



Isaac Chemistry

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Isaac A Level Chemistry overview





A Level Chemistry

Try a random question! [Get a different question](#)

 **Black Pepper**
Chemistry | Organic | Reactions

A Level Challenge 2 

**Question finder**
Find A Level Chemistry questions to try by topic and difficulty level.

[Find questions](#)

**Concepts**
Review the key concepts for A Level Chemistry.

[Explore concepts](#)

**Tests**
Use tests to practise a range of topics. These tests are available for you to freely attempt.

[Find a test](#)

**Question decks by topic**
Practise specific topics by using our ready-made question decks.

[View topic question decks](#)

**Glossary**
Use the glossary to understand the vocabulary you need for A Level Chemistry.

[Browse the glossary](#)

**Core skills practice**
Practise core skills required in A Level chemistry.

[Practise core skills](#)

Question finder



A Level Chemistry >

 Question finder Help

Search questions

Filter questions by

Learning Stage

2

 A Level Further A

Topic

 Foundations Physical Inorganic Organic Analytical

Difficulty

The questions shown on this page have been filtered to only show those that are relevant to A Level Chemistry. You can browse all questions [here](#).



Showing 30 of 739.

Shuffle questions 



2p Orbitals as Wavefunctions

Chemistry | Foundations | Atomic Structure

Further A Challenge 3

University Practice 3



C₃H₆ Combustion

Chemistry | Physical | Energetics

A Level Practice 2



CoCl₃-Ammonia Complexes

Chemistry | Inorganic | Transition Metals

A Level Challenge 2



LiH and PCl₃

Chemistry | Foundations | Stoichiometry

A Level Challenge 2



XCl_n

Chemistry | Inorganic | Bonding & IMFs

A Level Challenge 3



d-block Electronic Configurations

Chemistry | Foundations | Atomic Structure

A Level Practice 2



Questions: topics



Foundations

- Numerical Skills
- Atomic Structure
- Stoichiometry
- Gas Laws

Inorganic

- Periodic Table
- Bonding & IMFs
- Redox
- Transition Metals

Analytical

- Chromatography
- Mass Spectrometry
- IR Spectroscopy
- NMR Spectroscopy
- Electronic Spectroscopy

Physical

- Kinetics
- Energetics
- Entropy
- Equilibrium
- Acids & Bases
- Electrochemistry

Organic

- Functional Groups
- Isomerism
- Reactions
- Aromaticity
- Reactions (aromatics)
- Polymers

Questions: difficulty



Difficulty



[Learn more about difficulty levels](#)

Practice 1 A row of three hexagonal icons: one green hexagon followed by two grey hexagons.

Practice 2 A row of three hexagonal icons: two green hexagons followed by one grey hexagon.

Practice 3 A row of three green hexagonal icons.

Challenge 1 A row of three square icons: one orange square followed by two grey squares.

Challenge 2 A row of three square icons: two orange squares followed by one grey square.

Challenge 3 A row of three orange square icons.

- Practice questions are similar to what one would expect to see in an exam paper for the relevant stage (difficulty increasing P1 -> P3)
- Challenge questions require more problem solving/insights/... e.g. such as seen in C3L6 papers, Chemistry Olympiad, ...

Question decks by topic



Question decks by topic

Decks by stage

A Level

Decks by subject

Physics

Chemistry

Maths

Biology



The Chemistry topics below are ordered to allow for progression of ideas from one question deck to the next. To find a question deck on a specific topic, use `Ctrl+F` in your browser.

The "**What it contains**" column lists the difficulty levels of the questions and how many there are: for example, "7xP1" means seven questions of "Practice 1" difficulty. Generally, "Practice" questions are exam style, while "Challenge" questions use the same knowledge in a less familiar style and may require problem solving or combining of ideas. Some ratings are preliminary and subject to change, so feedback from teachers is very welcome. The table also shows which question types are used in each deck:

- **Quick:** show/hide the answer (not marked)
- **MCQ:** multiple-choice
- **Numeric:** enter a number (with or without units)
- **Symbolic:** enter an algebraic expression
- **Chemistry:** enter a chemical formula or chemical equation
- **Short-answer:** type a word or combination of words
- **Organic:** use the [external structure editor](#) to draw a structure and generate a SMILES string, then copy into Isaac for checking
- **Drag-and-drop:** drag pre-loaded options into gaps in text or a table

[Stoichiometry and Inorganic Chemistry](#) >

[Physical Chemistry](#) >

[Organic Chemistry and Spectroscopy](#) >

Concept pages



Concepts

Use our concept finder to explore all concepts on the Isaac platform.

[Share](#) [Print](#)

Search concepts

e.g. Forces 

Filter by subject and topic

Physics (78)

Maths (72)

Chemistry (27)

Showing 27 results

 **Acids and Bases**
Discusses the differences between the Arrhenius, Brønsted-Lowry and Lewis definitions of acids and bases. Other key terminology for acids and bases is also introduced with examples.

 **Activation Energy**
The minimum energy required to start a chemical reaction, and its link to reaction rates.

Glossary



A Level Chemistry >



A Level Chemistry Glossary

Use our glossary to find definitions of important words and phrases.



Search glossary

e.g. Bond



A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Switch learning stage

GCSE

A Level

University

A

[Addition](#)

A reaction where two or more starting materials combine to form one larger product.

[Alicyclic](#)

An organic compound containing at least one non-aromatic ring.

[Aliphatic](#)

An organic compound containing no aromatic rings.

[Allotrope](#)

A specific form of a chemical element, with atoms bonded together in a particular way. For example, graphite and diamond are two different allotropes of carbon.

[Aromatic](#)

An organic compound containing at least one aromatic ring (often a benzene ring).

Tests



A Level Chemistry >



Practice tests

This page lists tests you can take whenever you'd like to practise your skills and check your understanding.



Search practice tests

e.g. Practice



You can see all of the tests that you have in progress or have completed in your My Isaac:

[My tests →](#)

A purple hexagonal icon containing three horizontal lines of varying lengths.	Chemistry Admissions Practice 1	View test
A purple hexagonal icon containing three horizontal lines of varying lengths.	Chemistry Admissions Practice 2	View test
A purple hexagonal icon containing three horizontal lines of varying lengths.	Chemistry Admissions Practice 3	View test
A purple hexagonal icon containing three horizontal lines of varying lengths.	Chemistry Admissions Practice 4	View test
A purple hexagonal icon containing three horizontal lines of varying lengths.	Chemistry Admissions Practice 5	View test
A purple hexagonal icon containing three horizontal lines of varying lengths.	Chemistry Admissions Practice 6	View test

Core skills practice tools



A Level Chemistry >



Core skills practice

Select stage

GCSE

A Level

These are new tools and are still under development. We encourage you to try them out, and give us your feedback! However, please note that there may be bugs, and the difficulty levels of the questions may change before the final versions are released.

Below you can see the list of tools available for practising different chemistry skills. Click on the buttons to access particular tools.

Atomic structure

Using the periodic table

Number of protons, neutrons and electrons

Calculations

Mole calculations

Titration calculations

Buffer calculations

Organic chemistry and spectroscopy

Functional group recognition

Counting environments in NMR

Atomic structure practice tool



Generate new question

Enter the integers missing in the table below as numbers:

isotope

$^{75}_{33}\text{As}^{3-}$

number of protons

number of neutrons

number of electrons

Check answers

Tools to practise chemistry calculations



Hide menu

- include mass-based calculations
- include solution calculations
- include gas-phase calculations

Generate new question

What is the minimum mass, in grams, of CaCO3 that needs to be used to produce 23 grams of CaO in the following reaction?



g

check

I would like some help

Created by Andrea Chlebikova

Show menu

Generate new question

A student uses the method of titration to measure the concentration of sulfuric acid. Using a volumetric pipette, the student transfers 25.0 cm^3 of the acid solution to a conical flask containing an indicator, and fills a burette with a standard $0.187 \text{ mol dm}^{-3}$ solution of sodium hydroxide.

The student adds the base from the burette until the end point is reached. After repeating the procedure to obtain concordant titres, the student calculates a mean titre of 43.45 cm^3 .

Calculate the concentration of the sulfuric acid solution.

mol dm^{-3}

check

I would like some more help

Relevant formula: $n = cV$

Start by calculating the amount, in moles, of sodium hydroxide in the 43.45 cm^3 titre.

Created by Andrea Chlebikova

PART-CALCULATION QUESTION

mol

check

Looking at some questions



- Showcasing Isaac Chemistry:
https://isaacscience.org/question_decks#isaac_chem_sample

Question deck

Subject: Chemistry

Topic: Acids & Bases, Atomic Structure, Bonding & IMFs, Kinetics, Mass Spectrometry, NMR Spectroscopy, Organic Reactions, Polymers, Redox, Stoichiometry

Question key

- Not started
- In progress
- All attempted (some errors)
- All correct

Showcasing A Level Chemistry on Isaac

Periodic Table Explore the elements	A Level Practice 1	
Acid-Base Terminology Chemistry Physical Acids & Bases	A Level Practice 1	
d-block Electronic Configurations Chemistry Foundations Atomic Structure	A Level Practice 2	
Shapes of Fluorides Chemistry Inorganic Bonding & IMFs	A Level Practice 1	
Compounds from But-2-ene Chemistry Organic Reactions	A Level Practice 1	
Competing Reactions Chemistry Physical Kinetics	A Level Practice 2	

Looking at some questions



Acid-Base Terminology



Subject & topics
Chemistry | Physical | Acids & Bases

Status Not started
Stage & difficulty A Level Practice 1

The terminology surrounding acids and bases can be a bit confusing. Answer the questions below to test your understanding of this topic.

Part A Fully dissociated ▾

What do we call an acid or base that fully dissociates in aqueous solution?

Type your answer here.

Check my answer



Part B High mol dm⁻³ ▾

Part C Low mol dm⁻³ ▾

Part D Acidic solutions ▾

An acid with a very high K_a value is a [redacted] acid, but it can still be [redacted] if we create a solution of it with large amounts of water. At the same concentration, a [redacted] acid will have a lower pH than a [redacted] acid.

Items:

strong weak concentrated dilute

d-block Electronic Configurations



Subject & topics
Chemistry | Foundations | Atomic Structure

Status Not started
Stage & difficulty A Level Practice 2

Part A Cr^{3+} ▾

Chromium (atomic number 24) is a d-block element. Its compounds are useful reagents in the laboratory.

Using s, p and d notation for electron energy levels, write the electronic configuration of the Cr^{3+} ion.



Items:

[Ne] [Ar] [Kr] s p d 1 2 3 1 2 3 4 5 6

Check my answer

Need some help?

Periodic table ▶



Part B V^{2+} ▾

Which of the following electronic structures corresponds to the V^{2+} ion?

[Ar] 3d³

[Ar] 3d² 4s¹

Looking at some questions and concepts



Shapes of Fluorides

Subject & topics
Chemistry | Inorganic | Bonding & IMFs

Status: Not started

Stage & difficulty: A Level Practice 1

For each of the following, enter a one to two word answer, using appropriate shape of molecule terminology, e.g. "linear".

Part A BF_3

Describe the shape of BF_3 .

Type your answer here.

Check my answer

Need some help?

Hint 1

Concepts

Shapes of molecules

Part B CF_4

Part C NF_3

Part D SF_6

Shapes of Molecules

Valence Shell Electron Pair Repulsion theory

The shapes of molecules can be determined using Valence Shell Electron Pair Repulsion (VSEPR) theory which states that pairs of electrons in the valence shell of the central atom will be arranged as far apart as possible to minimise repulsion between them.

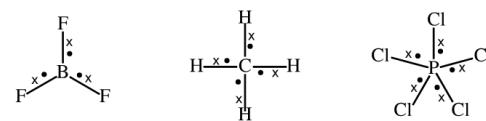
A Level

A Level

Step 1: determine number of electron pairs

First we need to find the number of electron pairs (or the number of areas of electron density) around the central atom, by accounting for all the valence electrons.

Each single bond from the central atom uses one of its valence electrons. The other electron in the bond is assumed to come from the atom it is bonded to. Therefore any single bond counts as one electron pair.



BF_3

3 valence electrons from B

3 x B-F bonds

= 3 electron pairs

CH_4

4 valence electrons from C

4 x C-H bonds

= 4 electron pairs

PCl_5

5 valence electrons from P

5 x P-Cl bonds

= 5 electron pairs

Figure 1: Structures of BF_3 , CH_4 and PCl_5

Note that the octet rule is not necessarily obeyed in this model! Remember to include any contribution from overall charge on the molecule to the number of valence electrons.

Any unused electrons contribute to non-bonding lone pairs.

Looking at some questions



Shapes of Fluorides

Subject & topics
Chemistry | Inorganic | Bonding & IMFs



Question



Status: Not started Stage & difficulty: A Level Practice 1

For each of the following, enter a one to two word answer, using appropriate shape of molecule terminology, e.g. "linear".

Part A BF_3

Describe the shape of BF_3 .

Type your answer here.

Check my answer

Need some help?

Hint 1

Concepts

Shapes of molecules

Part B CF_4

Part C NF_3

Part D SF_6

Shapes of Molecules

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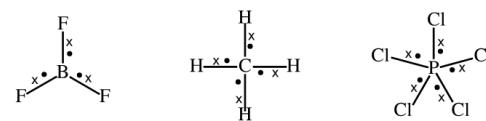
A Level

A Level

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First we need to find the number of electron pairs (or the number of areas of electron density) around the central atom, by accounting for all the valence electrons.

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BF₃

3 valence electrons from B

3 x B-F bonds

= 3 electron pairs

CH₄

4 valence electrons from C

4 x C-H bonds

= 4 electron pairs

PCl₅

5 valence electrons from P

5 x P-Cl bonds

= 5 electron pairs

Figure 1: Structures of BF_3 , CH_4 and PCl_5

Note that the octet rule is not necessarily obeyed in this model! Remember to include any contribution from overall charge on the molecule to the number of valence electrons.

Any unused electrons contribute to non-bonding lone pairs.

Looking at some organic questions



Compounds from But-2-ene

Subject & topics
Chemistry | Organic | Reactions

Status: Not started Stage & difficulty: A Level Practice 1

Complete the reaction scheme shown below which starts with but-2-ene. In each of the boxes A to D give the principal organic product or intermediate compound.

Use the [structure editor](#) to generate a SMILES string.

Figure 1: Compounds from but-2-ene

In the editor, after drawing your structure, click on the round, yellow smiley face to generate a SMILES string. Copy the SMILES string and paste it in the answer box.

[Using the structure editor](#)

Part A

A

A is:

Type your answer here.

https://jsme-editor.github.io/dist/JSME_test.html

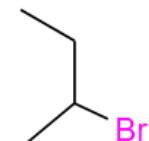


SMILES

CCC(C)Br

Close

F
Cl
Br
I



A is:

CCC(C)Br

Correct!

Looking at some more questions



Titrating Sulfur Dioxide

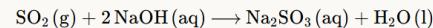
Subject & topics
Chemistry | Foundations | Stoichiometry

Status
 Not started

Stage & difficulty
A Level Practice 2

Sulfur dioxide is a by-product of the combustion of coal in power stations. It can react with oxygen and water vapour in the air to form sulfuric acid, H_2SO_4 . This is one of the causes of acid rain.

The amount of sulfur dioxide in the air may be determined by bubbling a sample of the air through sodium hydroxide solution, where it reacts according to the equation below:



The concentration of the unreacted sodium hydroxide can be determined by titration against a standard solution of hydrochloric acid.

1000 dm^3 of air were bubbled through 200 cm^3 of a 1.00 mol dm^{-3} solution of sodium hydroxide. The remaining solution was diluted to 1000 cm^3 with water, and 25.0 cm^3 of this solution was neutralised by 20.4 cm^3 of a 0.100 mol dm^{-3} solution of hydrochloric acid.

Part A H_2SO_4 formation ▾

Construct an overall equation for the formation of sulfuric acid from sulfur dioxide (do not include state symbols). Balance it so as to use the smallest possible integer coefficients.

Click to enter your answer

Check my answer



Part B Neutralisation reaction ▾

Part C Unreacted moles ▾

Part C Unreacted moles ▾

Find the amount, in moles, of unreacted sodium hydroxide.

Value

Unit

mol

ⓘ What can I type in this box?

Check my answer



Part D Sulfur dioxide moles ▾

Find the amount, in moles, of sulfur dioxide in 1000 dm^3 of air.

Value

Unit

mol

ⓘ What can I type in this box?

Check my answer



Part E Percentage by volume ▾

Hence calculate the percentage by volume of sulfur dioxide in air. (You may assume 1 mol of any gas occupies 24 dm^3 at this temperature and pressure.)

Value

Unit

%

ⓘ What can I type in this box?

Isaac Chemistry editor



https://isaacscience.org/questions/ch_editor_1

https://isaacscience.org/questions/ch_editor_2

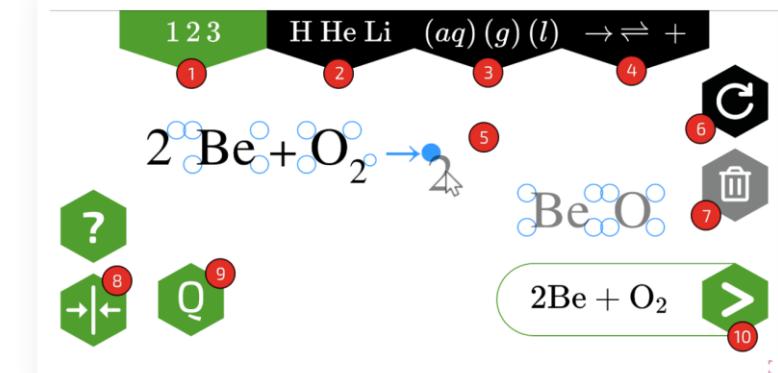
The interface features a top navigation bar with icons for file operations (New, Open, Save, Print, Copy link) and a search bar. Below the bar is a toolbar with numbered buttons (1, 2, 3) for element selection, and symbols for H, He, Li, α, γ, e, (aq), (g), (l), →, ⇌, +, C, and a trash bin.

A main workspace displays the chemical equation $3\text{H}_2(\text{g}) + \text{N}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$. To the right of the equation are buttons for C (calculator), a trash bin, and a reset button.

A small text box at the bottom left says: "Balance the following equation, and complete it to include state symbols. Use the lowest possible integer coefficients." Below the workspace is a text input field containing $\text{H}_2 + \text{N}_2 \rightarrow \text{NH}_3$, with a "HIDE QUESTION" button below it.

At the bottom right, a green button contains the balanced equation $3\text{H}_2(\text{g}) + \text{N}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$ followed by a right-pointing arrow.

Quick Help



Video tutorial



Isaac Chemistry content is expanding



- More core skills practice tools, concept pages and glossary entries

A. Atomic Structure

Progress in our knowledge of atomic structure over the last two centuries has allowed us to explain chemical observations and understand the chemical behaviour of many substances from first principles.

When students are first introduced to the model of the atom, they will be thinking about the components as particles: protons and neutrons (together commonly known as nucleons) at the centre of the atom in the nucleus, with electrons around it. In a neutral atom, the number of protons matches the number of electrons, and ions are formed by the gain or loss of electrons, giving negatively-charged anions and positively-charged cations respectively.

In early models, the electrons are often presented as spheres orbiting the nucleus, and for some purposes this model is useful, but for a better understanding, quantum mechanics is required. Instead of orbiting the nucleus, electrons exist in electron clouds in the atom, and their behaviour cannot be fully understood by thinking of them as classical particles. They can be described by wavefunctions, which in this context are more commonly known as atomic orbitals. While at A Level, orbitals are often presented as regions of space, in fact these wavefunctions describe the probability distribution of electrons: where the magnitude of the wavefunction is higher, the probability density is higher. This wavefunction understanding is also useful for making sense of bonding: when atomic orbitals overlap, they give rise to molecular orbitals (see Bonding chapter).

Atomic orbitals for a hydrogen atom can be found mathematically in essentially exact form. For other atoms, we often think of the atomic orbitals as scaled versions of the hydrogen orbitals. In hydrogen itself, the energy of the orbitals only depends on the shell number or, as we should properly call it, the principal quantum number, n .

However, in other atoms, electrons repel one another, resulting in shielding. We introduce the idea of an effective nuclear charge, Z_{eff} which is experienced by an electron in an atom. It is calculated by subtracting a shielding term, s from the actual nuclear charge Z . Electrons close to the nucleus experience almost the full nuclear charge, while the outer electrons are quite effectively shielded by those in lower shells.

- GCSE content (also suitable for KS3)
- Book collating A Level questions
- What would you most like to see?