

Formulations

5.8.1.2 · Chemistry · revision notes

A formulation is a mixture designed as a useful product, with each component there for a reason. Questions ask you to recognise formulations, suggest what a component does from the information given, and do simple mass or percentage calculations.

Key facts

- Formulation = a mixture that has been designed as a useful product
- Components are mixed in carefully measured quantities so the product has the required properties
- Mass of component = $\text{percentage} \div 100 \times \text{total mass}$
- All the percentages in a formulation add up to 100%
- Each component has a particular purpose
- Examples: fuels, cleaning agents, paints, medicines, alloys, fertilisers, foods
- Percentage = $\text{mass of component} \div \text{total mass} \times 100$

Notes

What a formulation is

- A **formulation** is a mixture that has been designed as a useful product.
- Each component has a particular purpose (job) in the product.
- The components are mixed in **carefully measured quantities** so that the product has the properties it needs.
- A formulation is a mixture, so it is not a pure substance. Changing the amounts of the components changes how the product behaves.

Examples

- Formulations include **fuels, cleaning agents, paints, medicines, alloys, fertilisers and foods**.
- Paint: a pigment gives the colour, a binder sticks the pigment to the surface, and a solvent makes the paint runny enough to spread, then evaporates.
- Medicine tablet: the active ingredient treats the illness; other components bulk out the tablet, hold it together, improve the taste or control how fast it dissolves.
- Alloy: steel is iron mixed with set amounts of carbon (and sometimes other metals) to give it the hardness and strength needed.
- You do not need to learn the ingredients of branded products. The question gives you the information you need.

Formulation calculations

- Mass of a component = (percentage ÷ 100) × total mass.
- Percentage of a component = (mass of component ÷ total mass) × 100.
- The percentages of all the components add up to 100%, and the masses add up to the total mass.

500 g of paint (a formulation)

pigment 20%	binder 30%	solvent 50%
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100 g

colour

150 g

sticks it on

250 g

spreads, then evaporates

$$20\% + 30\% + 50\% = 100\% \quad 100 \text{ g} + 150 \text{ g} + 250 \text{ g} = 500 \text{ g}$$

Each component has a job; mass = percentage ÷ 100 × total mass.

- Keep the units the same: all in g or all in kg.

How to answer each type of question

Recognise formulations

1 to 2 marks

Grade 3

1. Use the definition: a mixture designed as a useful product.
2. Rule out single elements and compounds, such as helium or pure water: they are not mixtures.

Example. Which **two** of these are formulations?

A fertiliser

B helium

C sodium chloride

D washing-up liquid

E iron

Model answer. A (1)

D (1)

Explain why the components are carefully measured

2 marks

Grade 5

1. Say that each component has a particular purpose in the product.
2. Say that the correct amounts give the product the properties it needs, so it works as intended.

Example. A company makes a hand-cleaning gel. The gel is a formulation.

Explain why the company must measure the amount of each component carefully.

Model answer. Each component has a particular job in the gel (1). The correct amount of each component gives the gel the properties it needs / makes sure it works properly (1).

Suggest the purpose of a component

1 to 2 marks

Grade 5

1. Read the information for clues about what the product must do.
2. Link the component to a property of the product: colour, taste, strength, how it spreads, how it dissolves.
3. Give one clear purpose for each component asked about.

Example. A tablet for treating headaches contains a painkiller, starch, a sweetener and a thin, smooth outer coating.

Suggest the purpose of:

- (a) the sweetener
- (b) the coating.

Model answer. (a) To make the tablet taste pleasant (1)
(b) To make the tablet easier to swallow / to protect the tablet (1)

Don't lose marks

- ✗ Defining a formulation as just 'a mixture'. Say it is a mixture **designed as a useful product**.
- ✗ Calling a formulation a pure substance or a compound. Its components are mixed, not chemically joined.
- ✗ Saying the amounts are measured 'to make it safe'. The mark is for giving the product the properties it needs.
- ✗ Mixing units in calculations, e.g. a total in kg and an answer in g without converting.
- ✗ Forgetting to work out a missing percentage (100% minus the others) before finding a mass.

More tips

Memory tricks

- A formulation is a recipe: chosen ingredients, in fixed amounts, each with a job.
- The seven examples: 'Fresh Crisp Pizza Makes Anyone Feel Full' = Fuels, Cleaning agents, Paints, Medicines, Alloys, Fertilisers, Foods.
- Sense check: the masses of the components must add up to the total mass.
- 10% is easy: divide by 10, then scale up (e.g. $30\% = 3 \times 10\%$).

Exam technique

- Key phrases: 'mixture designed as a useful product', 'each component has a purpose', 'carefully measured quantities', 'required properties'.
- In 'suggest' questions you are not expected to know the product: use the information in the question.
- Show every step of a calculation and give the unit.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

Define a formulation

A mixture that has been designed as a useful product.

Grade 3

Give examples of formulations

Fuels, cleaning agents, paints, medicines, alloys, fertilisers and foods.

Grade 4

Identify formulations from given information

Look for a product made by mixing measured amounts of components, each with a purpose.

Grade 5

Explain why quantities are carefully measured

The right amount of each component gives the product the properties it needs.

Grade 5

Suggest the purpose of a component

Use the information given, e.g. a pigment gives colour and a sweetener improves taste.

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