Quantitative Chemistry: From Moles to Titrations [1.0]

Section A: The Mole and Molar Mass

> **Discussion:**
> If you were tasked with counting every grain of sand on a beach, would you count them one by one, or would you find a way to weigh them instead?

The Central Pillar: The Mole

In chemistry, we cannot count individual atoms because they are too small. Instead, we use the **mole**, which represents a specific number of particles (6.022×10^{23}).

1. The mass of one mole of a substance is called its _____ .
2. The units for molar mass are _____ (or $g\ mol^{-1}$).
3. To find the number of moles (n), we use the formula:

$$n = \frac{m}{M}$$

Where:

- n is the number of _____ .
- m is the [mass] / [molar mass] in grams.
- M is the [mass] / [molar mass] from the Periodic Table.

> **REMEMBER**
>
> **The "m" vs "M" Trap**
> Always remember: lowercase **m** is what you weigh on the scale (mass), and uppercase **M** is what you find on the Periodic Table (molar mass).

Draw a 'Formula Triangle' for n, m, and M below:

Question 1
1 mark

What is the number of moles in 10.0g of Sodium (M = 22.99 g/mol)?

A. 0.435 mol

B. 2.299 mol

C. 229.9 mol

D. 0.230 mol

Question 2
1 mark

If the number of moles increases while the molar mass remains constant, the mass of the sample must:

A. Decrease

B. Stay the same

C. Increase

D. Become zero

Question 3
1 mark

Which of the following contains the greatest number of moles?

A. 10g of H_2 (M = 2.02)

B. 10g of O_2 (M = 32.00)

C. 10g of Cl_2 (M = 70.90)

D. 10g of N_2 (M = 28.02)

Question 4
1 mark

The term 'molar mass' refers to the mass of:

A. One atom

B. One molecule

C. 6.022×10^{23} particles

D. 1 kilogram of substance

Specific Heat Capacity and Energy

When we add heat to a substance, its temperature rises. The amount of energy required to raise the temperature of 1 gram of a substance by 1 degree Celsius is called the _____ (c).

The formula for heat energy (q) is:

$$q = mc\Delta T$$

- q = Heat energy in _____ (J).
- m = Mass of the substance being heated (usually water) in _____.
- c = Specific heat capacity (for water, this is _____ $J\ g^{-1}\ K^{-1}$).
- ΔT = Change in _____ ($T_{final} - T_{initial}$).

<table>
<tr><td>

COMMON MISCONCEPTION ⚠️

</td></tr>
<tr><td>

Mass of what?

In calorimetry, m is the mass of the **surroundings** (usually the water in the beaker), NOT the mass of the fuel or the solid being reacted.

</td></tr>
</table>

Thermometer

Insulated Cup

Reaction Mixture
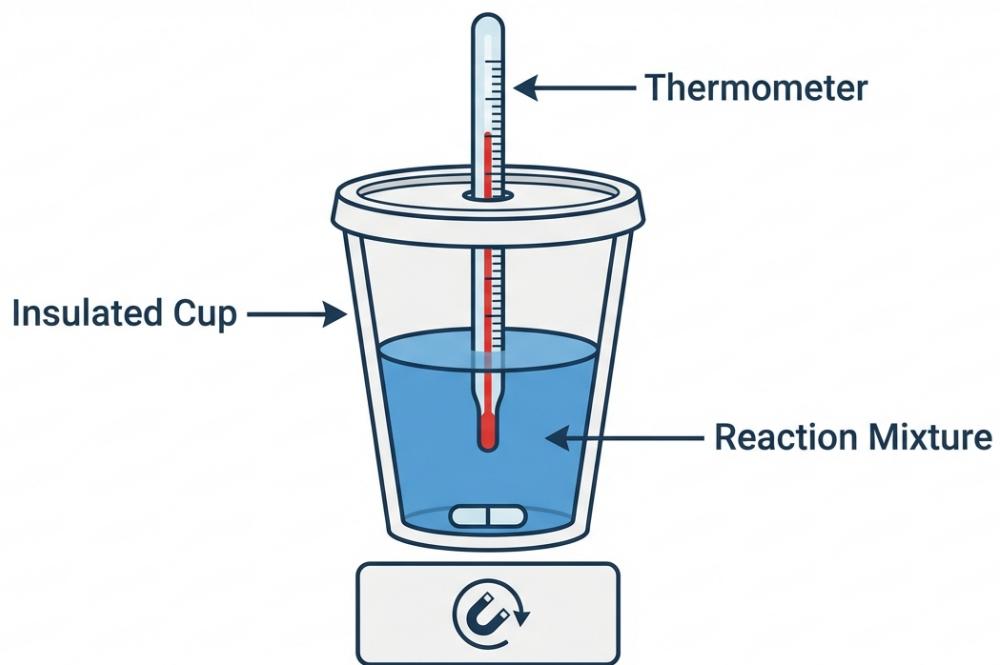
Question 6 — 2 marks

Mirror Question: Determine the mass of 0.750 moles of Zinc Nitrate $(Zn(NO_3)_2)$.
(Molar masses: Zn = 65.38, N = 14.01, O = 16.00 g/mol)

Question 7 — 3 marks

A sample of an unknown metal weighs 15.5g and contains 0.277 moles. Calculate the molar mass of the metal and identify it using a periodic table.

Access the full workbook for free in our Chemistry 3+4 Headstart class.

Every lesson at Trajectory Education comes with useful resources just like this, with no additional fee or surprise payment.

Enrol for free to access

or ask us a question