



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 1 green hexagon followed by 2 white hexagons.

☐ Practice 2 2 green hexagons followed by 1 white hexagon.

☐ Practice 3 3 green hexagons.

☐ Challenge 1 1 orange square followed by 2 white squares.

☐ Challenge 2 2 orange squares followed by 1 white square.

☐ Challenge 3 3 orange squares.

- 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, "7×P1" 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.



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



Switch learning stage

GCSE

A Level

University

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

A

[!\[\]\(9db214d549b9aeebe72aa11d3a5c4b1a_img.jpg\) **Addition**](#)

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

[!\[\]\(9a795c4c0c43d0827b424565265fc8e6_img.jpg\) **Alicyclic**](#)

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

[!\[\]\(a05a1b59a958625e01d770867ed2a42e_img.jpg\) **Aliphatic**](#)

An organic compound containing no aromatic rings.

[!\[\]\(98e0dd3c5f32ab687ab08e39ab3c4a93_img.jpg\) **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.

[!\[\]\(aa01ebfc70be4fd3093ce28c2f248648_img.jpg\) **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 →](#)



Chemistry Admissions Practice 1

[View test](#)



Chemistry Admissions Practice 2

[View test](#)



Chemistry Admissions Practice 3

[View test](#)



Chemistry Admissions Practice 4

[View test](#)



Chemistry Admissions Practice 5

[View test](#)



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

number of protons

number of neutrons

number of electrons

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

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 CaCO_3 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**

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

 **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 acid, but it can still be if we create a solution of it with large amounts of water. At the same concentration, a acid will have a lower pH than a 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

Cr³⁺ ▾

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 Cr³⁺ ion.

Items:

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

Check my answer



Part B

V²⁺ ▾

Which of the following electronic structures corresponds to the V²⁺ 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

BF₃ ▾

Describe the shape of BF₃.

Type your answer here.

Check my answer

Need some help?

Hint 1 ▾

Concepts

[Shapes of molecules](#) 🔗



Part B

CF₄ >

Part C

NF₃ >

Part D

SF₆ >

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**.

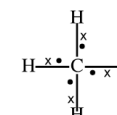


BF₃

3 valence
electrons
from B

3 x B-F bonds

= **3 electron
pairs**

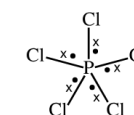


CH₄

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 BF₃, CH₄ and PCl₅

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



Status

☐ Not started

Stage & difficulty

A Level Practice 1

Subject & topics

Chemistry | Inorganic | Bonding & IMFs

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

Part A

BF₃ ▾

Describe the shape of BF₃.

Type your answer here.

Check my answer

Need some help?

Hint 1 ▾

Concepts

[Shapes of molecules](#) ⓘ

Part B

CF₄ >

Part C

NF₃ >

Part D

SF₆ >

Shapes of Molecules

Valence Shell Electron Pair Repulsion theory



The shapes of molecules can be determined using Valence Shell Electron Pair Repulsion theory. This 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.

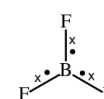
A Level

A Level

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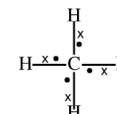


BF₃

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 BF₃, CH₄ and PCl₅

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.

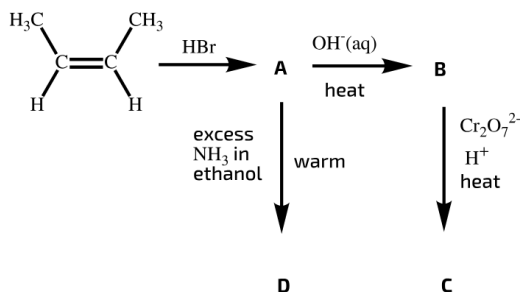


Figure 1: Compounds from but-2-ene

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

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

Quick Help

[CLOSE](#)

- 1 Click here to **add numbers**. Tap the buttons like a calculator, then drag the large number down.
- 2 Click here to drag down **chemical elements** and other particles.
- 3 Click here to drag down **state symbols**.
- 4 Click here to drag down **operators**, brackets and fractions.
- 5 This is the **main space**. Drag quantities onto the blue circles to join them together and build a longer expression.
- 6 Click on the **reset** button to reset the answer and erase your work.
- 7 Drag expressions onto the **bin** to remove them.
- 8 Click here to **move** the main expression to the centre of the screen.
- 9 A **reminder** of the question. Click **HIDE QUESTION** to hide it, click **Q** to see it again.
- 10 When you are finished, click here to **return to the question page**.

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 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?