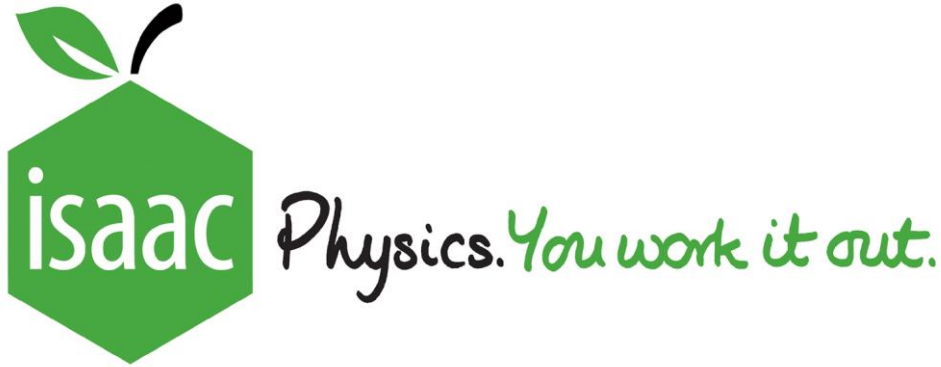


Isaac Chemistry

Andrea Chlebikova

andrea.c@isaacphysics.org

ac782@cam.ac.uk

Today's Focus Points:

- Finding Isaac Chemistry resources
- Using the Question Finder to select questions
- Overview of chemistry topics covered
- Gameboard to showcase different topics and question types
- Boards by Topic
- Using the Chemistry Equation Editor
- Using the Structural Formula Editor
- Applications for practice of key skills

Chemistry Landing Page

https://isaacphysics.org/chemistry

Introducing Isaac Chemistry Resources

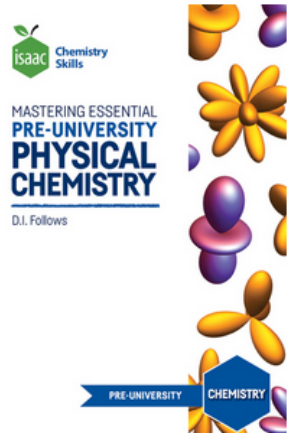
All the questions and use of the site is completely FREE for all, students and teachers alike.

Like Isaac Physics, Isaac Chemistry resources will focus on developing problem solving skills in chemistry from A-level through to the transition to university. Also like Isaac Physics, we have commissioned a mastery book for pre-university physical Chemistry.

Mastery Book | A Level Chemistry Questions | Free Registration | For Teachers

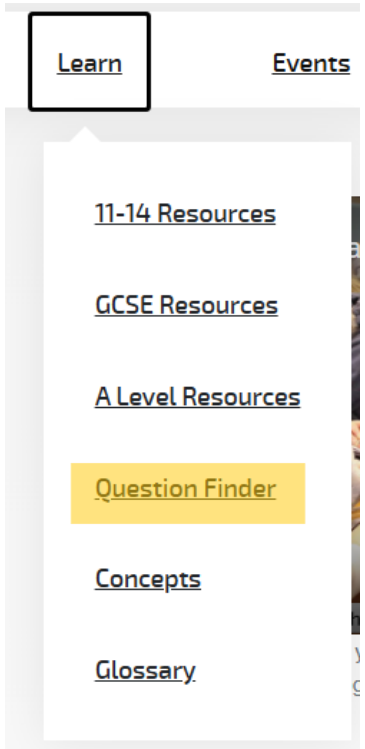
Developing mastery of essential pre-university chemistry by Dr David Follows

- The first two chapters of this book, aimed at A-level students studying Chemistry, are available to download as a pdf.
- The complete first edition is **now available** for £1 and is purchasable from Isaac Books
- **See questions from the Mastering Chemistry skills book.** Isaac marks them for you!
- The values for relative atomic masses and the constants used in the book are those given on this Periodic Table
- **For teachers**: See school syllabus maps for the pages of this book.



Question Finder

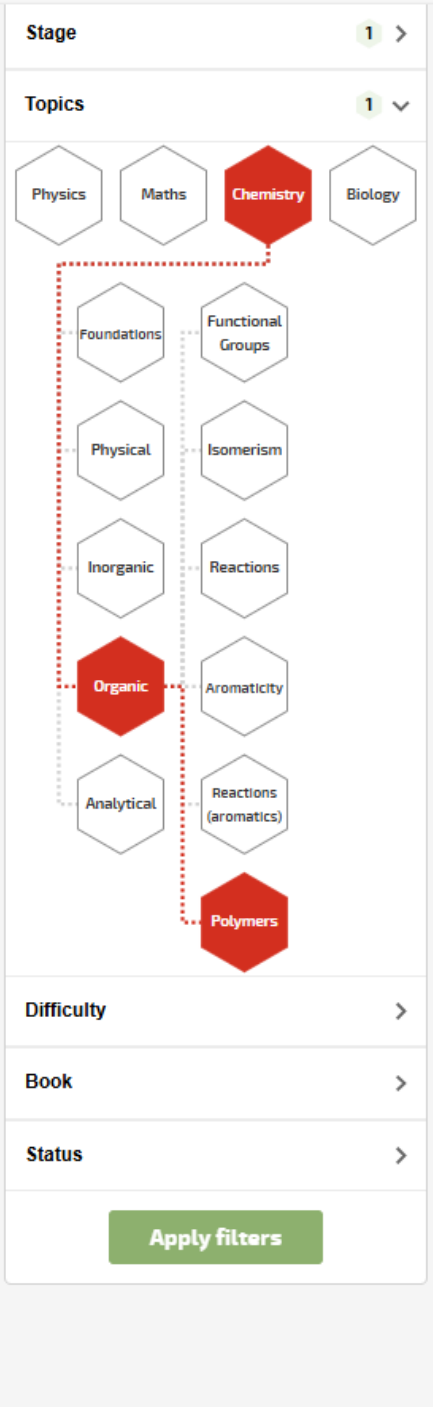
Use the Question Finder to find questions on a particular topic

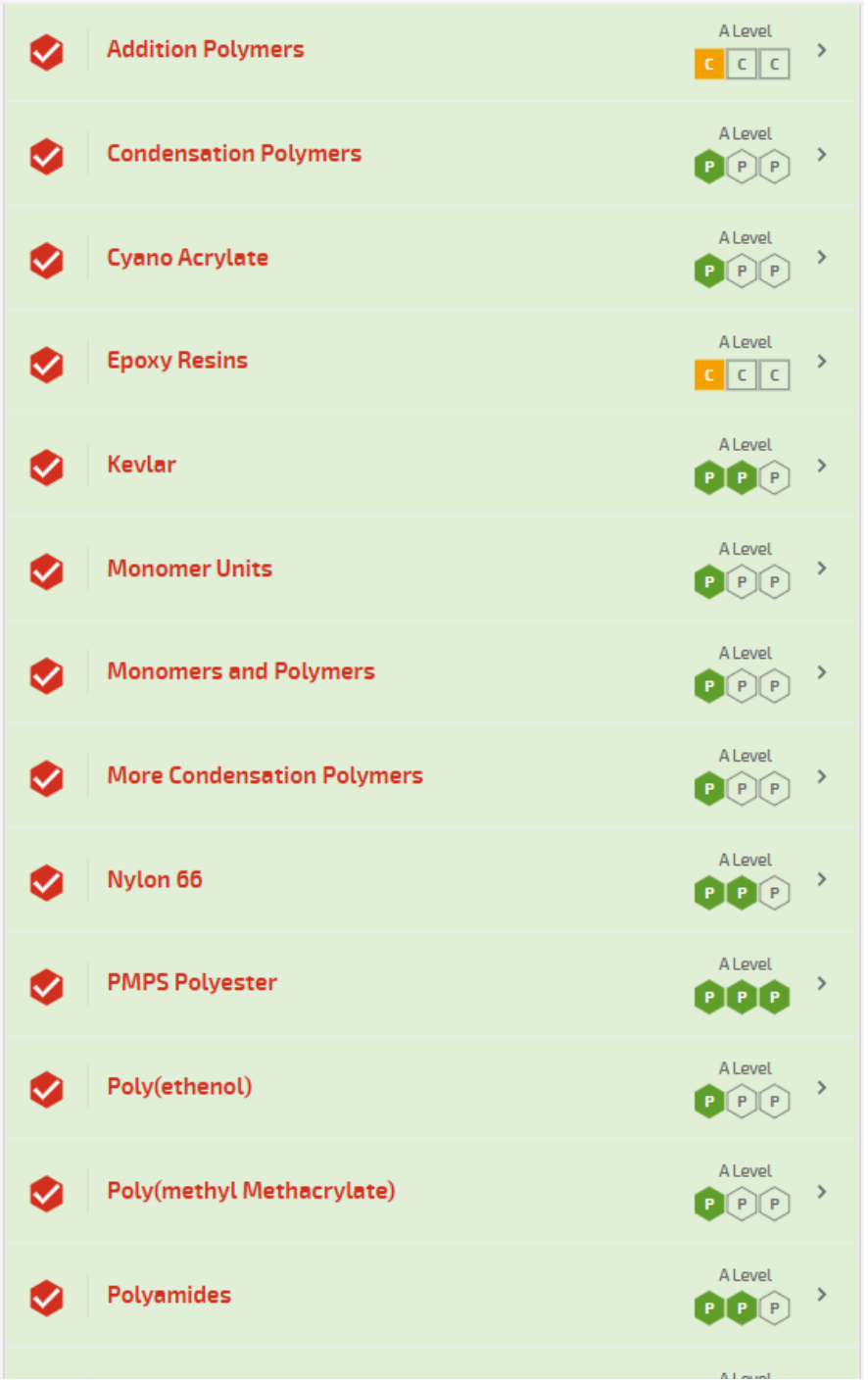


Chemistry content currently mostly A Level as developed for STEM SMART

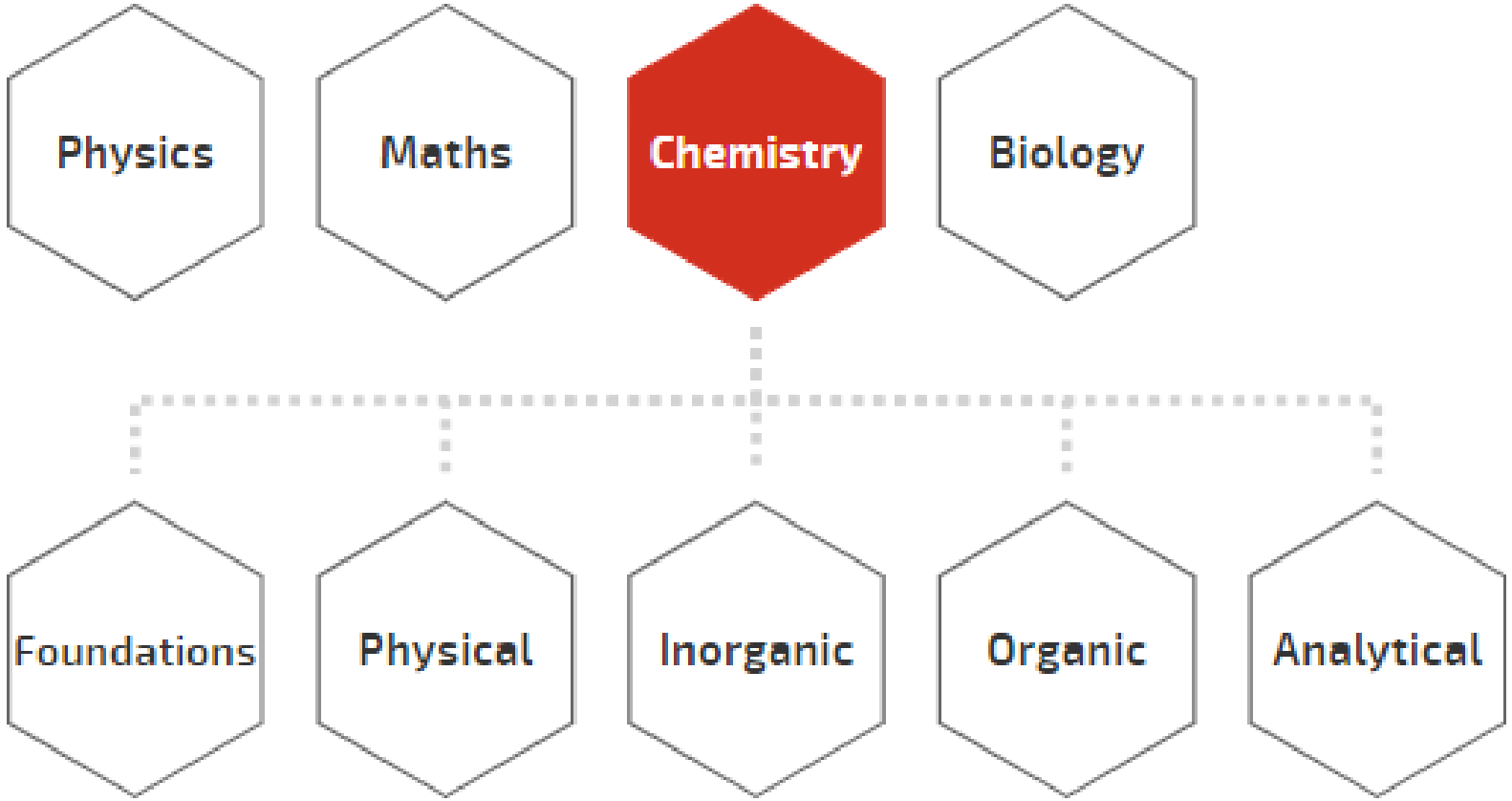
Select a subject, field and topic

Practice: level expected in standard exams, P1 easiest
Challenge: more challenging, may require additional thinking, problem solving, combining of ideas, …





Question Finder



- Numerical Skills
- Atomic Structure
- Stoichiometry
- Gas Laws

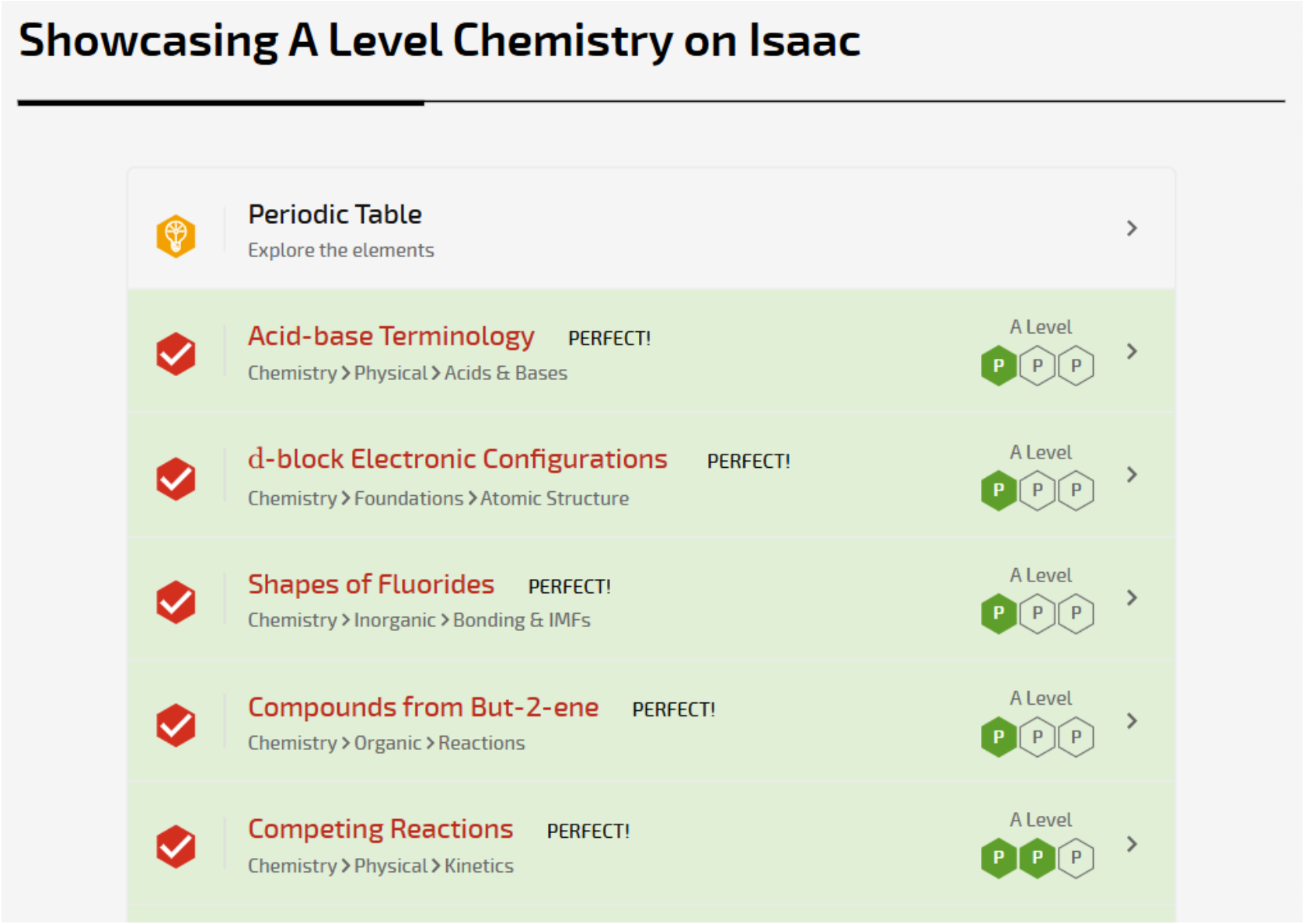
- Kinetics
- Energetics
- Entropy
- Equilibrium
- Acids & Bases
- Electrochemistry

- Periodic Table
- Bonding
- Redox
- Transition Metals

- Func. Groups
- Isomerism
- Reactions
- Aromaticity
- Reactions (aromatics)
- Polymers

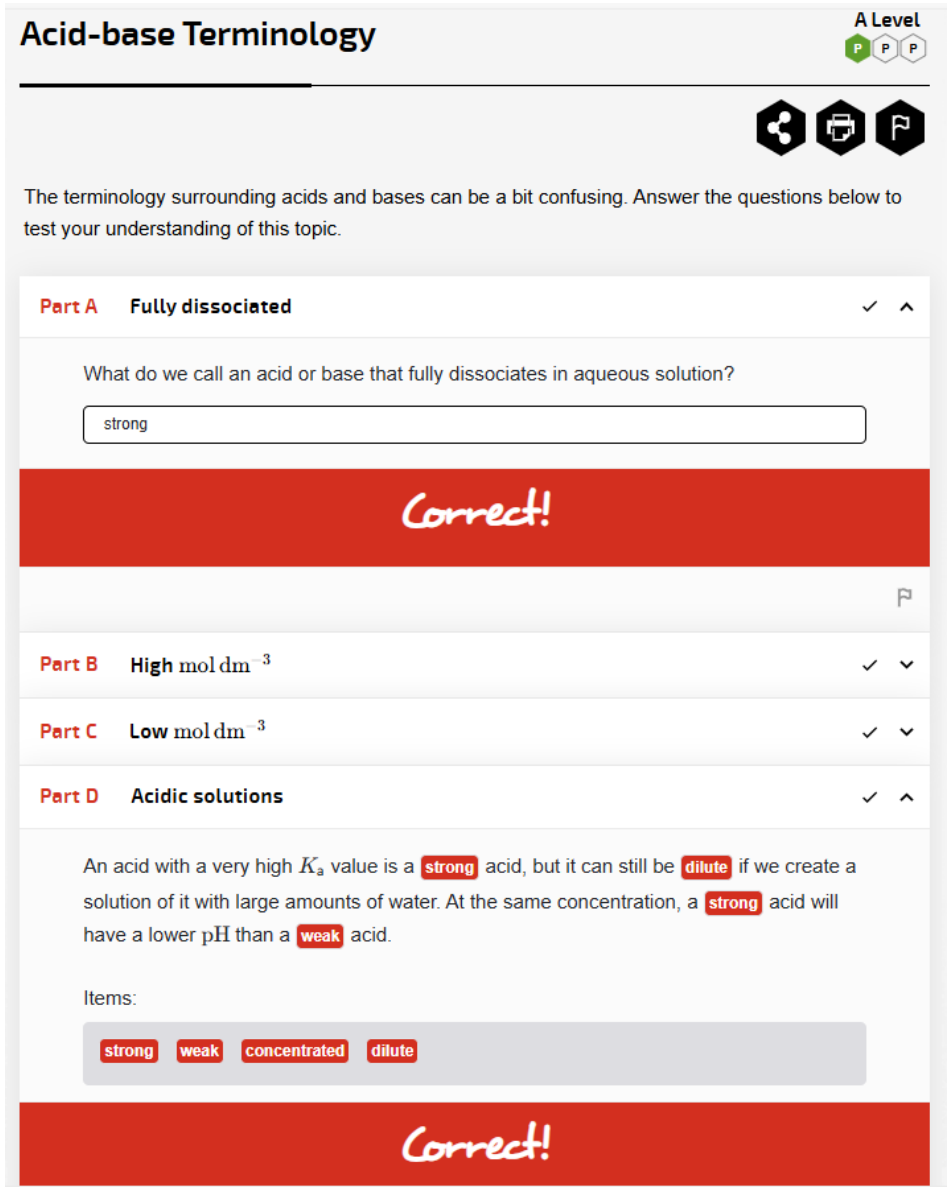
- Chromatography
- Mass spectrometry
- IR spectroscopy
- NMR spectroscopy
- Electronic spectroscopy

Example Chemistry Questions



https://isaacphysics.org/gameboards#isaac_chem_sample

Example Chemistry Questions



Acid-base Terminology

A Level

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?

strong

Correct!

Part B **High** $\mathrm{mol\,dm^{-3}}$

Part C **Low** $\mathrm{mol\,dm^{-3}}$

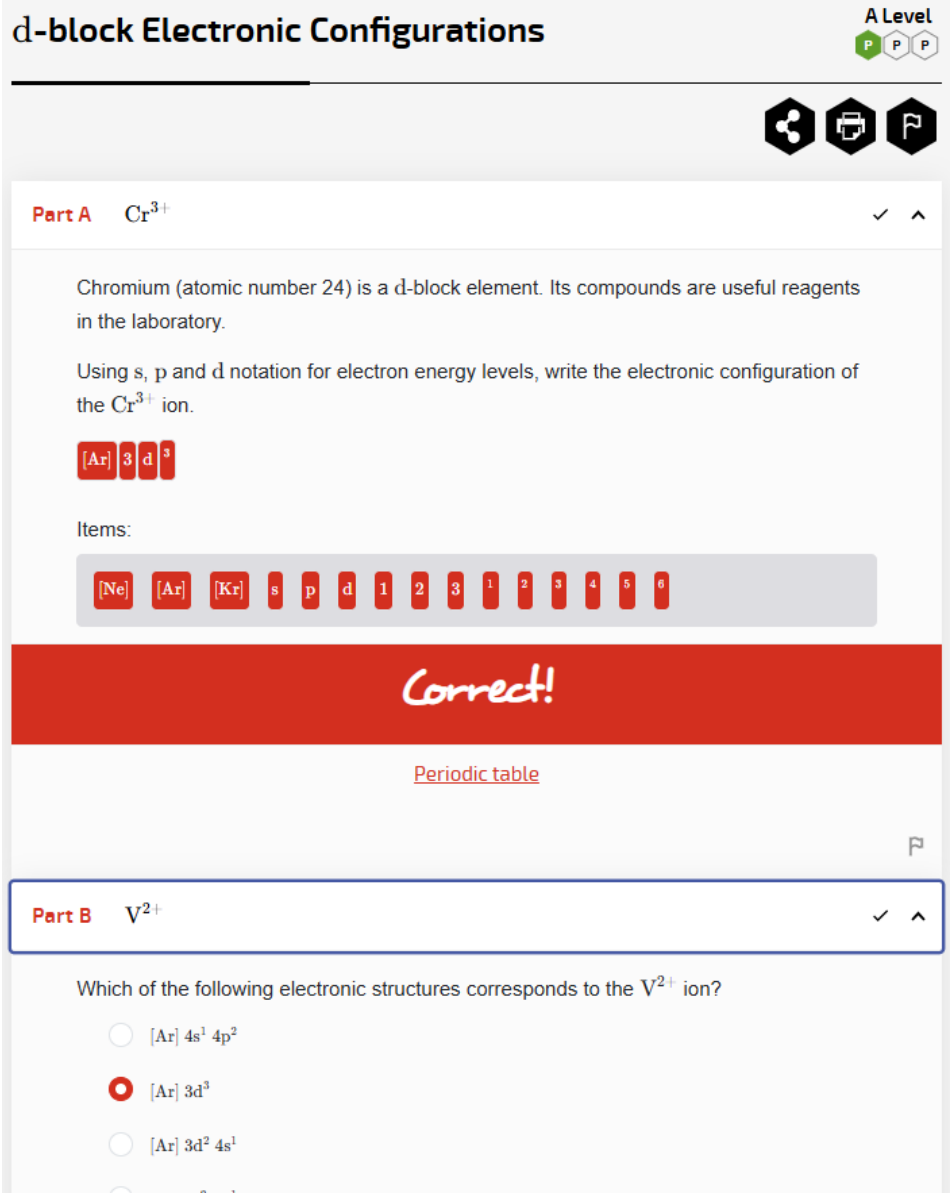
Part D **Acidic solutions**

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

Items:

strong **weak** **concentrated** **dilute**

Correct!



d-block Electronic Configurations

A Level

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.

[Ar] 3 d 3

Items:

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

Correct!

Periodic table

Part B V^{2+}

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

- $[Ar]\ 4s^1\ 4p^2$
- $[Ar]\ 3d^3$
- $[Ar]\ 3d^2\ 4s^1$

https://isaacphysics.org/gameboards#isaac_chem_sample

Example Chemistry Questions

Shapes of Fluorides

A Level

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.

pyramidal

Incorrect

Check my answer

Hint 1

Concepts

Shapes of molecules

Shapes of Molecules

Valence Shell Electron Pair Repulsion theory

All stages

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 **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**.

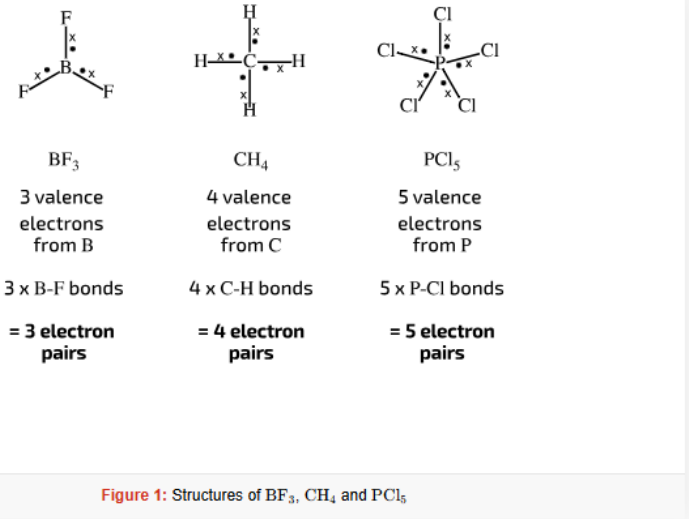


Figure 1: Structures of BF_3, CH_4 and PCl_5

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.

https://isaacphysics.org/gameboards#isaac_chem_sample

Example Chemistry Questions

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

Compounds from But-2-ene

A Level

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.

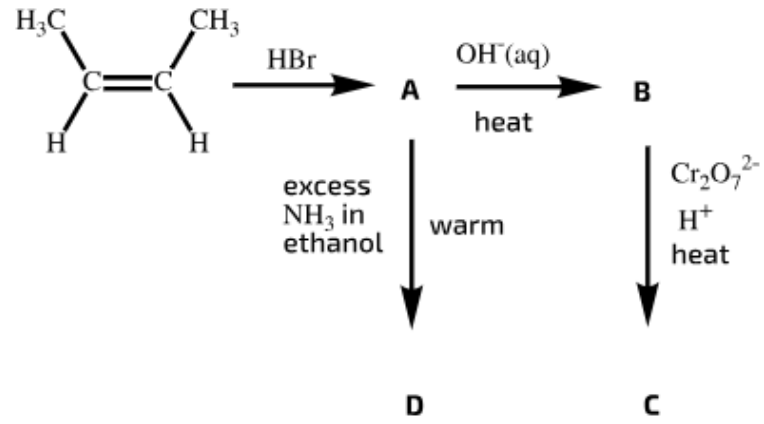
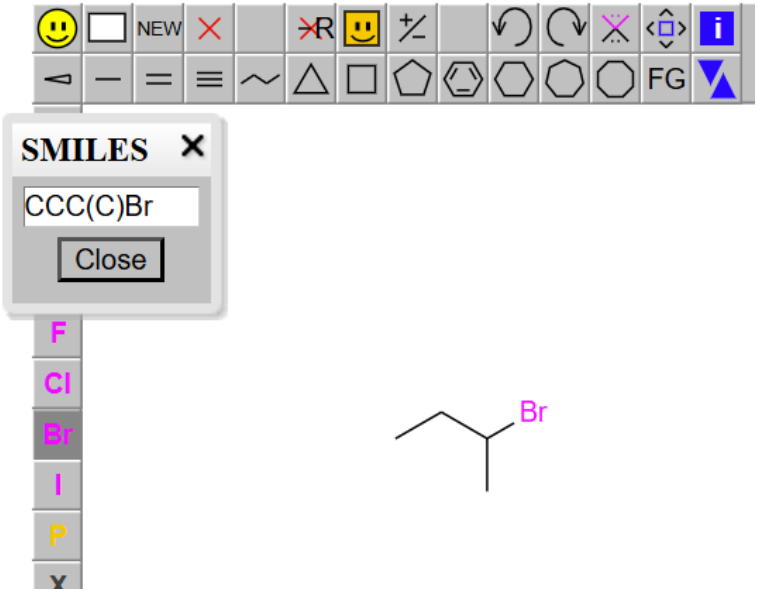
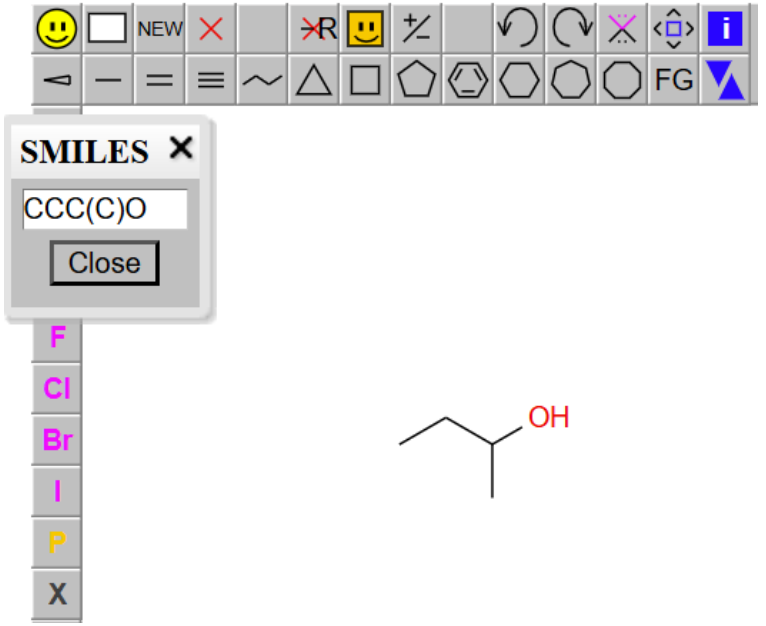


Figure 1: Compounds from but-2-ene

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.

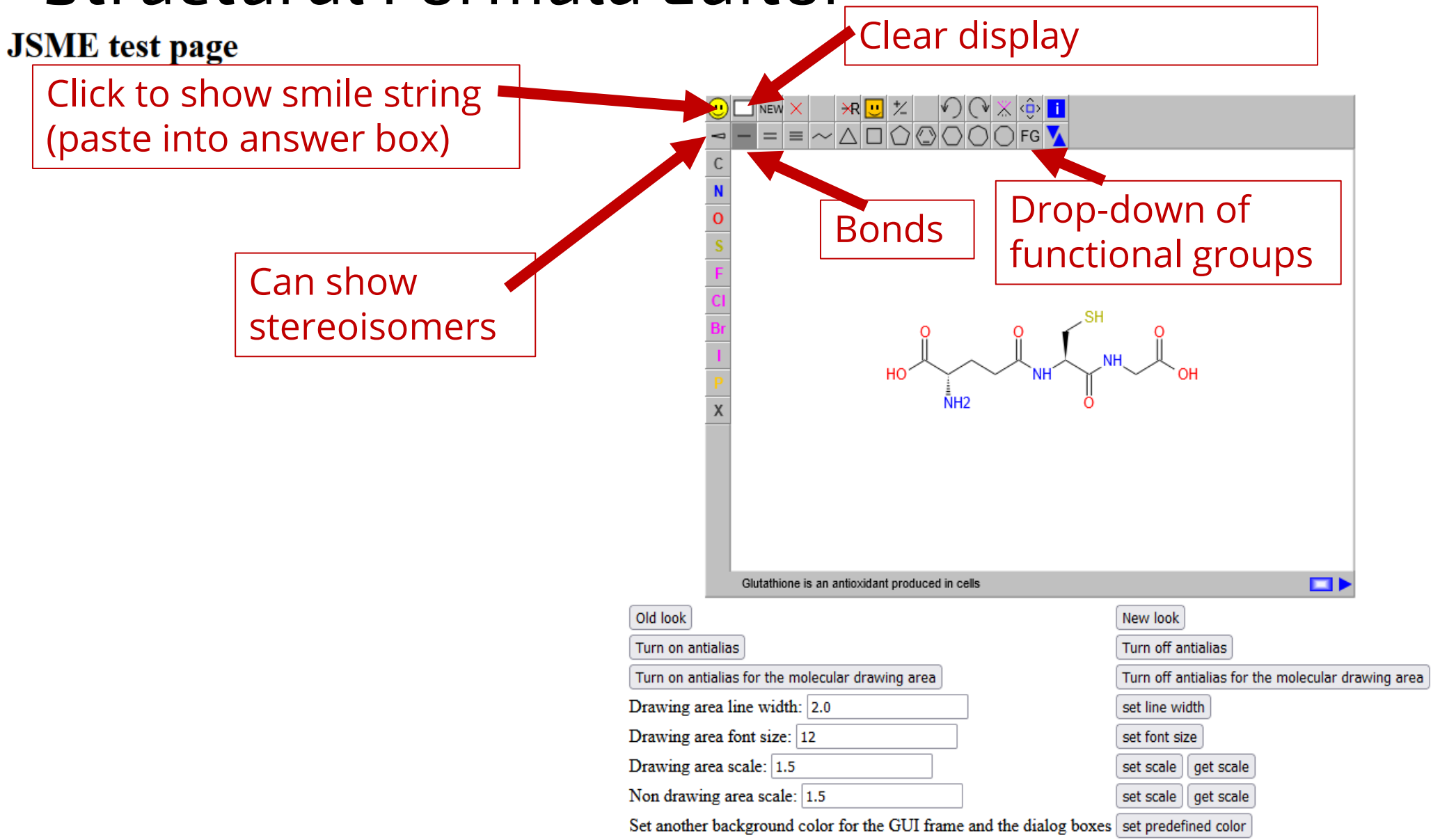
Using the structure editor





https://isaacphysics.org/gameboards#isaac_chem_sample

Structural Formula Editor



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

Example Chemistry Questions

Competing Reactions

A Level

A compound X can produce two possible products, Y and Z, under the same reaction conditions. An energy profile for this reaction can be represented as shown below.

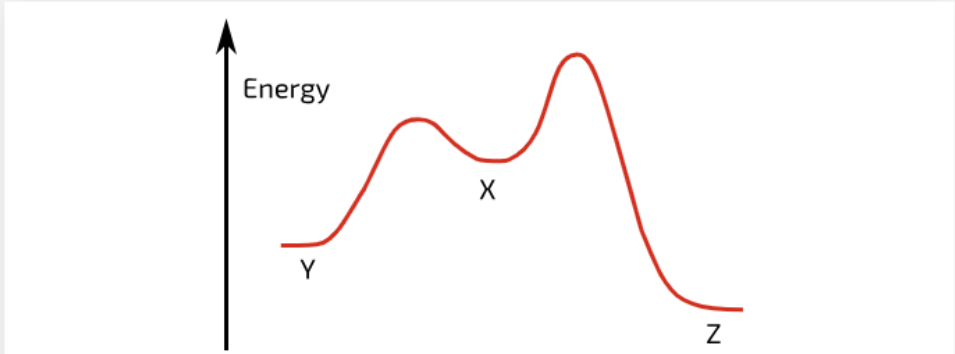


Figure 1: A reaction profile for the reaction described.

Part A Activation energy

The *activation energy* is the [ ] energy required for a reaction to take place. It is given by the difference in energy between the [ ] and the [ ] state. In the set-up above, the reaction producing product Y has a [ ] activation energy than the process producing product Z due to the [ ] state being [ ] in energy for the former.

Items:

minimum | maximum | optimal | starting materials | products | transition | higher | lower

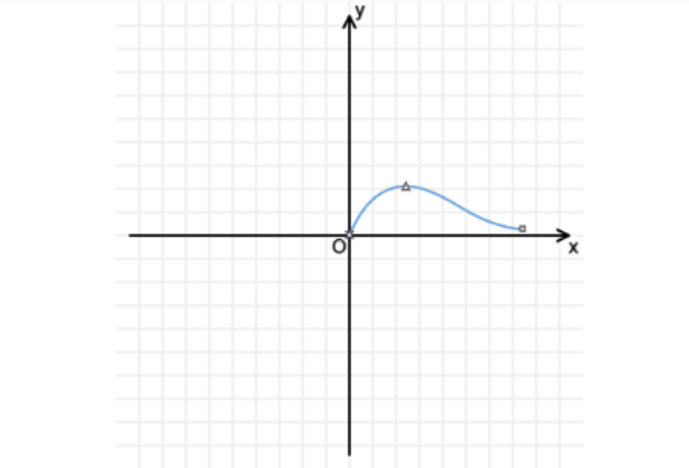
Part B Molecular speed distribution

What do we call the distribution of molecular speeds?

Type your answer here.

Check my answer

What does this distribution look like (assume particle speed is on the x-axis, and number of particles on the y-axis)?



Click on the grid to edit your sketch.

Correct!

Make sure your graph starts at the origin, goes through a maximum and then levels out but doesn't reach 0.
See the concept page on the Maxwell-Boltzmann distribution for some examples.

https://isaacphysics.org/gameboards#isaac_chem_sample

Example Chemistry Questions

Titrating Sulfur Dioxide

A Level

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:

$$SO_2\,(g) + 2\,NaOH\,(aq) \longrightarrow Na_2SO_3\,(aq) + H_2O\,(l)$$

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 C **Unreacted moles**

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

Value ? Unit mol

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

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 %

Check my answer

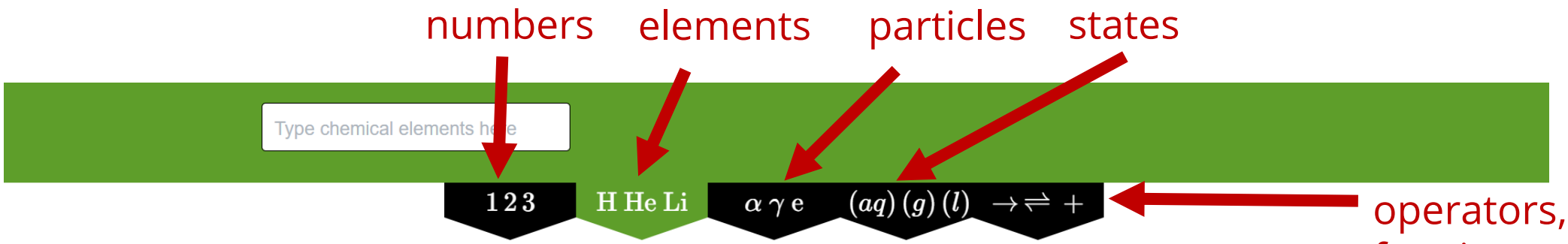
https://isaacphysics.org/gameboards#isaac_chem_sample

Chemistry Equation Editor

https://isaacphysics.org/questions/ch_editor_1
https://isaacphysics.org/questions/ch_editor_2

Help Video

https://youtu.be/zeBHUkVeKPE



$$3\ H_2\ (g) + N_2\ (g) \rightarrow 2\ N\ H_3\ (g)$$

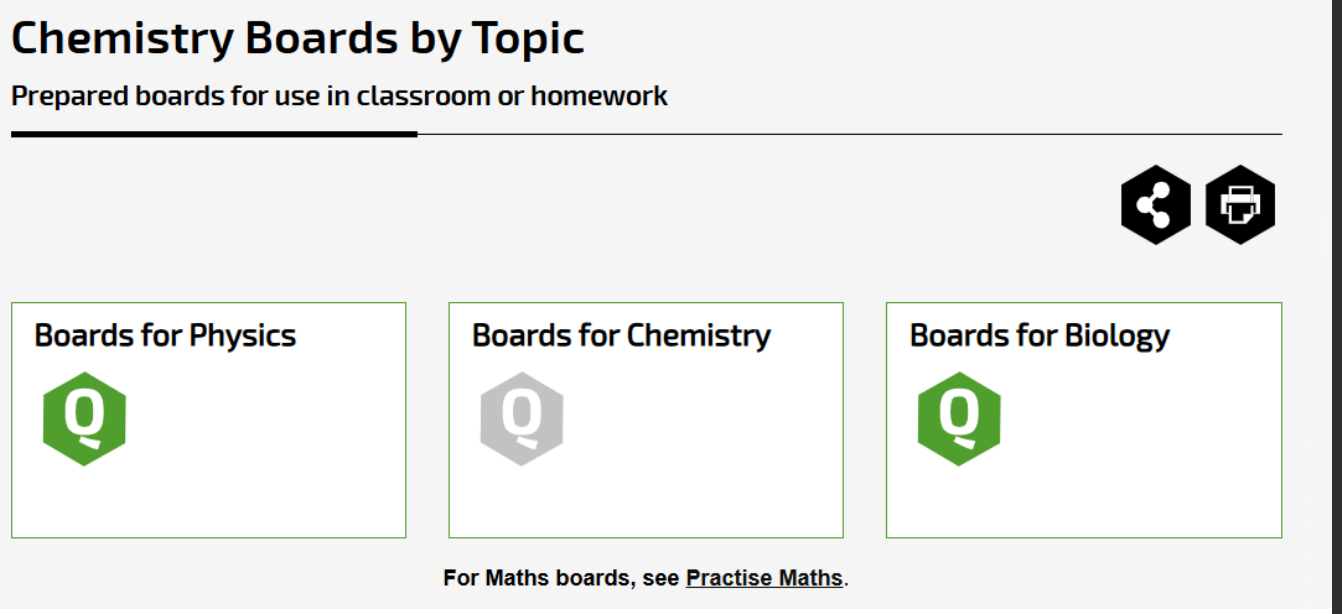
Balance the following equation, and complete it to include state symbols. Use the lowest possible integer coefficients.

HIDE QUESTION

$3H_2(g) + N_2(g) \rightarrow 2NH_3(g)$

Boards by Topic

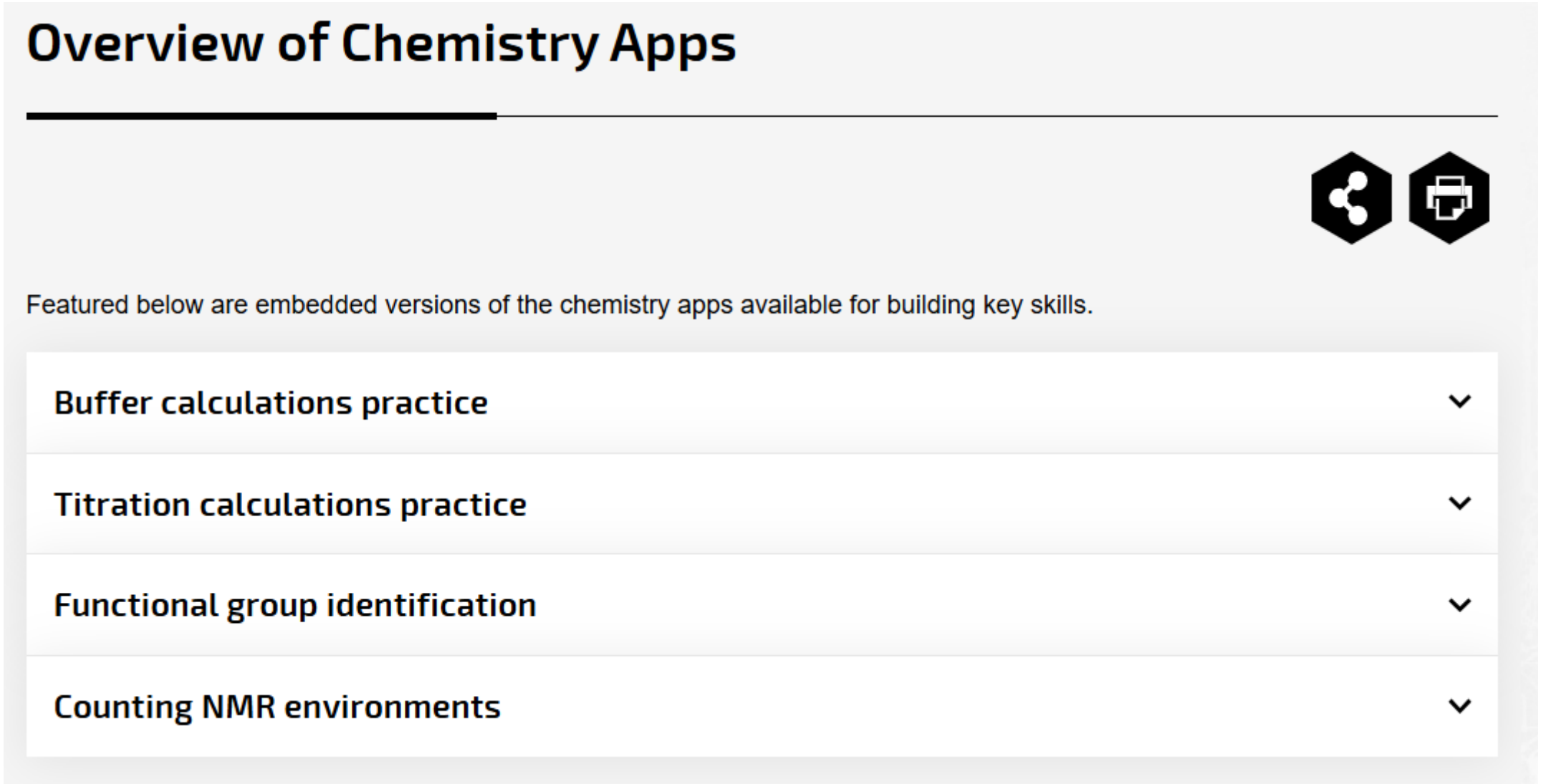
Use this overview of gameboards to directly set work on a particular topic, or see what is available and create and set your own gameboard



Topic	What it contains	Link
Stoichiometry and Inorganic Chemistry		
Atomic Structure	7×P1, 1×P2;	View board
Electron Configurations	7×P1, 1×P2;	View board
Mass Spectrometry	4×P1, 2×P2, 1×C2;	View board

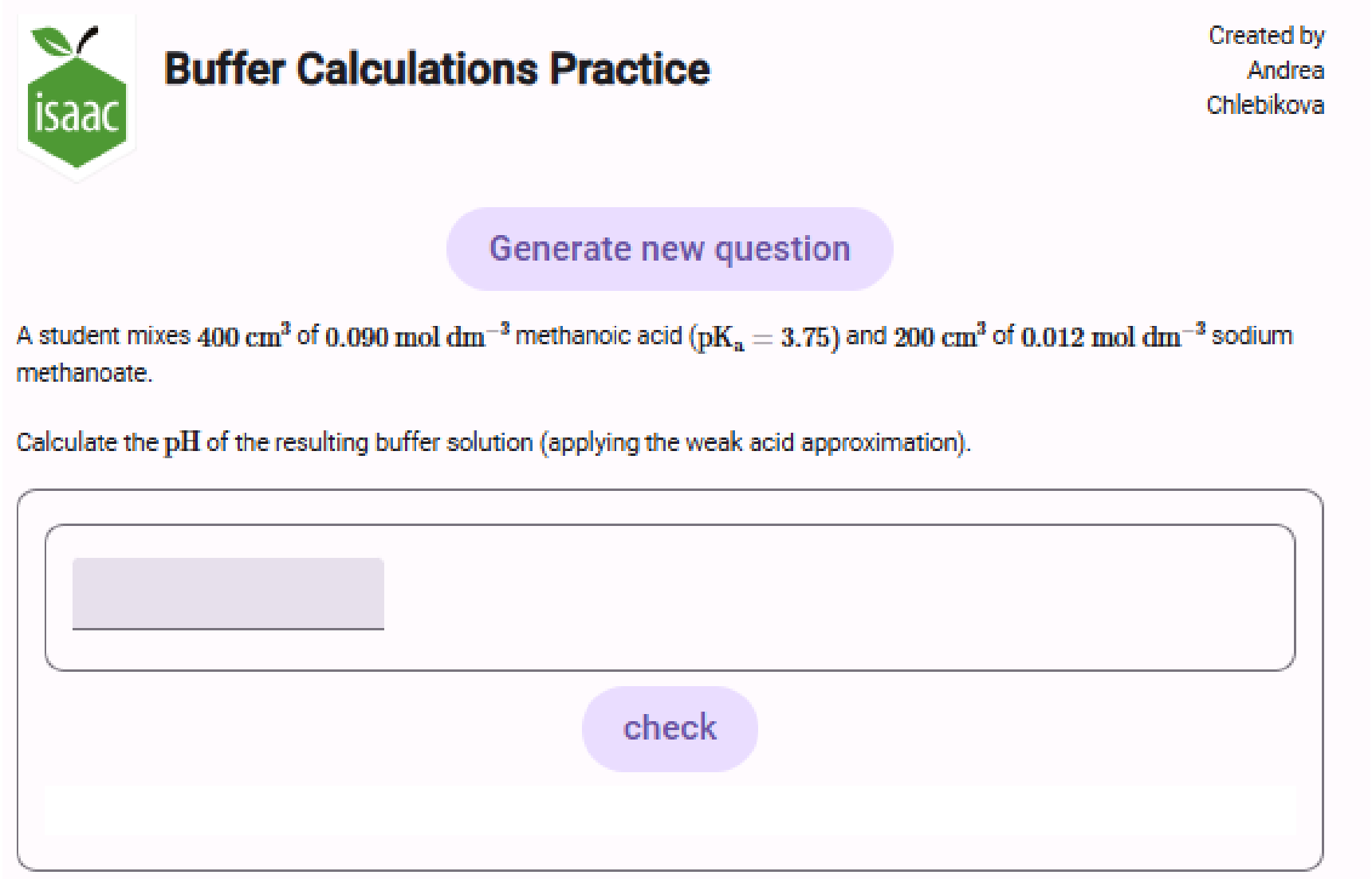
https://isaacphysics.org/pages/boards_by_topic_chem

Applications for Skills Practice



https://isaacphysics.org/pages/chemistry_app_overview

Applications for Skills Practice



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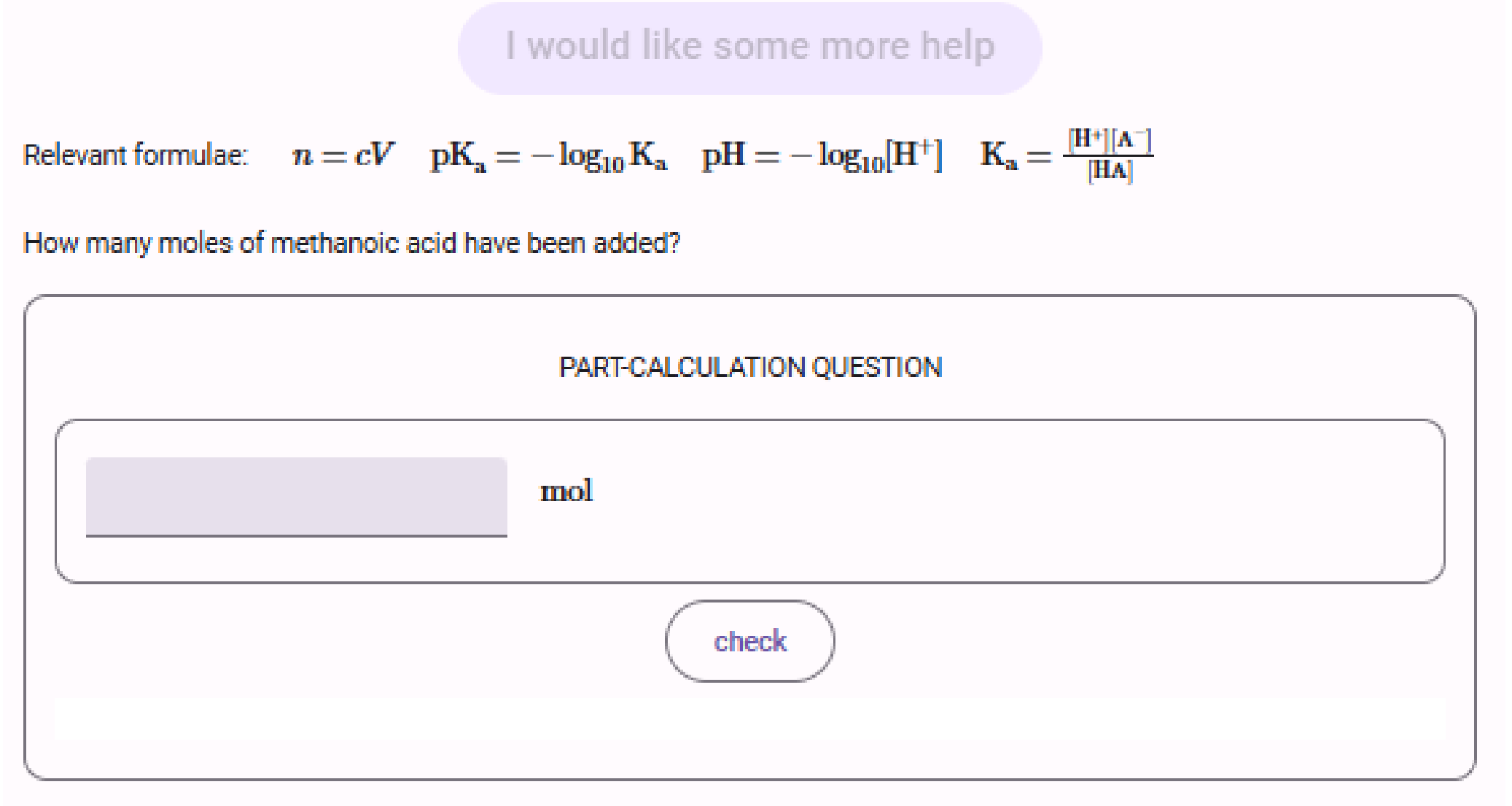
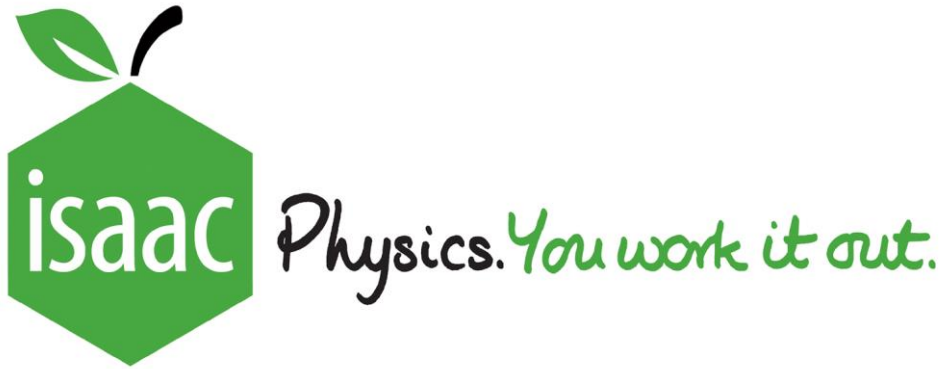


https://isaacphysics.org/pages/chemistry_app_overview

Work in Progress (input very welcome!)

- More practice apps: what areas would be most helpful?
- Practice "tests" for students to identify gaps and practise weaknesses identified similar to current apps
- Syllabus map: what format and what level of granularity?
- Improving hint provision in questions and concept pages
- More questions on platform: KS3, GCSE and University-level
  + Any A Level areas which would benefit from expanding (spectroscopy, specification-dependent topics, …)
- Book compiling organic and inorganic questions
- Tests on Isaac platform: allow setting of questions students cannot see ahead of time; students cannot reattempt tests (unless teacher allows reattempt) and teachers can see what answers students have submitted



Thank you!

andrea.c@isaacphysics.org

ac782@cam.ac.uk