

## IYPT Crystals Battlecards

**Ages 8+**  
**For 2+ players**

To mark the 150th birthday of the periodic table, the United Nations declared 2019 the International Year of the Periodic Table (IYPT). To join the celebrations, the Cambridge Crystallographic Data Centre ([CCDC](#)), the British Crystallographic Association ([BCA](#)), and the National Crystallography Service ([NCS](#)) teamed up and celebrated each element with a crystal structure in its honour. To know more, explore the periodic table of crystals celebrating the IYPT on the CCDC website ([IYPT Crystals](#))!

The IYPT Crystals Battlecards are the latest addition to our celebrations. Have fun battling friends and family with the periodic table in your hands!

### Contents

- Game rules
- 54 IYPT Crystals Battlecards

### Prepare the cards deck

*Before proceeding with the activity, please read the [Health and Safety](#) directions at the end of this handout.*

- Print out the card pages. We recommend at least 30 cards.
- Cut out each card, fold it and stick it, as shown on the card pages.
- Your deck is ready!

### How to play

To set up the game, shuffle the deck and deal the cards equally among the players, so that each of them has a pile of cards face down in front of them.

#### *The round*

1. All players pick the top card off their deck, without showing it to the other players.
2. *Player 1* picks a category (see “*The Card*” on the following page for the list and explanation of the categories), and each player reveals their card and declares their score in the chosen category.
3. The player with the highest score in the chosen category wins all the cards in that round and places them at the bottom of their pile.
4. The winner will then choose the category during the next round.

*In case of a tie:* If two or more players have the same score, the cards are left in the middle and all the players play another round, with the same player selecting the category. The winner will take all the cards in the middle.

#### *End of the game*

Play until one player has no more cards. The player who wins the entire deck is the [IYPT Battlecards Champion](#)!

### Create your own cards

This deck includes elements from hydrogen to xenon, but the periodic table currently counts 118 elements. For this reason, you can find a page of empty cards that you can personalise to include more elements. To find inspiration, you can explore the structures on the IYPT Crystals periodic table or check teaching resources from the CSD-Community on the CCDC website.

## IYPT Crystals Battlecards

### The Card

Unique database identifier of the crystal structure celebrating this element (CSD Refcode for structures in the Cambridge Structural Database (CSD) or ICSD Number for structures in the Inorganic Crystal Structure Database (ICSD))

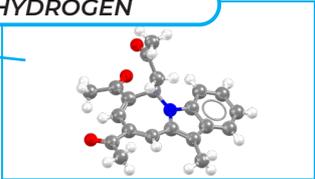
Element name

Visualisation of interesting characteristics of the crystal structure (either one or more molecules included or packing patterns)

Fun fact about the element

#IYPTCrystals CSD Refcode: XOPCAJ

**HYDROGEN**



Element Frequency:	<b>37,628,455</b>
Formula Weight:	<b>335.4</b>
Space Group:	<b>14</b>
Cell Volume:	<b>1,805.96</b>
Publication Year:	<b>2019</b>

*Hydrogen is the lightest element, and a big source of energy*

Scan to learn more and view in 3D



#IYPTCrystals  
Battlecards



Scan the QR code with a smart phone for a 3D view of the crystal structure and for fun facts about the element!

The categories for the battle are features of the element or of the crystal structure

### Categories

#### **Element Frequency: 0 to 37,628,455 times**

The number of times the element is found in crystal structures present in the Cambridge Structural Database (CSD) - a database of over 1 million published crystal structures!

#### **Formula Weight: 78.07 to 6,800.18 g/mol**

The combined molecular weight of all the molecules reported in the formula of the structure.

#### **Space Group: 1 to 230**

All crystal structures belong to one of 230 space groups. These are unique in terms of atoms placement and shape of the unit cell. The unit cell is the smallest unit representing the packing order of a crystal.

#### **Cell Volume: 152.74 to 701,860.31 Å<sup>3</sup>**

The volume of the cell of the crystal structure. It is measured in cubic angstroms. An angstrom is one ten-billionth of a metre, which means one ten-millionth of a millimeter!

#### **Publication Year: 1926 to 2020**

The year in which the crystallographers published the crystal structure in a scientific journal. The publication contains information on the experiments performed to obtain the crystals and on the crystal structure itself. When crystallographers deposit the structure into the CSD, they are required to include the structure's details, some of which are the Battlecards categories!

The images present on the cards were realised using Mercury. A free version of this software is available to download from the [CSD Community webpage](https://www.ccdc.cam.ac.uk/mercury).

## IYPT Crystals Battlecards

### The Battlecards Team

The IYPT Crystals Battlecards are part of the IYPT through Crystals project, launched by CCDC, BCA, and NCS in 2019. This is a community led project involving volunteer contributors throughout the crystallographic community. You can meet them on the [CCDC website](#).

Each contributor took charge of one or more elements, picking fun facts and crystal structures. But how can one choose one single structure to celebrate each element when the CSD alone contains more than one million structures? There is not a right or unique answer, and each volunteer put their personal view and background in their selection. Some structures include molecules of the everyday life (e.g., vitamin B12), some are milestones for the CSD (the one millionth structure is on a card!), some relates to growing fields (e.g., metal-organic frameworks), some are the first of their kind or present some unique characteristics (e.g., only one structure in the CSD contains helium), and the list could go on!

As you play with the IYPT Crystal Battlecards, you will find that each card is a window onto the periodic table and the crystallographic world.

### Have fun playing with the IYPT Crystals Battlecards!

We hope you enjoy this game and have fun learning about elements and structures. We would love to hear from you and see the cards in actions. If you want, share your tips with other players: which is the strongest card in the deck? Which category would you pick for each card? Let us know on our social media, using the hashtag [#IYPTCrystals](#) and tagging us on Twitter [@ccdc\\_cambridge](#) [@UK\\_NCS](#) and Facebook [@ccdc.cambridge](#) and [@britishcrystallography](#).

### Health and Safety

The creation of the deck of cards should be carried out under the supervision of an adult and it is done at your own risk. Health and safety risks include potential cuts from scissors or papers (including during the game), and irritation from contact of glue with eyes, skin, hair or ingestion. Any access to the internet form minors should be done under adult supervision.