

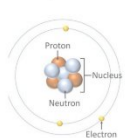
## Online Volunteer Tutoring

### KS5 Chemistry in Westminster

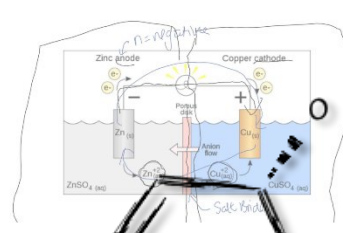
Shape	Bonds and lone pairs
Trigonal planar	Three bonds and no lone pairs
Organic examples	Aldehydes, ketones, alkenes
Inorganic examples	BF <sub>3</sub> , BCl <sub>3</sub>
Tetrahedral	Four bonds, no lone pairs
Examples	Carbon, water, CO <sub>2</sub>
Pyramidal	Three bonds with one lone pair
Examples	Ammonia
Bent	Two bonds with two lone pairs
Example	Water, C-O-H groups
Linear chemicals	Two covalent bonds, no lone pairs
Examples	Carbon dioxide
Octahedral examples	Sulphur hexafluoride (SF <sub>6</sub> )

Probably the big surprise here is what doesn't matter: the type of bond. Three bonds, no lone pairs is 120° whether or not they're double bonds.

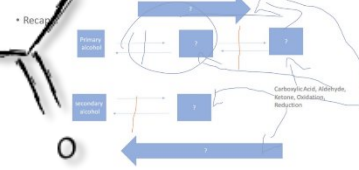
#### Recap: Structure of an atom



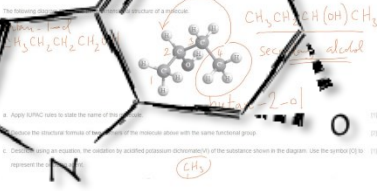
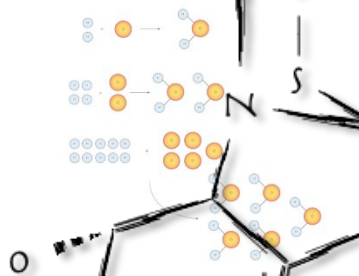
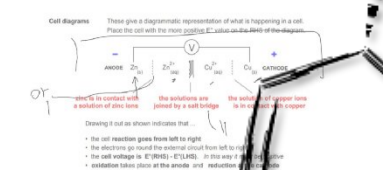
Particle	Location	Mass	Charge
Proton	Nucleus	1	+1
Neutron	Nucleus	1	0
Electron	Orbitals	0	-1



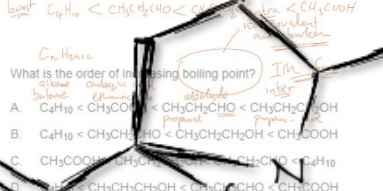
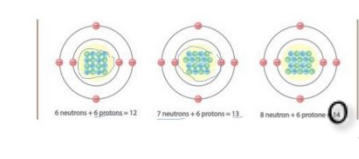
#### Start with Organic



#### Representing Cells



#### Recap: Isotopes



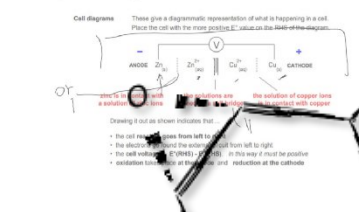
British Spring Water

Plant based protein/amino acids

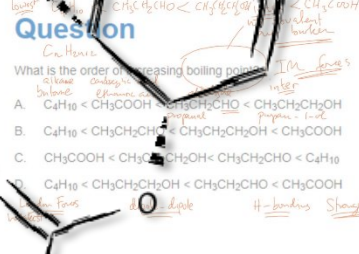
No added sugar

• No amino acid  
• Contains?  
• Super hot in O  
• Really taste  
• Really visible in water (tastes only good - kind of 38 parts in 100)

#### Representing Cells



Shape	Bonds and lone pairs
Trigonal planar	Three bonds and no lone pairs
Organic examples	Aldehydes, ketones, alkenes
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#### How can we pull Ea and A values from the equation?

Values of A and Ea are obtained from the Arrhenius equation by the relationship

$$\ln k = \ln A - \frac{E_a}{RT} + \ln A$$

ln is a logarithmic term (log, NOT log base 10, can be obtained from a calculator)

$$y = mx + c$$

Table with columns for Ea and A values.

Reaction	Ea (kJ mol <sup>-1</sup> )	A (s <sup>-1</sup> )
1	...	...
2	...	...
3	...	...

***“My tutor has brought back my interest in Chemistry and has in fact made me like it more than I thought I would. She has increased my confidence, and both taught and helped me with many aspects of Chemistry, Biology and other matters related to university.”***

*Year 13 Student*

***“Students' education and understanding of the subject improved as a direct result of the tutoring provided by Tutorfair. The students who took part would never have received such an opportunity if Tutorfair did not offer it.”***

*Westminster Academy*

***“The help and support that Tutorfair has provided to our students has been immense and the students and I are grateful for this opportunity.”***

*Westminster City School*

**2020 - 2021**

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## Executive Summary

Tutorfair Foundation is an education charity on a mission to make tutoring fair by widening access for young people from less advantaged backgrounds. Since 2012, we have worked to connect a growing community of volunteer tutors with students in London and across the UK who need their support.

This project, conceived in the summer of 2020, was undertaken to support young people through academic year 2020-21 against the changing background of the COVID-19 pandemic. Existing methods of delivery (including school visits and events) were no longer feasible, and a fully online delivery model was needed to provide longer-term engagement through a period of unprecedented difficulty in education.


Since November 19<sup>th</sup> 2020, 15 tutors have delivered 331 hours of KS5 Chemistry tutoring to 29 students attending 3 schools in The City of Westminster – Pimlico Academy, Westminster City School and Westminster Academy. This was made possible by Evince Asset Management, who were eager to support young people in their local area and generously funded our work from August 2020. Later, the programme attracted further support from Westminster Foundation and The Royal Society of Chemistry.

The opportunity to access tutoring was welcomed by students from all three schools and the programme's initial 30 placements were at one stage oversubscribed. However, school closures in January 2021 and the subsequent cancellation of 2021's A-Level and IB examinations cooled interest from many students, with exam technique and preparation being a substantial area of concern amongst young people studying at that level.

This extended the timeline of the programme (which was initially planned to finish in March) by approximately 6 weeks and led to the inclusion of a small number of Year 12 students alongside their Year 13 peers. The project was formally concluded on 30<sup>th</sup> April, although a small number of weekly sessions will through May and into June.

The tutoring has been extremely well received by students, schools and tutors alike, with students reporting a high level of enjoyment of and benefit from the lessons. All participating schools have indicated that they would like to be involved again if the project is repeated in the academic year 2021-22.

Joss Serrailier  
**Foundation Director**

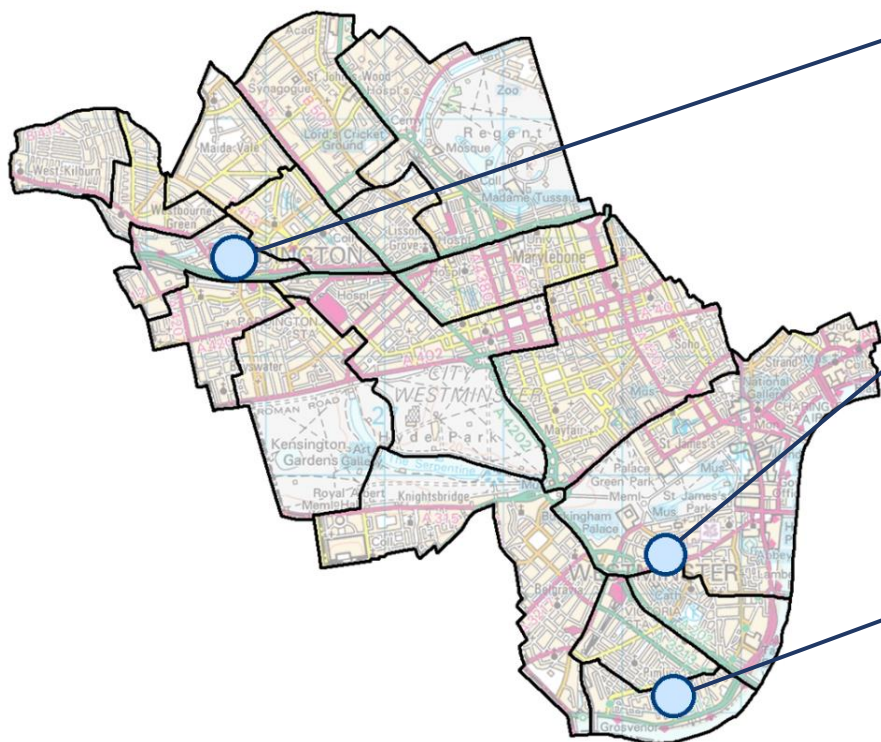


## Wider Impact

The impact of this programme has already extended beyond the schools and students that took part. Tutorfair Foundation is now a member of Westminster's Young People's Foundation and is currently exploring opportunities to support their network of Youth Hubs and other community-facing organisations.

Connections with participating schools have also led to designs for a new project based in the borough which aims to empower young voices and engage young volunteers who are driven to support their local area.

## Overview of Participating Schools



**Westminster Academy W2 5EZ**

55% low-income students  
 1.92x national average  
 3 participants

**Westminster City School SW1E 5HJ**

39% low-income students  
 1.36x national average  
 14 participants

**Pimlico Academy SW1V 3AT**

57% low-income students  
 2.00x national average  
 12 participants

## Existing Relationships

Students from Westminster Academy and Westminster City School have been attending our annual *Chemistry Day* at UCL since 2015. This programme was due to take place again in early 2020 but was cancelled due to COVID-19 restrictions.

In previous years, Pimlico Academy has been a partner of our *Schools Programme* which involves volunteers regularly visiting their site to provide free tuition to Pupil Premium students.

Westminster Academy and Westminster City schools were involved in the early stages of this project, with Pimlico Academy joining after funding was confirmed.



## Overview of Participating Students

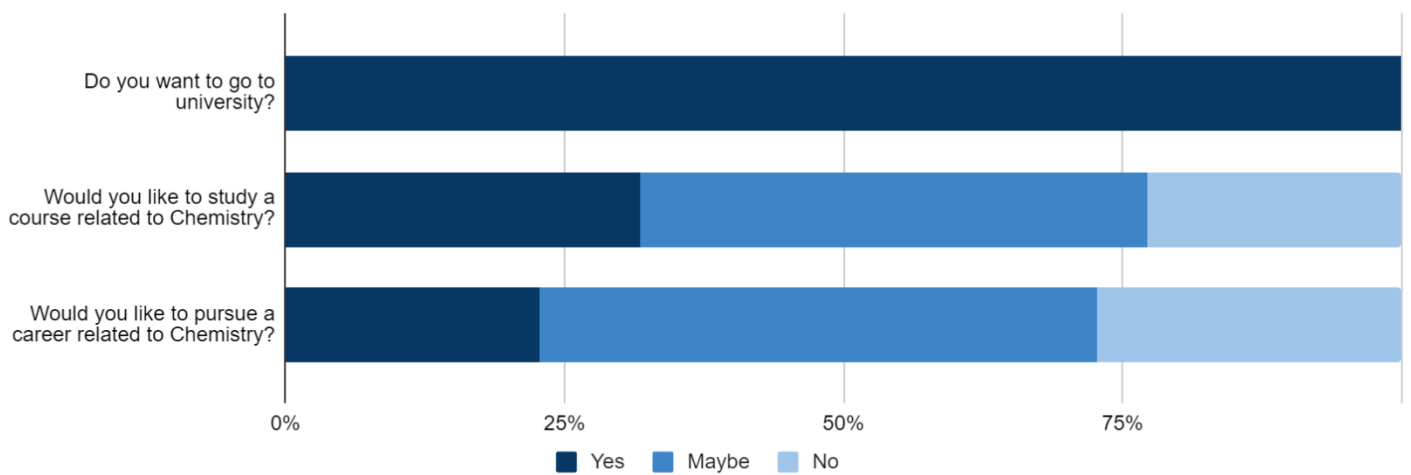
29 students took part in the programme, receiving weekly one-to-one tutoring between November 2020 and April 2021. All students currently attend one of the three participating schools and were selected either because:

- they were eligible for the Pupil Premium Grant at the age of 16; or
- their academic progress was disproportionately affected by COVID-19 school closures

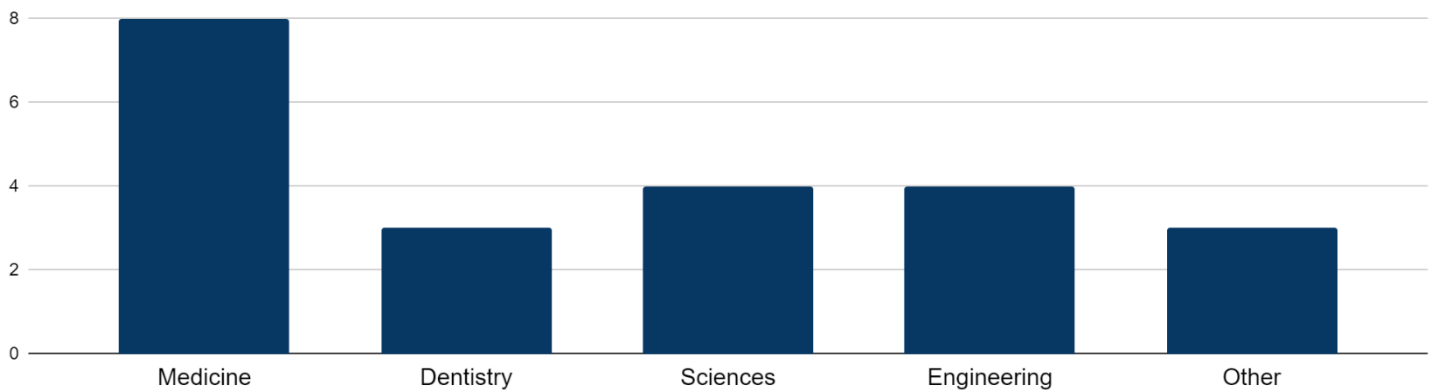
Students completed an introductory questionnaire including questions about their attitudes to learning, their access to tutoring and their ambitions for Higher Education and careers.



## Higher Education and Careers



### What career are you hoping to pursue?



## Attitudes to Learning

Students were asked to rate their confidence about learning Chemistry out of 5 and then to compare this score to their 'baseline' confidence in other subjects. They were also asked to rate their enjoyment of Chemistry and to rank it against their other subjects in terms of preference.

Consistently, participants reported that they were marginally less confident about learning Chemistry than they were about learning their other subjects.

Notably, most students rated their enjoyment of the subject higher than or equal to their confidence in it, with an average 'enjoyment' score of 3.5 out of 5. Most students (85%) ranked Chemistry as 'somewhere in between' their favourite and least favourite subjects.

Average Confidence in Chemistry

**3.13 / 5**

Average Confidence in Other Subjects

**3.94 / 5**

Average Enjoyment of Chemistry

**3.50 / 5**

*Chemistry can be confusing and difficult when you don't understand the concepts. Then you can't understand the questions and then the calculations associated with them.*

Student

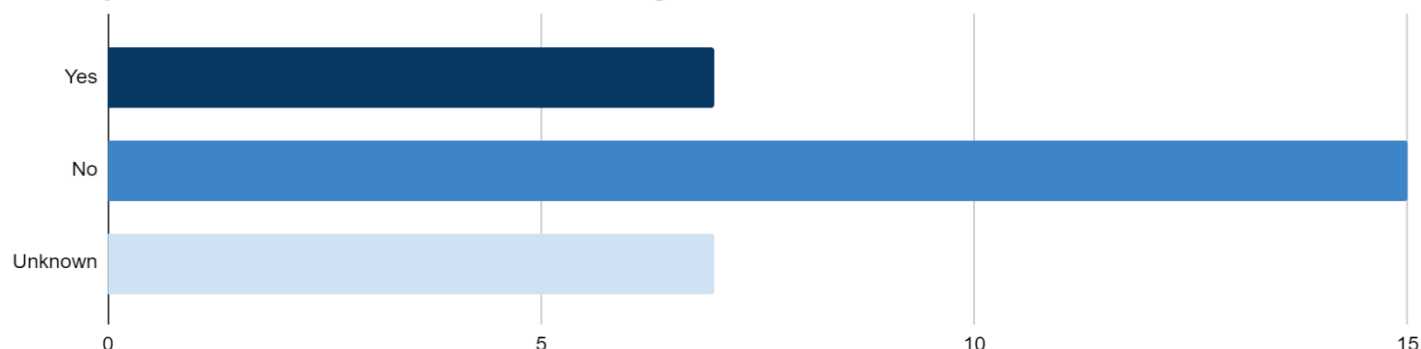
*Exams and tests are the worst part of Chemistry because they don't show our full understanding. Tests make us come across as dumb when we just need a bit more help with exam questions.*

Student

## Previous Access to Tutoring

Only 7 of the 29 participating students told us that they had received some form of one-to-one tuition in the past. This is comparable to the national average (approximately 25%) but significantly lower than the average for young people in London (approximately 40%). 5 of the students who answered 'no' did say that they had received help from a friend or family member. 7 participants did not provide an answer to this question.

Have you ever received one-to-one tutoring before?



## Overview of Participating Tutors

15 tutors took part in the programme, all of whom had significant tutoring experience before starting with us. Several of the tutors were full-time tutors and/or teachers and all had studied Chemistry or a related subject to at least undergraduate level.

12 of the 15 tutors had not volunteered with Tutorfair Foundation before and all but 2 volunteers have signed up to participate in future projects with us.

We had planned to need 20 volunteers to deliver 10 hours' tutoring each for 30 students. However, many volunteers far exceeded the minimum commitment required of them – with two tutors engaging as many as 4 students (40+ hours) through the programme.

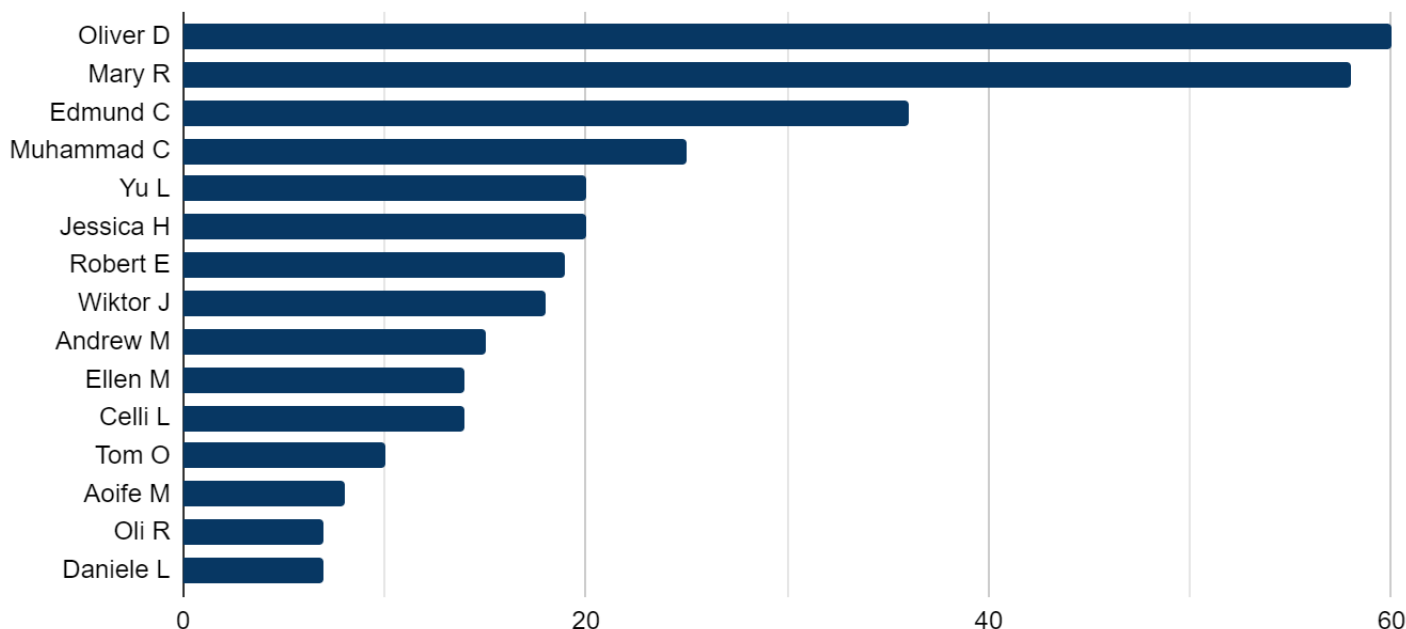


## Volunteering Hours

Tutors who register to volunteer with Tutorfair Foundation are asked to commit to a minimum of 10 hours' teaching through their placement. This is not always achievable - a volunteers' circumstances might change, they might join a programme part-way through or their student may not match their commitment. However, as is evident below, the vast majority of tutors exceed the minimum number of hours they have committed to.

Through this project, tutors volunteered an average of 22 hours' teaching and there were 0 tutor absences. Only 1 volunteer left the programme prematurely due to a change in personal circumstances and 2 volunteers began tutoring within 10 weeks of the programme's conclusion, so did not pass the 10 hour mark.

## Number of Hours Volunteered Per Tutor





## Objectives and Outcomes

The objectives of this programme were:

- To offer one-to-one tutoring as a resource to 3 schools in The City of Westminster
- To engage 30 students with weekly one-to-one tutoring
- To provide 300 hours of one-to-one teaching (an average of 10 hours per student)
- To engage 20 volunteers including providing training and references

Objective	Target	Outcome	Performance
Number of Westminster schools engaged	3	3	100%
Number of students who received weekly one-to-one tutoring	30	29	97%
Number of hours' one-to-one tutoring provided	300	331	110%
Average number of hours' tutoring per student	10	11.4	114%
Number of volunteer tutors trained and placed	20	15	75%

Although targets were generally met or exceeded, the distribution of the delivery was not as even as we had planned for. The average number of hours delivered per student is skewed by several students who engaged extremely well with the tutoring in November and continued through to April. Several students 'bounced' out of the programme after a small number of hours due to poor attendance or (in several cases) their exams being cancelled.

In future projects, we would like to see the distribution of 'hours per student' be more consistent across the programme. We believe that this will be easier to achieve in years when schools are not closed, or exams cancelled unexpectedly.

## Breakdown of Delivery by School Partner

The delivery also varied across our three partner schools, with different levels of take-up and attendance occurring. There are myriad reasons for these differences, including how students were selected for the programme, how well they engaged with their tutor and how much time school staff had available for organising and supporting delivery.

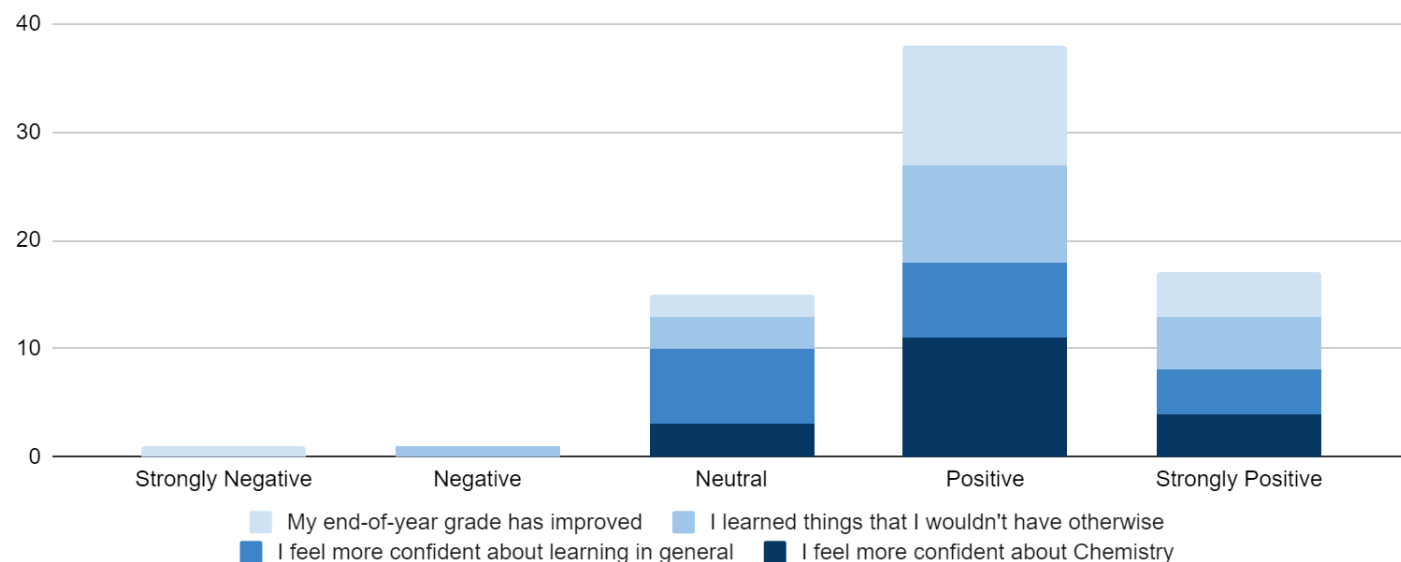
At 83%, student attendance was lower than we expect to see, with attendance closer to 90% reasonably common across our other programmes. However, this figure is skewed due to the length of the programme as well as a small number of students whose attendance was poor across transitions into and out of the school closures in Spring Term.

Objective	Students	Tutors	Hours	Hours per Student	Attendance
Westminster City School	14	12	127	9	85%
Pimlico Academy	12	5	156	13	85%
Westminster Academy	3	4	48	16	80%
<b>Total</b>	<b>29</b>	<b>15</b>	<b>331</b>	<b>11.4</b>	<b>83%</b>

## Student Likert Scale Survey

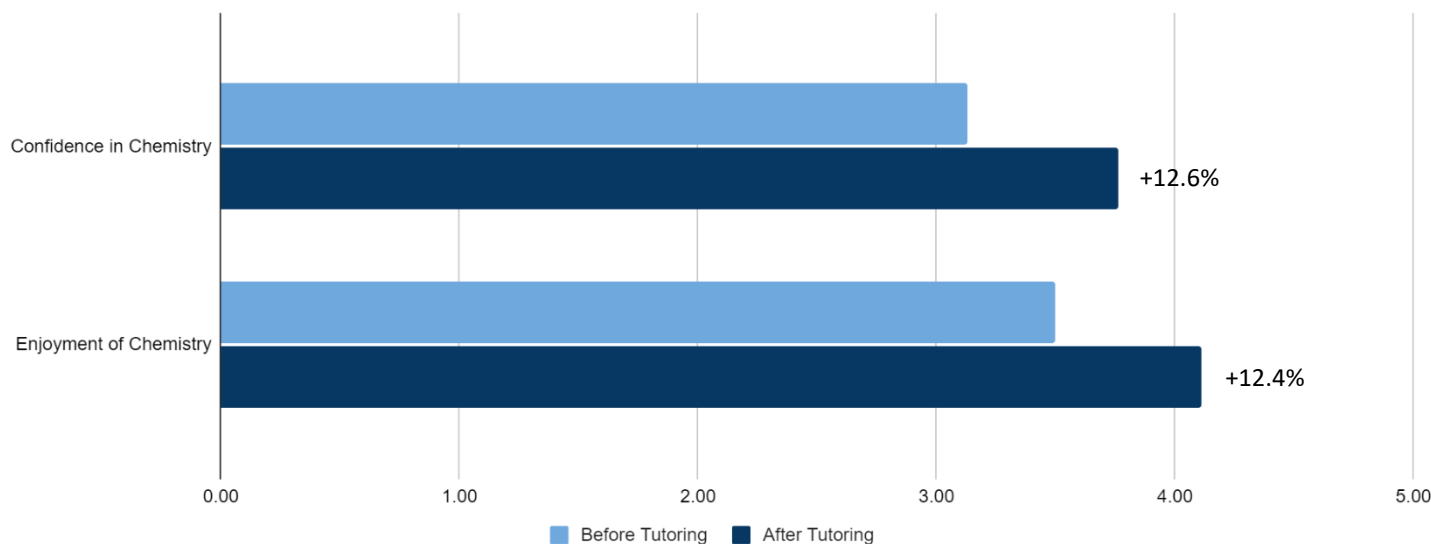
At the conclusion of the programme, students were invited to complete a post-tutoring questionnaire. This included selecting an option from 'strongly disagree' to 'strongly agree' in response to a series of statements about their tutoring. Their responses have been summarised below.

76% of all responses were positive - i.e. to 'agree' or 'strongly agree' with a positive statement. 21% of responses were neutral. The remaining 3% consists of one negative and one strongly negative response – both provided by the same student who was the last to join the programme and had suffered significant technical difficulties in early sessions.



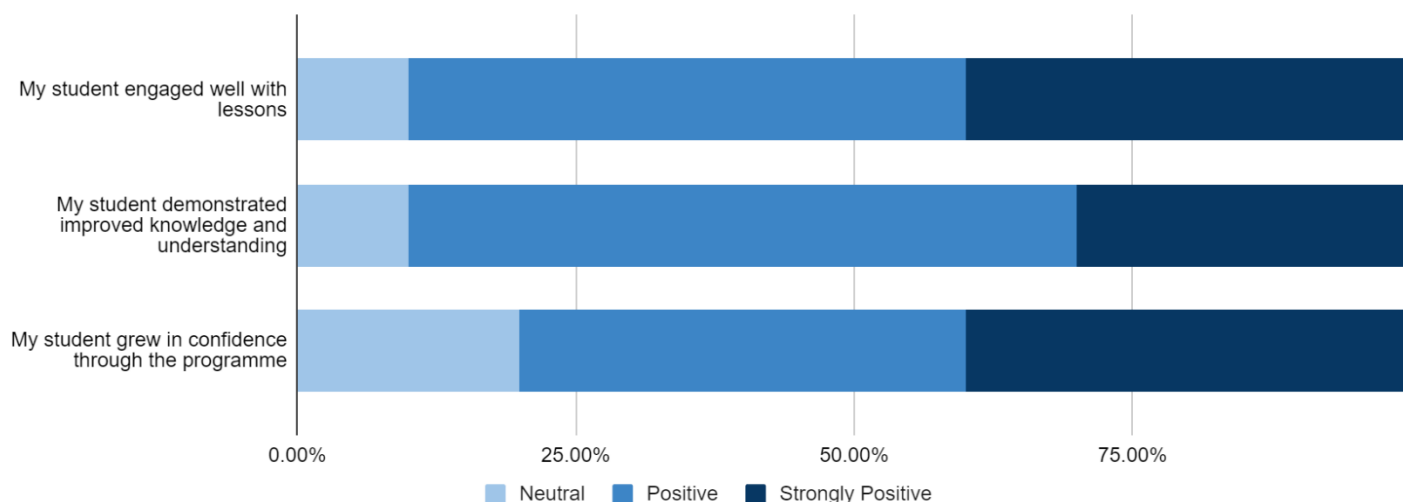
## Confidence and Enjoyment Versus Baseline

Without reference to the responses provided in their introductory survey, students were again asked to rate their enjoyment of Chemistry, their confidence in Chemistry and their confidence in their other subjects out of 5. Their responses show a clear increase in reported enjoyment of and confidence in the subject following the tutoring.



## Tutor Likert Scale Survey

Tutors also completed a Likert Scale Survey, selecting responses to statements about the tutoring from a multiple-choice scale between ‘strongly disagree’ and ‘strongly agree’. Tutors were asked about their students’ engagement, subject understanding and confidence. 87% provided positive responses (i.e. to ‘agree’ or ‘strongly agree’ with a positive statement) and the remaining 13% were neutral responses.



## Student Voices

Students were asked to describe in their own words the impact they had experienced. Only one respondent stated that the tutoring had had no impact on them – the same student that returned negative responses in the Likert Scale Survey. Most students identified that either their confidence, their grade or their exam technique had improved. Some student responses are shared below.

*Tutoring helped me with exam techniques and answering exam questions for other subjects too. It really helped to deepen my understanding of Chemistry.*

**Student**

*A good impact, it has helped me with my weakest topics.*

**Student**

*It has boosted my grade.*

**Student**

*A great, positive impact. It’s allowed me to enjoy studying and learning Chemistry.*

**Student**

*It has improved my grades greatly.*

**Student**

## Overall Experience

Both students and tutors were invited to rate their overall experience out of 5. On average, students rated their overall experience as 4.2, with 50% of respondents choosing a rating of 5. On average, tutors rated their overall experience as 4.5, with 60% of respondents choosing a rating of 5.

### Students' Average Overall Experience

4.2 / 5

### Tutors' Average Overall Experience

4.5 / 5

## Insights

94% of students (all but one) agreed that the description "friendly, patient and explains things well" this was an accurate depiction of their tutor. We would normally expect to see 100% approval of tutors.

### Students' Approval of Tutors

94%

### Students' Approval of Technology

78%

78% of students believed that the technology used for online tutoring worked well for them every time it was used. This figure is higher than it has been in previous projects.

90% of tutors believed that the online classroom technology worked well for them every time it was used. This figure is significantly higher than it has been in previous projects.

### Tutors' Approval of Technology

90%

### Tutors' Approval of Training

100%

100% of tutors felt that their training was 'informative and effective' and that it made clear the course of action to take in the event of a Safeguarding incident. 90% felt that the training had directly helped them to deliver sessions.

88% of students said that they had enjoyed the tutoring, with several students specifically commenting that learning from someone other than their classroom teacher had been a valuable experience.

### Students' Enjoyment of Lessons

88%

### Tutors' Enjoyment of Lessons

100%

100% of tutors reported that they had enjoyed their lessons. Every tutor agreed that the Foundation's team was appropriately supportive and responsive, with 70% of respondents describing the process of arranging and rearranging lessons as 'easy'.

## School Testimonials

*Tutorfair has helped increase the attainment of our students at Westminster City School in the subject of Chemistry. This was evident through class tests that the students carried out. Their improvement showed how the tutoring had been beneficial in increasing the knowledge of the students and having that time to review content that they were not confident with on a one-to-one basis.*

*Subject teachers of the students also commented multiple times on the visible improvements and confidence that the students were displaying in the classroom.*

*The help and support that Tutorfair has provided to our students has been immense and the students and I are grateful for this opportunity that we have been provided with. Without this help, a lot of our students would have been disadvantaged, especially due to covid. Therefore, it has been an extremely useful resource in these unprecedented times in helping our students be more confident.*

**N Chaudhry, Science Teacher, Westminster City School**

*Tutorfair have been incredibly organised throughout the process. Their communication has been excellent. They have liaised directly with students but have also kept designated school staff members informed so they could step in and support when necessary. All students who took part provided very positive feedback on the quality of sessions delivered by the tutors. Students' education and understanding of the subject improved as a direct result of the tutoring provided by Tutorfair. The students who took part would never have received such an opportunity if Tutorfair did not offer it.*

**A James, IBCP Coordinator and Science Teacher, Westminster Academy**

*Super-organised, absolutely on it! They have tracked individual students relentlessly which means every opportunity has been utilised - sometimes with these sort of programmes things are happening on paper but not actually happening to quite the same degree! But this is definitely not the case with Tutorfair, they've been a pleasure to work with and have delivered more than we originally discussed. They've been flexible when needed and generally totally focussed on what is best for the students.*

*I would say to anyone thinking of taking up the opportunity that you do need someone in school who will engage with it and chase students, I think if we'd left it in the hands of a busy science teacher we would not have had the same result.*

**S Essaye, Raising Aspirations Coordinator, Pimlico Academy**

## Student Testimonials

*My tutor has brought back my interest in chemistry and has in fact made me like it more than I thought I would. She has increased my confidence, and both taught and helped me with many aspects of Chemistry, Biology and other matters related to university.*

**Student**

*Experiencing a different way of being taught has helped tremendously in terms of coping with revision and revision techniques - not just for chemistry but for other subjects, too.*

**Student**

*I enjoyed working with my tutor as he helped improve my understanding of Chemistry.*

**Student**

*I like the 1-to-1 teaching. I can learn at my own pace and ask any questions I might not in class.*

**Student**

*I find my tutor very helpful. He helps me understand the topics very well and he's a great tutor. I understand some aspects of chemistry much better now that he has explained them to me. I know how to approach exam questions as well. He's a good tutor.*

**Student**

*Everything to do with the tutoring experience has been great.*

**Student**

*The tutoring has made me consider a Chemistry course [at university.]*

**Student**

*I've really enjoyed the Tutorfair sessions as the one-to-one help is improving my Chemistry massively. My tutor has been very helpful, and we have gone through a lot of the content which is good*

**Student**

*I have found my Tutorfair lessons profitable, and I believe they have helped me improve my Chemistry. I really enjoy the interactivity of it and the way in which my tutor has gone about teaching me.*

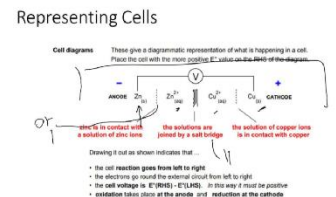
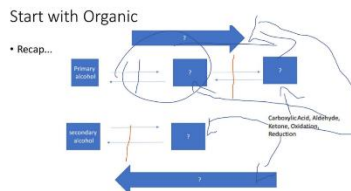
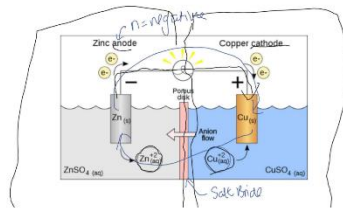
**Student**

# Tutorfair foundation

The images below were captured from our virtual classroom during Chemistry lessons delivered as part of this project. Tutors and students use the interactive whiteboard to work collaboratively on resources.

Geometry	Bonds and lone pairs
Trigonal planar	Three bonds and no lone pairs
Organic examples	Aldehydes, ketones, alkenes
Inorganic examples	BF <sub>3</sub> , BCl <sub>3</sub>
Tetrahedral	Four bonds, no lone pairs
Examples	Carbon, NH <sub>4</sub> <sup>+</sup> , SO <sub>4</sub> <sup>2-</sup>
Pyramidal	Three bonds with one lone pair
Examples	Ammonia
Bent	Two bonds with two lone pairs
Example	Water, C-O-H groups
Linear chemicals	Two covalent bonds, no lone pairs
Examples	Carbon dioxide
Octahedral examples	Sulphur hexafluoride (SF <sub>6</sub> )

Probably the big surprise here is what **doesn't** matter: the type of bond. Three bonds, no lone pairs is 120° whether or not they're double bonds.



## Recap: Structure of an atom

Particle	Location	Mass	Charge
Proton	Nucleus	1	+1
Neutron	Nucleus	1	0
Electron	Shells	0	-1

The following diagram shows the three-dimensional structure of a molecule:

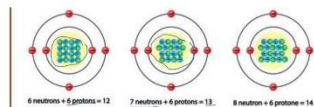
Butan-1-ol  
CH3CH2CH2CH2OH  
 secondary alcohol  
 butan-2-ol  
CH3CH2CH(OH)CH3  
 secondary alcohol

a. Apply IUPAC rules to state the name of this molecule. (1)

b. Deduce the structural formula of two isomers of the molecule above with the same functional group. (1)

c. Describe, using an equation, the oxidation by acidified potassium dichromate(VI) of the substance shown in the diagram. Use the symbol [O] to represent the oxidising agent. (1)

## Recap: Isotopes



lowest C4H10 < CH3CH2CHO < CH3CH2CH2OH < CH3COOH

What is the order of increasing boiling point?

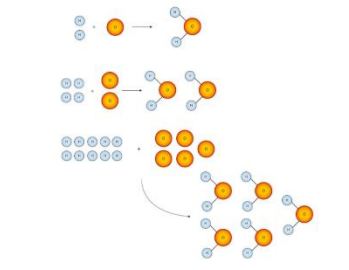
A. C4H10 < CH3COOH < CH3CH2CHO < CH3CH2CH2OH

B. C4H10 < CH3CH2CHO < CH3CH2CH2OH < CH3COOH

C. CH3COOH < CH3CH2CH2OH < CH3CH2CHO < C4H10

D. C4H10 < CH3CH2CH2OH < CH3CH2CHO < CH3COOH

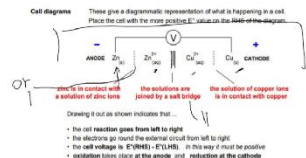
London Forces dipole-dipole H-bonding Strongest



British Spring Water  
 Plant based protein/amino acids  
 No added sugar

apple  
 mint  
 No amino acid  
 Cationic?  
 Slightly basic  
 Probably soluble in water (mixes with water - hence need 1 B for C to solve)

## Representing Cells



lowest C4H10 < CH3CH2CHO < CH3CH2CH2OH < CH3COOH

What is the order of increasing boiling point?

A. C4H10 < CH3COOH < CH3CH2CHO < CH3CH2CH2OH

B. C4H10 < CH3CH2CHO < CH3CH2CH2OH < CH3COOH

C. CH3COOH < CH3CH2CH2OH < CH3CH2CHO < C4H10

D. C4H10 < CH3CH2CH2OH < CH3CH2CHO < CH3COOH

London Forces dipole-dipole H-bonding Strongest

11. The rate constant of the reaction between ethyl bromide and hydroxide ions is given by the equation:

$$k = A e^{-E_a/RT}$$

12. The rate constant of the reaction between ethyl bromide and hydroxide ions is given by the equation:

$$\ln k = \ln A - \frac{E_a}{RT}$$

13. The rate constant of the reaction between ethyl bromide and hydroxide ions is given by the equation:

$$y = mx + c$$

## How can we pull Ea and A values from the equation?

values of A and E<sub>a</sub> are obtained from the Arrhenius equation by the relationship

$$\ln k = \ln A - \frac{E_a}{RT}$$

ln is a logarithmic term (log, NOT log<sub>10</sub>) (it can be obtained from a calculator)

$$\frac{-E_a}{RT} = \ln k - \ln A$$

$$y = mx + c$$

11. The rate constant of the reaction between ethyl bromide and hydroxide ions is given by the equation:

T/K	ln k
298	-11.5
308	-10.5
318	-9.5
328	-8.5

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This report was prepared by Joss Serrailier in June 2021