigh on the scale?
20. Given 6.40 g of HBr . How many moles is this?

Write the correct formula for calcium acetate and then answer 21 - 23 based on it.

21. What is the mass of exactly one mole of calcium acetate?
22. How many moles are contained in 1.58 g of the substance in #23?
23. How much does 0.400 mole of #23 weigh?
24. Write the formula for oxygen gas.
25. How many atoms (and moles) are represented by the formula in #24?
26. What is the mass of Avogadro Number of oxygen molecules?

More Combined Mole Calculations - Solutions

1. Calculate the mass of 1.000 mole of CaCl_2 *110.986g/mol*
2. Calculate grams in 3.0000 moles of CO_2 *132.03g*
3. Calculate number of moles in 32.0 g of CH_4 *2.00mol*
4. Determine mass in grams of 40.0 moles of Na_2CO_3 *4240g*
5. Calculate moles in 168.0 g of HgS *0.722mol*
6. Calculate moles in 510.0 g of Al_2S_3 *3.396mol*
7. How many moles are in 27.00 g of H_2O *1.50mol*
8. Determine the mass in grams of Avogadro number of $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ *342.3 g/mol*
9. Find mass in grams of 9.03 moles of H_2S *308g*
10. Determine grams in 1.204 mole of NH_3 *20.50g*

Consider the molecule CuNH_4Cl_3 as your answer 11 - 20.

11. Name the elements present. *Copper, Nitrogen, Hydrogen, Chlorine*
12. How many atoms form the molecule? *Nine*
13. How many of each atom in the molecule? *Cu-1, N-1, H-4, Cl-3*
14. How many hydrogen atoms in one mole of molecules? *2.41×10^{24} atoms*
15. How many chlorine atoms in six moles of molecules? *1.084×10^{25} atoms*
16. What is the molar mass of this molecule? *187.94 g/mol*
17. What is the mass in grams of one molecule? *3.121×10^{-22} g*
18. How many moles would be in 6.84 g of this substance? *0.0364mol*
19. You need 0.0100 mole of lead (II) chromate.
How much should you weigh on the scale? *3.23g*
20. Given 6.40 g of HBr . How many moles is this? *0.0791mol*

Write the correct formula for calcium acetate and then answer 21 - 23 based on it.

21. What is the mass of exactly one mole of calcium acetate? *$\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$ 158g/mol*
22. How many moles are contained in 1.58 g of the substance in #23? *0.01mol*
23. How much does 0.400 mole of #23 weigh? *63.3g*
24. Write the formula for oxygen gas. *O_2*
25. How many atoms (and moles) are represented by the formula in #24?
2 atoms, $1/N_A$ mole of molecules
26. What is the mass of Avogadro Number of oxygen molecules? *31.9988 g/mol*