

Home Gameboard Chemistry Foundations Stoichiometry Empirical Formulae 1

Empirical Formulae 1

GCSE P P P



Essential Pre-Uni Chemistry A1.1

Find the empirical formulae for the ten compounds in Parts A - J, from the data given below. No compound contains more than 15 atoms in total in its formula. All compositions are by mass.

| Element | Atomic Mass | Element | Atomic Mass |
|----------|-------------|-----------|-------------|
| Hydrogen | 1.0 | Chlorine | 35.5 |
| Carbon | 12.0 | Potassium | 39.1 |
| Nitrogen | 14.0 | Vanadium | 50.9 |
| Oxygen | 16.0 | Chromium | 52.0 |
| Sulfur | 32.1 | Lead | 207.2 |

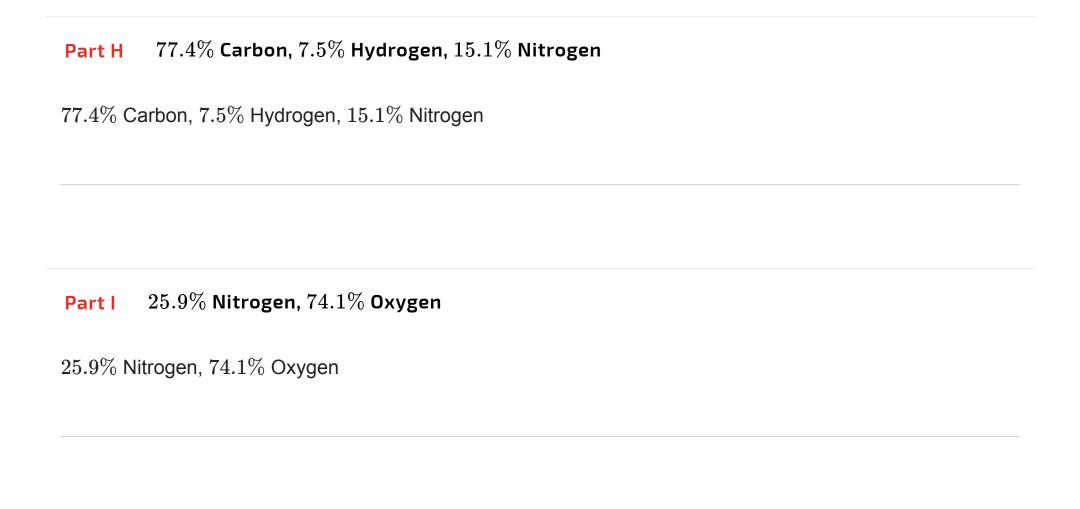
Part A 35.0% Nitrogen, 5.0% Hydrogen, 60.0% Oxygen

35.0% Nitrogen, 5.0% Hydrogen, 60.0% Oxygen

Part B 90.7% Lead, 9.3% Oxygen

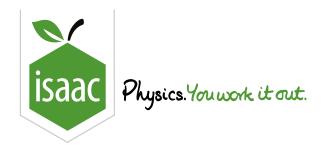
90.7% Lead, 9.3% Oxygen

26.6% Potassium, 35.3% Chromium, 38.1% Oxygen Part C 26.6% Potassium, 35.3% Chromium, 38.1% Oxygen 40.3% Potassium, 26.8% Chromium, 32.9% Oxygen Part D 40.3% Potassium, 26.8% Chromium, 32.9% Oxygen 29.4% Vanadium, 9.2% Oxygen, 61.4% Chlorine Part E 29.4% Vanadium, 9.2% Oxygen, 61.4% Chlorine 81.8% Carbon, 18.2% Hydrogen Part F 81.8% Carbon, 18.2% Hydrogen 38.7% Carbon, 9.7% Hydrogen, 51.6% Oxygen Part G 38.7% Carbon, 9.7% Hydrogen, 51.6% Oxygen



Part J 29.7% Carbon, 5.8% Hydrogen, 26.5% Sulfur, 11.6% Nitrogen, 26.4% Oxygen

29.7% Carbon, 5.8% Hydrogen, 26.5% Sulfur, 11.6% Nitrogen, 26.4% Oxygen. In your answer, place the elements in the order just given.



Home Gameboard Chemistry Foundations Stoichiometry Empirical Formulae 2

Empirical Formulae 2

Essential Pre-Uni Chemistry A1.2



Complete combustion of $6.4\,\mathrm{g}$ of compound K produced $8.8\,\mathrm{g}$ of carbon dioxide and $7.2\,\mathrm{g}$ of water.

Calculate the empirical formula of K.

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Home Gameboard Chemistry Foundations Stoichiometry Empirical Formulae 3

Empirical Formulae 3

GCSE A Level

Essential Pre-Uni Chemistry A1.3

Complete combustion of $1.80\,\mathrm{g}$ of compound L produced $2.64\,\mathrm{g}$ of carbon dioxide, $1.08\,\mathrm{g}$ of water and $1.92\,\mathrm{g}$ of sulfur dioxide.

Calculate the empirical formula of L.

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STEM SMART Chemistry Week 4



Home Gameboard Chemistry Foundations Stoichiometry Ar & Mr and Molecular Formula 6

Ar & Mr and Molecular Formula 6



Essential Pre-Uni Chemistry A2.6

Assume that the mass of an isotope in \mathbf{amu} to 3 significant figures is equal to its mass number.

The relative molecular mass of compound M is $135\,\mathrm{amu}$. M contains 3.7% hydrogen, 44.4% carbon and 51.9% nitrogen by mass.

Find the molecular formula of M.

Gameboard:

STEM SMART Chemistry Week 4



Home Gameboard Chemistry Foundations Stoichiometry Ar & Mr and Molecular Formula 7

Ar & Mr and Molecular Formula 7



Essential Pre-Uni Chemistry A2.7

Assume that the mass of an isotope in \mathbf{amu} to 3 significant figures is equal to its mass number.

Complete combustion of compound N occurs in a stoichiometric ratio of 1:6 with oxygen gas. Complete combustion of $4.2\,\mathrm{g}$ of compound N produces $13.2\,\mathrm{g}$ of carbon dioxide and $5.4\,\mathrm{g}$ of water.

Find the molecular formula of N.

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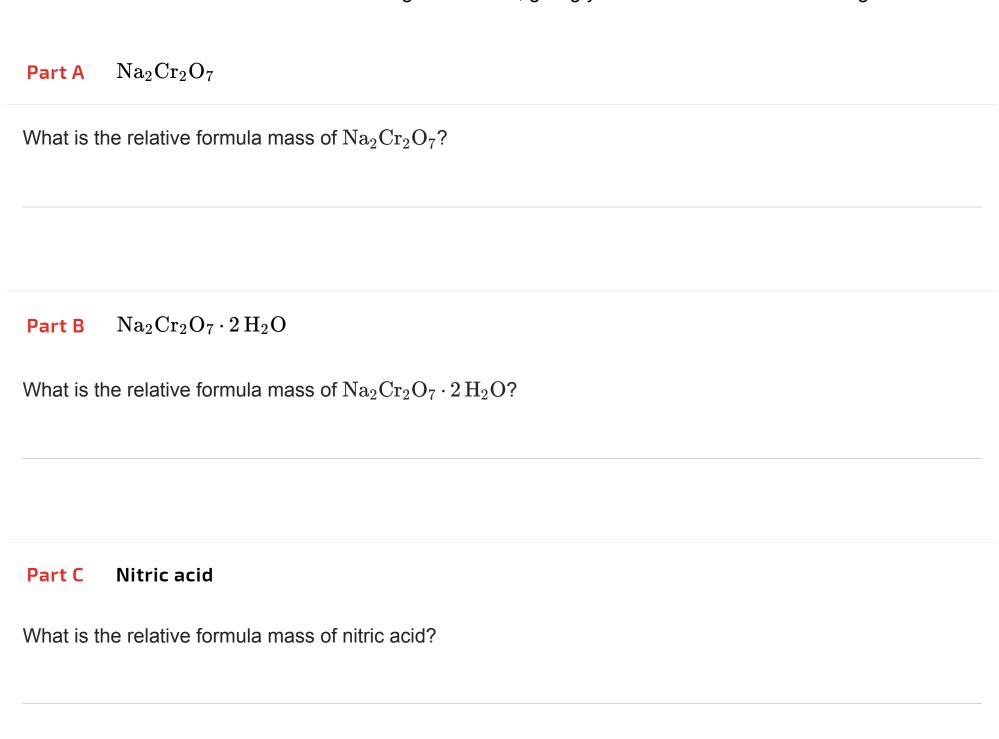


Home Gameboard Chemistry Foundations Stoichiometry Relative formula mass

Relative formula mass



Find the relative formula mass of the following substances, giving your answer to the nearest integer.



Part D Propanol

What is the relative formula mass of propanol?

Part E Sodium carbonate

What is the relative formula mass of sodium carbonate?

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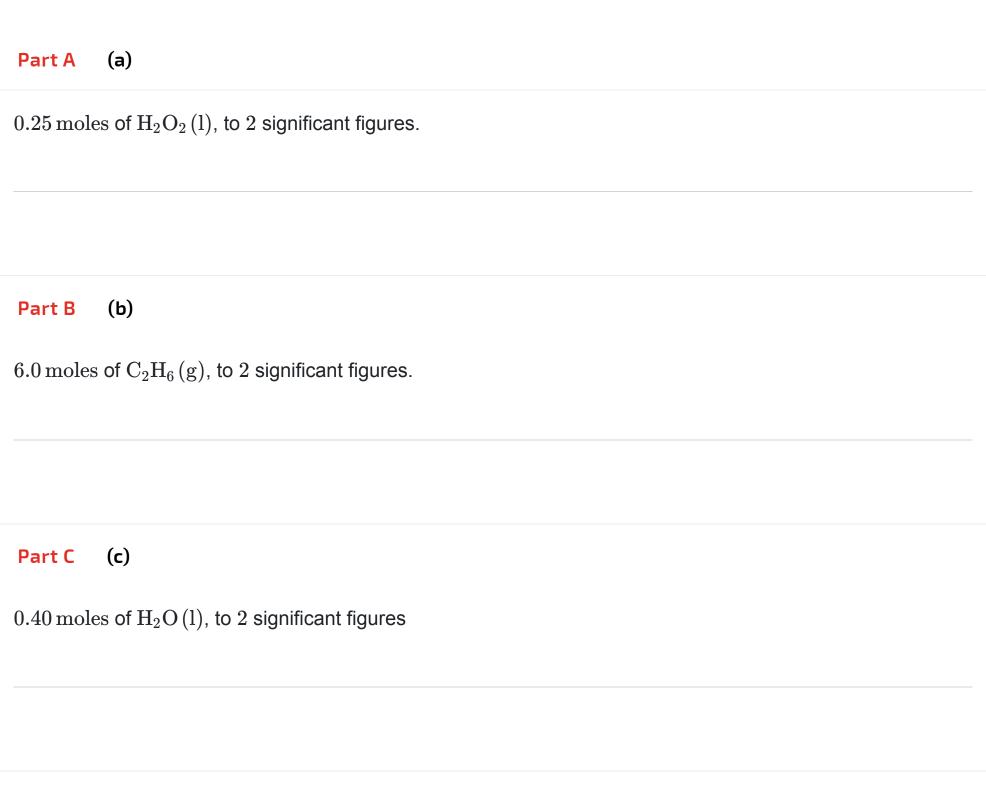
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Solids 2

GCSE A Level

Essential Pre-Uni Chemistry B4.2

Calculate the mass of the following compounds. Give your answers to the appropriate number of significant figures.



Part D (d)

 $20.0 \,\mathrm{moles}$ of $\mathrm{Sr}\,(\mathrm{s})$, to 3 significant figures.

| Part E (e) |
|--|
| $1.20\mathrm{moles}$ of aluminium oxide, to 3 significant figures. |
| |
| |
| Part F (f) |
| $7.4\mathrm{moles}$ of ammonium sulfate, to 2 significant figures. |
| |
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Chemistry Foundations Stoichiometry Solutions 1 <u>Home</u> <u>Gameboard</u>

Solutions 1



Essential Pre-Uni Chemistry B5.1

Calculate the concentration in $\mathrm{mol}\,\mathrm{dm}^{-3}$ of the following solutions:

(a) Part A $0.40\,\mathrm{g}\;NaOH$ in $100\,\mathrm{ml}$ water (b) Part B

$7.3\,\mathrm{g}\;\mathrm{HCl}$ in $1000\,\mathrm{ml}$ water

Part C (c)

 $2.5\,\mathrm{g}\;H_2SO_4$ in $50\,\mathrm{ml}$ water

(d) Part D

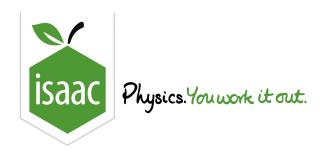
 $15\,\mathrm{g}\; FeSO_4$ in $500\,\mathrm{ml}$ water, to 2 significant figures

Part E (e)

 $0.16\,\mathrm{g}\;KMnO_4$ in $200\,\mathrm{ml}$

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Home Gameboard Chemistry Foundations Stoichiometry Homeopathy

Homeopathy



Part A Arsenous acid

 As_2O_3 is moderately soluble in water: one dm^3 of a saturated solution at $25\,^{\circ}\mathrm{C}$ contains $20.6\,\mathrm{g}$. When dissolved in water, the oxide reacts to form arsenous acid, H_3AsO_3 .

Balance the equation for the formation of arsenous acid from As_2O_3 , using the smallest possible integer coefficients (do not include state symbols).

Part B Saturated solution concentration

 As_2O_3 is moderately soluble in water: one dm^3 of a saturated solution at $25\,^\circ C$ contains $20.6\,g$. When dissolved in water, the oxide reacts to form arsenous acid, H_3AsO_3 .

Calculate the concentration of the arsenous acid in $m mol\,dm^{-3}$ in the saturated solution, giving your answer to 3 significant figures.

Part C Mass in glass

In homeopathy, a decimal-scale is often used to specify the dilution of a given sample: D1 (sometimes labelled 1X) means the sample has been diluted 1 part in 10. D2 (or 2X) means the sample has been diluted 1 in 10, then 1 part of that solution has been further diluted 1 in 10 again to give a 1 in 100 dilution. A D6 (or 6X) solution has repeated this process six times to give a final dilution of 1 in 10^6 .

Arsenicum album is often sold as a D30 preparation. Let us assume that the initial stock solution before dilution was the saturated solution containing $20.6\,\mathrm{g\,dm^{-3}}$ of $\mathrm{As_2O_3}$.

Calculate the mass (in g) of As_2O_3 present in a $100\,\mathrm{cm^3}$ glass of the D30 *Arsenicum album* remedy, giving your answer to 3 significant figures.

Part D Fatal dose

In homeopathy, a decimal-scale is often used to specify the dilution of a given sample: D1 (sometimes labelled 1X) means the sample has been diluted 1 part in 10. D2 (or 2X) means the sample has been diluted 1 in 10, then 1 part of that solution has been further diluted 1 in 10 again to give al in 100 dilution. A D6 (or 6X) solution has repeated this process six times to give a final dilution of 1 in 10⁶.

Arsenicum album is often sold as a D30 preparation. Let us assume that the initial stock solution before dilution was the saturated solution containing 20.6 g dm $^{-3}$ of As_2O_3 .

Given that $0.1 \,\mathrm{g}$ of $\mathrm{As_2O_3}$ is usually fatal, calculate the volume (in $\mathrm{m^3}$) of the D30 solution that would be needed for a fatal dose of $\mathrm{As_2O_3}$, giving your answer to 3 significant figures.

Part E Volume equivalent

In homeopathy, a decimal-scale is often used to specify the dilution of a given sample: D1 (sometimes labelled 1X) means the sample has been diluted 1 part in 10. D2 (or 2X) means the sample has been diluted 1 in 10, then 1 part of that solution has been further diluted 1 in 10 again to give a 1 in 100 dilution. A D6 (or 6X) solution has repeated this process six times to give a final dilution of 1 in 10^6 .

Arsenicum album is often sold as a D30 preparation. Let us assume that the initial stock solution before dilution was the saturated solution containing $20.6 \,\mathrm{g}\,\mathrm{dm}^{-3}$ of $\mathrm{As_2O_3}$.

Given that $0.1\,\mathrm{g}$ of $\mathrm{As_2O_3}$ is usually fatal, calculate the volume of the D30 solution that would be needed for a fatal dose of $\mathrm{As_2O_3}$, expressing your answer as a multiple of the volume of the Earth (approximately $1.08\times10^{12}\,\mathrm{km^3}$), i.e. how many Earths would fill the same volume, to 2 significant figures.

Part F Bottles for one atom

In homeopathy, a decimal-scale is often used to specify the dilution of a given sample: D1 (sometimes labelled 1X) means the sample has been diluted 1 part in 10. D2 (or 2X) means the sample has been diluted 1 in 10, then 1 part of that solution has been further diluted 1 in 10 again to give a 1 in 100 dilution. A D6 (or 6X) solution has repeated this process six times to give a final dilution of 1 in 10^6 .

Arsenicum album is often sold as a D30 preparation. Let us assume that the initial stock solution before dilution was the saturated solution containing $20.6 \,\mathrm{g}\,\mathrm{dm}^{-3}$ of $\mathrm{As_2O_3}$.

The preparations are usually sold in one ounce bottles ($1 \text{ ounce} = 28 \text{ cm}^3$).

Calculate how many bottles of the D30 solution need to be bought in order, on average, to include one atom of arsenic.

Part G D2

In homeopathy, a decimal-scale is often used to specify the dilution of a given sample: D1 (sometimes labelled 1X) means the sample has been diluted 1 part in 10. D2 (or 2X) means the sample has been diluted 1 in 10, then 1 part of that solution has been further diluted 1 in 10 again to give a 1 in 100 dilution. A D6 (or 6X) solution has repeated this process six times to give a final dilution of 1 in 10^6 .

Another 'remedy' is *Muriaticum acidum* which is actually diluted hydrochloric acid. This is available in various dilutions up to the extremely 'potent' D2000 preparation.

Assuming the original stock solution before dilution was $1.0\,\mathrm{mol\,dm^{-3}}$, what is the concentration of HCl in D2?

Part H D4

In homeopathy, a decimal-scale is often used to specify the dilution of a given sample: D1 (sometimes labelled 1X) means the sample has been diluted 1 part in 10. D2 (or 2X) means the sample has been diluted 1 in 10, then 1 part of that solution has been further diluted 1 in 10 again to give a 1 in 100 dilution. A D6 (or 6X) solution has repeated this process six times to give a final dilution of 1 in 10^6 .

Another 'remedy' is *Muriaticum acidum* which is actually diluted hydrochloric acid. This is available in various dilutions up to the extremely 'potent' D2000 preparation.

Assuming the original stock solution before dilution was $1.0\,\mathrm{mol\,dm^{-3}}$, what is the concentration of HCl in D4?

Part I D6

In homeopathy, a decimal-scale is often used to specify the dilution of a given sample: D1 (sometimes labelled 1X) means the sample has been diluted 1 part in 10. D2 (or 2X) means the sample has been diluted 1 in 10, then 1 part of that solution has been further diluted 1 in 10 again to give a 1 in 100 dilution. A D6 (or 6X) solution has repeated this process six times to give a final dilution of 1 in 10^6 .

Another 'remedy' is *Muriaticum acidum* which is actually diluted hydrochloric acid. This is available in various dilutions up to the extremely 'potent' D2000 preparation.

Assuming the original stock solution before dilution was $1.0\,\mathrm{mol\,dm^{-3}}$, what is the concentration of HCl in D6?

Part J D8

In homeopathy, a decimal-scale is often used to specify the dilution of a given sample: D1 (sometimes labelled 1X) means the sample has been diluted 1 part in 10. D2 (or 2X) means the sample has been diluted 1 in 10, then 1 part of that solution has been further diluted 1 in 10 again to give a 1 in 100 dilution. A D6 (or 6X) solution has repeated this process six times to give a final dilution of 1 in 10^6 .

Another 'remedy' is *Muriaticum acidum* which is actually diluted hydrochloric acid. This is available in various dilutions up to the extremely 'potent' D2000 preparation.

Assuming the original stock solution before dilution was $1.0\,\mathrm{mol\,dm^{-3}}$, what is the concentration of HCl in D8?

Part K D10

In homeopathy, a decimal-scale is often used to specify the dilution of a given sample: D1 (sometimes labelled 1X) means the sample has been diluted 1 part in 10. D2 (or 2X) means the sample has been diluted 1 in 10, then 1 part of that solution has been further diluted 1 in 10 again to give a 1 in 100 dilution. A D6 (or 6X) solution has repeated this process six times to give a final dilution of 1 in 10^6 .

Another 'remedy' is *Muriaticum acidum* which is actually diluted hydrochloric acid. This is available in various dilutions up to the extremely 'potent' D2000 preparation.

Assuming the original stock solution before dilution was $1.0\,\mathrm{mol\,dm^{-3}}$, what is the concentration of HCl in D10?

Adapted with permission from the Cambridge Chemistry Challenge 2012, Question 1