SCIENCE FOUNDATIONS

Mole concept

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how chemists count atoms and molecules, which are far too tiny to count one by one, by working with huge fixed bundles the way a baker counts eggs by the dozen. A baker never counts eggs one at a time for a big order, and a chemist never counts atoms one at a time for a reaction. A fixed bundle lets both of them talk about amounts that are practical to handle. Knowing the mole tells you how chemists measure amounts of things far too small to see.



Rule

Mole concept: a mole is a count, not a mass.

One mole of anything contains 6.02×10^{23} particles, which is Avogadro's number.

Particles = moles $\times$ 6.02×10^{23}, and moles = $\frac{\text{particles}}{6.02 \times 10^{23}}$.

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Worked examples

EXAMPLE 1

Q How many particles are in 2 moles of water molecules?

SOLUTION

Recall the bundle size:

1 mol = 6.02×10^{23} particles.

Multiply by the moles given:

$2 \times 6.02 \times 10^{23} = 1.204 \times 10^{24}$

Write the answer with the particle named.

The result is 1.204×10^{24} water molecules.

EXAMPLE 2

Q How many moles are 1.204×10^{24} particles?

SOLUTION

Recall the bundle size:

1 mol = 6.02×10^{23} particles.

Divide the particles by the bundle size:

$1.204 \times 10^{24} \div 6.02 \times 10^{23} = 2$ mol

Write the answer in moles.

The result is 2 moles.

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Practice questions

1 How many particles in one mole?

- A 3.01×10^{23}
- B 6.02×10^{23}
- C 1.204×10^{24}
- D 6.02×10^{24}

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2 How many particles in 3 moles?

- A 6.02×10^{23} particles
- B 1.204×10^{24} particles
- C 1.806×10^{24} particles
- D 3.01×10^{23} particles

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3 How many moles is 6.02×10^{23} particles?

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4 Which has more particles: 2 moles of carbon atoms or 1 mole of water molecules?

- **A** 1 mole of water molecules
- **B** 2 moles of carbon atoms
- **C** They have the same number of particles
- **D** You cannot tell without the masses

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5 What is Avogadro's number?

- **A** 6.02×10^{23} per mole
- **B** 3.01×10^{23} per mole
- **C** 1.204×10^{24} per mole
- **D** 6.02×10^{24} per mole

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6 Why use moles?

- **A** To count huge numbers of tiny particles in handy bundles
- **B** To weigh single atoms one at a time
- **C** To make chemical reactions go faster
- **D** To change the mass of an atom

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7 **Is a mole a mass or a count?**

A A mass

B A count

C A volume

D A temperature

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8 **How many moles of hydrogen atoms have the same number of particles as 3 moles of oxygen atoms?**

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9 A sample has 1 mole of particles. If you double the amount to 2 moles, what happens to the number of particles?

- **A** It stays the same
- **B** It doubles
- **C** It halves
- **D** It becomes zero

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10 What does 6.02×10^{23} count?

- **A** Mass of one atom
- **B** Molecules in one litre
- **C** Particles in one mole
- **D** Electrons in one atom

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ANSWER KEY

1. 6.02×10^{23}

2. 1.806×10^{24} particles

3. 1 mole

4. 2 moles of carbon atoms

5. 6.02×10^{23} per mole

6. To count huge numbers of tiny particles in handy bundles

7. A count

8. 3 moles

9. It doubles

10. Particles in one mole

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