

Simple Step-by-Step
Guides to Solving
Chemistry Problems

Relative Formula Mass



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Relative Formula Mass (M_r)

To find the relative formula mass (M_r) of a compound ($X_aY_bZ_c$), just add together the relative atomic mass (A_r) values for all the atoms in its chemical formula:

Chemistry Calculating Frame for Relative Formula Mass

Element	No. of atoms	A_r	Mass
X	a	$A_r(X)$	$a \times A_r(X)$
Y	b	$A_r(Y)$	$b \times A_r(Y)$
Z	c	$A_r(Z)$	$c \times A_r(Z)$
Total			M_r

Step 1
Derived from chemical formula.

Step 2
Derived from Periodic Table.

Step 3
Mass of each element present in the compound.

Step 4
 $M_r = a \times A_r(X) + b \times A_r(Y) + c \times A_r(Z)$

Step 1: Identify the number of atoms of each element present in the compound from its chemical formula;

Step 2: Using the Periodic Table find the relative atomic mass (A_r) for each element present;

Step 3: Calculate the total mass of each element present in the chemical formula of the compound, i.e.

Mass of element in a compound = relative atomic mass \times number of atoms

Step 4: Add together all the element masses to obtain the Relative Formula Mass (M_r).

Examples: Determine the relative formula mass (M_r) of $MgCO_3$ and $K_4Pt(CN)_6$

$MgCO_3$

Element	No. of atoms	A_r	Mass
Mg	1	24	$1 \times 24 = 24$
C	1	12	$1 \times 12 = 12$
O	3	16	$3 \times 16 = 48$
Total	5		84

Answer: $RFM[MgCO_3] = 84$

Example: $K_4Pt(CN)_6$

Element	No. of atoms	A_r	Mass
K	4	39	$4 \times 39 = 156$
Pt	1	195	$1 \times 195 = 195$
C	6	12	$6 \times 12 = 72$
N	6	14	$6 \times 14 = 84$
Total			507

Answer: $RFM[K_4Pt(CN)_6] = 507$

Additional Information

Chemical Formula



Chemical symbols (X, Y, Z)

Subscripts (a, b, n) - gives the number of atoms of each element in a molecule. If no subscript then assume "1".

Examples:

	Number of types of atoms	Number of each atom type	Total number of atoms
$X_a Y_b Z_c$	3 types: X, Y and Z	a atoms of X b atoms of Y c atoms of Z	$a + b + c$
NO_2	2 types: N and O	1 atom of N 2 atoms of O	$1 + 2 = 3$
$MgCO_3$	3 types: Mg, C and O	1 atom of Mg 1 atom of C 3 atoms of O	$1 + 1 + 3 = 5$
$X_a(Y_b Z_c)_n$	3 types: X, Y and Z	$a \times n$ atoms of X $b \times n$ atoms of Y $c \times n$ atoms of Z	$a + nb + nc$
$Al_2(SO_4)_3$	3 types: Al, S and O	2 atoms of Al 1×3 atoms of S 4×3 atoms of O	$1 + 3 + 12 = 16$

Practice Problems



Determine the relative formula mass (M_r) of the following chemicals?

- Carbon dioxide, CO_2
- Iron (II) sulphide, FeS
- Copper sulphate, $CuSO_4$
- Benzene, C_6H_6
- Calcium hydroxide, $Ca(OH)_2$
- Oxygen, O_2
- Sodium oxide, Na_2O
- Lead (II) nitrate, $Pb(NO_3)_2$

- i) Nitrogen dioxide, NO_2
- j) Ethanoic acid, CH_3COOH
- k) Aluminium sulphate, $\text{Al}_2(\text{SO}_4)_3$
- l) Iron (III) nitrate, $\text{Fe}(\text{NO}_3)_3$
- m) Calcium phosphate, $\text{Ca}_3(\text{PO}_4)_2$
- n) Silver nitrite, AgNO_2
- o) Potassium permanganate, KMnO_4
- p) Potassium dichromate, $\text{K}_2\text{Cr}_2\text{O}_7$
- q) Nickel sulphite, NiSO_3
- r) Copper tartrate, $\text{Cu}_2\text{C}_4\text{H}_4\text{O}_6$
- s) Cobalt (II) chlorate, $\text{Co}(\text{ClO}_3)_2$
- t) Diethyl zinc, $(\text{C}_2\text{H}_5)_2\text{Zn}$

Answers:

a) 44; b) 88; c) 159.5; d) 78; e) 74; f) 32; g) 62; h) 331; i) 46; j) 60; k) 342; l) 242; m) 310; n) 154; o) 158; p) 294; q) 139; r) 275; s) 226; t) 123