

# Subject “Clusters”

How schools can use schedules and micro-sites to minimise cross links during pandemics

## Summary

From a timetabling perspective what effectively happens here is to treat the school as independent 7 microsities with dedicated staff and bespoke and timetable. Doing so conveys many benefits. It allows the maintenance of social distancing and educational standards. This system is also compatible with other schemes such as split timetables or online-hybrids.

Students only study 4 Subjects. They only rotate between those subjects for 3 weeks. Therefore teachers and students are only seeing the same people. After three weeks, there is one week off. Students go home and do large homework tasks. This gives time for any symptoms to show up and the whole student/teacher “cluster” can then be isolated. Teachers can also rest. After they return the students move onto their other 4 subjects. The 4 classes per subject can also be divided into lower, middle and higher abilities and online. The combination of non-returning students and the week off being different for different year groups will mean we only have a fraction of the student body on site at any one time. The subjects can be cycled through in only 2 rotations. This will take roughly 8 weeks. When it is time to return to normal schools can decide if they want to return immediately or complete the cycle.

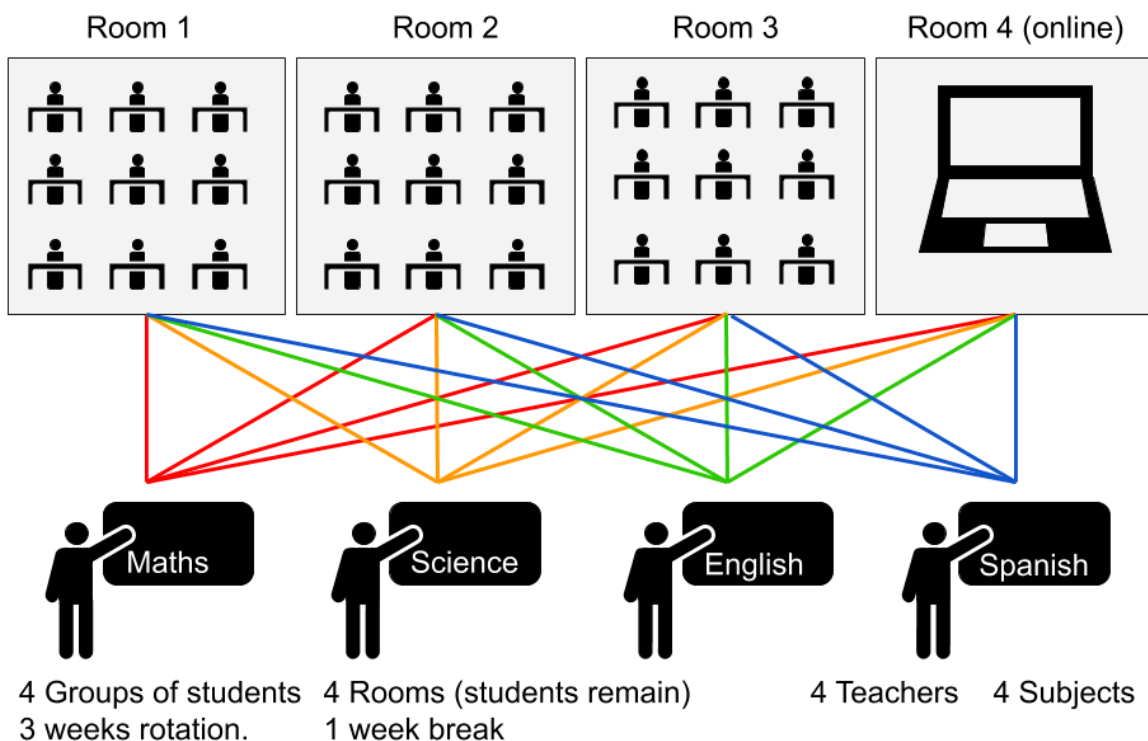


Figure 1: Visualisation of approach by A. Kilford

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*“Il meglio è l'inimico del bene”  
The best is the enemy of the good  
- Italian proverb*

## Introduction

I have no expertise about epidemiology or healthcare so I will set out the underlying premises that lead to this scheme. What I have learned is that we should avoid the three “C”. Closed in spaces, Crowds and Conversations. A school is a carousel of conversations with crowds in closed spaces. A perfect environment for spreading the virus. My school is going to continue to teach remotely until the summer holidays and therefore we will not be rushing into ad hoc measures that some schools have unfortunately been forced to implement. This is a plan for the long term.

1. **Schools will be compelled to open.** The mental health of the staff and students is not served by remote teaching. Neither is an on site atmosphere of constant vigilance, anxiety and dread. Schools are lifelines for many disadvantaged children and families. We would prefer to only open for a minority of students who need support. These decisions are not always ours. Children in schools also allow parents to work and economies to function. Children's education and wellbeing may be the school's and my priority, but the country has many more concerns to balance.
2. **A school can control schedules,** it cannot control much else. The interaction between students and between teachers will extend any contact tracing program to include the whole school. In my school that would be about 700 (1400 if you include primary). Many British schools are double this size. Many American schools are ten times the size. This scheme uses timetabling to minimise crosslinks and keep contact clusters under 100. It is also scalable.
3. **Time in proximity will undo most of the protections** granted by distancing and mask due to the cumulative effects of improper use or the underlying imperfections of protection equipment. We should still be using such protocols and equipment, but they were not designed for children who are exposed for 30 hours per week.
4. **Many parents will not send their children in.** We are a private school, however, even in a public school I would expect many protesting parents. I would not expect many schools to enforce attendance during this time. Continuing to provide an online session would ease the strain and class sizes on site.
5. **We can catch up later.** Hopefully these measures will not last for the whole year. The set-backs of being taught by non-specialists, inadequate hours or lack of experiments etc. can be addressed at a later point in the academic year or following years. We must also remember the whole world is in the same position. Hold the highest standard you can and stop worrying about meeting the standards of before.

6. **Staff to Student ratio will not improve.** School cannot drastically improve staff to student ratios during this period. If they had that capacity they would have done so before the pandemic. Many staff may also have conditions that put them at increased risk or are trapped in another country waiting for travel restrictions to ease.

This means attempts to keep students in small groups of less than ten will be hampered by a lack of staff to divide them amongst. Point 3 also counteracts the importance of small sizes. Point 4 is a blessing that nudges us towards small sizes.

I will list the major benefits and issues so you know what I have considered as you read the plan and will explore them more during the relevant part of the scheme. Please keep in mind that some issues are common across several or most proposed solutions and therefore judgements should not be made in light of what is lost but against what else could be done. Seeking solutions should obviously continue.

<b>Benefits</b>	<b>Issues</b>
Infection buffers for rest and intermissions	Teacher overload
Contact clusters are restricted to the same people.	Sibling will link clusters
Has near full subject coverage	Optional Topics Taught by non-specialists
Might be able to include physical activity	Physical activity overlooked
Easy to stagger start, end and break times	Other non-scheme related failure points
Provision for students still at home	The arts suffer again.
Scalable	
Compatible with many other protocols	

**Table 1:** Benefits and issues of the subject clusters plan

Special thanks to Dr. Gonzales, Adam Darwich and A.J. Kilford for their help in figuring out this proposal.

## The Scheme - Elegant but unrealistic

I would like to stress that this is NOT my school's plan. This is something I have thought up and am proposing publicly because this may be beneficial to a school out there somewhere. I have prioritised creating and maintaining firewalls above all else. I hope this explains the absurdities and compromises. From this kernel I was able to map out a workable system for my school. Complete with room and teacher allocations. By explaining the basics I hope you will be able to find the final solution for your school. I would like to stress the base of fours that underpins this plan is not essential.

For context, my school teaches the International Baccalaureate Diploma Programme (IB)<sup>1</sup> to grades 12 and 11. Cambridge International General Certificate of Secondary Education (IGCSE)<sup>2</sup> to grade 10 and 9. For 8, 7 and 6 we do follow a curriculum, however, the requirements here are more flexible and up to the school's discretion. Each year group is about 85 students. In a British context the grade number should be incremented by one. Grade 6 is equal to Year 7.

## An example using the IGCSE

Since the IB schedule is far more complicated and the younger years far more flexible I will begin by illustrating a possible implementation with Grade 9 and 10.

At my school students normally rotate between nine subjects. Teachers can have between 7-10 groups. Figure 1 shows a sample timetable for both one teacher and one student with "non-essentials" greyed out. We actually operate a two week timetable, but I want to keep things simple. Students form links within year groups. Teachers link between year groups.

Teacher timetable					
	M	T	W	T	F
Reg	Tutor	Tutor	Tutor	Tutor	Tutor
P1	8	11			
P2	9A	9A	10B	12	9A
P3		10B	9B	10A	11
Br					
P4	11	8	12	9B	12
P5	10B	12	11		10A
Lu					
P6	12		10A		11

Student timetable				
M	T	W	T	F
Tutor	Tutor	Tutor	Tutor	Tutor
Spanish	Spanish	Spanish	Life Skills	Econ.
Comp Sci	Comp Sci	Physics	Econ	Comp Sci
Econ	Physics	English Lit	Biology	Life Skills
English Lit	Maths	PE	Maths	Maths
Physics	English Lang	Chemistry	Chemistry	Biology
Math	Econ.	Biology	Comp Sci	PE

Figure 2: Sample typical timetable for one secondary teacher and one IGCSE Student

<sup>1</sup> International Baccalaureate <https://www.ibo.org/programmes/diploma-programme/>

<sup>2</sup> Cambridge International General Certificate of Secondary Education <https://www.cambridgeinternational.org/programmes-and-qualifications/cambridge-upper-secondary/cambridge-igcse/>

Rather than the teacher moving between year groups, they are restricted to one year group with three other colleagues. For the student, rather than cover the whole list of subjects, they can cover half of their subjects every day for a few weeks. After a one week break they can then move to the second half on a new schedule with a new roster of teachers. The teachers will still create epidemiological links between classes. The key is that these links will be to one consistent cohort. This contact cluster can then be easily isolated if there is a suspected case without disrupting the rest of the school. The other 400-600 students can continue their education. The one week break is key. It will allow time for symptoms to show up if there is an infection before rotating clusters.

The example below is just to help one conceptualise the system. Once the major blocks figured out it is possible to begin adjusting the hours and number of teachers apportioned to these lessons.

Teacher timetable					Student timetable				
	Physics	Chemistry	English	Humanities*	Grade 10 A	Grade 10 B	Grade 10 C	Grade 10 D Online	
P1	10A	10D Online	10C	10B	Physics	Humanities	English	Chemistry	
P2	10B	10A	10D Online	10C	Chemistry	Physics	Humanities*	English	
P3	10C	10B	10A	10D Online	English	Chemistry	Physics	Humanities*	
P4	10D Online	10C	10B	10A	Humanities*	English	Chemistry	Physics	

**Figure 3a:** Example Plan for first set of Subjects cluster timetable “Rotation A”. Break times not shown.

\* Humanities includes Geography, History and Economics

Teacher timetable					Student timetable				
	Maths	Biology	Spanish	Optional topic*	Grade 10 A	Grade 10 B	Grade 10 C	Grade 10 D Online	
P1	10A	10D Online	10C	10B	Maths	Optional topic	Spanish	Biology	
P2	10B	10A	10D Online	10C	Biology	Maths	Optional topic	Spanish	
P3	10C	10B	10A	10D Online	Spanish	Biology	Maths	Optional topic	
P4	10D Online	10C	10B	10A	Optional topic	Spanish	Biology	Maths	

**Figure 3b:** Example Plan for second set of Subjects cluster timetable “Rotation B”.

\*Art and Design, Computer Science, Drama, Music, and French. Also a 2<sup>nd</sup> group of Geography and History

Since the IGCSE is a 2 year course, the grade 9s will be doing the same topics. Thus the timetable for them will just be the opposite of the grade 10s. In a similar way to how grade 9 and 10 are mirrored, we can also mirror Grade 6 and 7 as well as Grade 11 and 12. Grade 8 will have its own timetable. This means each subject needs 4 teachers across the whole school. In reality we will be using more but we are not sure if staff will be able to return to school. Also many teachers have conditions that put them into risk groups. Once we plan with the minimum number for viability we can spread out the workload.

## Subjects with options

Here we can begin to see a major issue with the plan. Humanities students have already selected their specialism. We may be able to group A, B and C into geography, history and economics so that the teacher can focus on only one of these three, however, it may still be taught by a non-specialist. For the optional topics the situation is far worse. It would require an incredible polymath to cover all of the optional topics in four periods. While most schools will have several mathematics and english teachers, many schools have only one teacher for these optional topics. Since we are trying to prevent teachers moving between year groups we should not have the specialist just drop in. So unfortunately all of these subjects will suffer. There might be the possibility of having these sessions continue to be delivered remotely. Theatre at the IB level does not have many students and thus the teacher will have unallocated classes where he will be free to teach Drama online. It would be prudent to consider that we are currently teaching these topics remotely. They are already not being served well. At least we are not worsening the situation.

## Coverage

A less obvious issue is that English Language and Literature has been reduced to one subject called English. This was arbitrary. I could have chosen to squash the three sciences into two parts and many schools actually deliver science in this way. This compromise will depend on each school and there are ways around it including creating clusters of three subjects and rotating between three timetables. Or we could have subject groups of five rather than four. Another is to fully lean into prioritising the core subjects rather than to try seek balance. Students could also take fewer IGCSEs. The least worst solution will require a deeper look at both the old provision, recommended teaching hours, comparisons against alternatives and consultation with the entire school corpus.

Coverage loss is unavoidable. The most common suggestion of splitting the school body in half and having them come in on an alternating schedule. This is a coverage loss of 50%. Under this plan teachers will be teaching for 20 periods per week compared to the current schedule of 23. Students will study for 20 periods, down from 26 curriculum lessons. This is a significant drop but far better than a split timetable which would cause an immediate drop of 50%. Some extra time can be made up by continuing to have some remote lessons during the week off.

## Staying online

You can see that I have allowed for one group of students to continue to be taught remotely for all subjects. This is based on the assumption that many parents will not allow their children to return under uncertainty. Providing a dedicated online lesson, unfortunately, means increasing the number of students per room since they are spread across three groups rather than four. Some schools may choose not to provide this and instead spread attending students across all four groups to reduce class sizes. I feel as you continue to read that maintaining an online schedule is very important in ameliorating shortfalls and serving

the greatest number of students. In both cases the cohort is reduced significantly. It can also serve as a teacher room during breaks and lunch times.

Teachers with health conditions may continue to teach remotely to students who are physically present. Since there are multiple reasons for attending students to be taught remotely I would suggest easing any policies around the use of headphones. We may be able to match up the online only students and teachers more consistently once we see how the situation plays out.

## Continuing work over the intermission

The one week intermission can be treated as part of the school term and run in an identical manner to the remote implementation many are utilising at this very moment. Or it may be assigned in lieu of a week's worth of holiday. The exact decision will affect many things. How many hours are lost compared to the regular timetable. The mental health of staff and students. Parental choice and childcare accommodations.



# Micro-Sites - Flexibility and Staggered Schedules

These subject clusters are wonderfully independent from each other. This provides some benefits with regards to spacing. We can ensure that each cluster is limited to four adjacent classrooms with a designated bathroom to increase the isolation from other groups. We have effectively separated the school into split micro-sites. It provides multiple opportunities to stagger the timetable and increase separation over time.

## Start and end times

There is also no longer a need to synchronize lesson times. Each cluster can start and finish at different times. Between periods only the teachers have to move. We can also make sure that lunch and breaks do not overlap, but the students should be eating and remaining in their classrooms. I have made two examples in Figure 4. I have set five periods to allow students to have study time. It also provides teachers some respite and the possibility of PE and other non-exam activities.

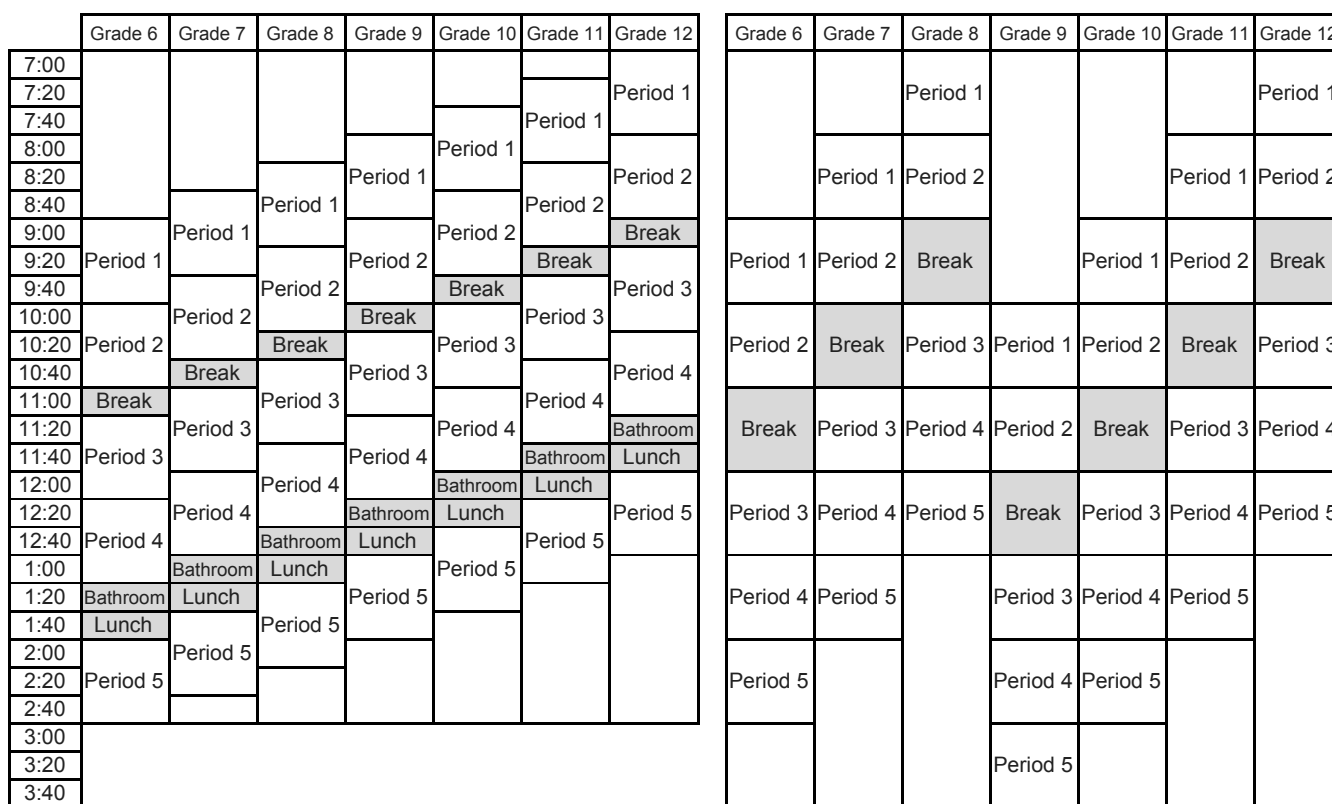


Figure 4: Two examples of staggered timetables

These staggers can unfortunately undo the possibility of specialist teachers remote teaching during unallocated timeslots. The second solution preserves that possibility but extends the school day. Schools are large and have multiple entrances so the breaks and starts do not necessarily overlap in location even though they do in time.

Additionally the week no longer needs to run Monday to Friday for all years allowing even further staggering and reduction in on site presence by 29%.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Grades 6 and 7						Weekend	
Grade 8	Weekend						Weekend
Grades 9 and 10		Weekend					
Grade 11 and 12				Weekend			
Avg. 71% on Site	86%	71%	71%	71%	71%	71%	57%

Figure 5: Weekends reducing on-site population

## One week at home - The cluster buster

The one week break has a few benefits. It will allow symptoms time to develop. The rooms can also be cleaned then left for a the few days that the virus can last on some surfaces<sup>3</sup>. Additionally it reduces the population. Remember that we have mirrored Grades 6 and 7, Grades 9 and 10, Grade 11 and 12. With the addition of Grade 8, we have now seperated the year groups into four stages. If we cycle their week off there will be a reduction in the number of students on site at any given time. If you combine this with the likelihood of many students in absentia and a staggered week, we could have a population of below 50%.

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Grades 6 and 7	Break	Rotation A			Break	Rotation B		
Grade 8	Rotation B	Break	Rotation A			Break	Rotation B	
Grades 9 and 10	Rotation B		Break	Rotation A			Break	Rotation B
Grade 11 and 12	Rotation B			Break	Rotation A			Break
Avg. 75% on Site	71%	86%	71%	71%	71%	86%	71%	71%

Figure 6: Rotation breaks reducing on-site population

The Grade 8 Rotation does mean that we will have teachers with an entire month of unallocated lessons. Management and specialist teachers should be assigned to these classes. They can carry out other duties and remote teaching during their off rotation.

When it is time to return to normal schools can decide if they want to return immediately or complete the cycle.

## Parents of multiple children

These schemes help reduce the on-site population, however, they are impractical for parents with several children in different years. The weekends stage could mean some families no

<sup>3</sup> The New England Journal of Medicine - Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1 <https://www.nejm.org/doi/10.1056/NEJMc2004973>.

N.B The guidelines on this have changed many times and I am working on the schedule more than researching for latest reliable references.

longer have weekends together. Siblings are the biggest compromise to the isolation offered to the scheme and will be discussed in their own section.

With regards to daily pick up and drop off, since siblings may have very different starting and end time, students should be able to wait in their classrooms and the teachers of that year group should take turns to stay earlier and later than the class schedule to supervise the waiting children.

The continued online lessons mean that some students can organise with their teachers to do half of their lessons online and the other on site. Even during single days they can begin period 1 and 2 online then travel into school with a sibling for a few face to face lessons.

We can and should regard any system during the pandemic as what the school is offering and that parents and students can avail themselves of these provisions in the best way that suits them.

## Advanced structuring - Meeting the requirements

I will not detail the creation of a cycle for Grade 6, 7, or 8 as that proved to be trivial. The rule of four has made conceptualising across years and subjects easier but unrealistic and unsuitable. 4 teachers × 4 subjects × 4 classes × 4 rooms × 4 periods × 4 weeks × 4 sites is far too simple for complex curriculum needs. Ultimately this quaternate scheme does not need to be applied strictly to the whole school. It forms a conceptual base which is supposed to be adapted to specific needs. Everything in this section has been run through timetabling software and is viable. For me it required using an alternative way of assigning lessons buried deep in the manuals. Schools should consult with their software provider.

## Maintaining proportions - Stretching across weeks

Not all subjects were designed for equal time. Therefore the allocations should not assign equal time. If instead of the simple idea of one class of each subject per day we can look over the whole week or even over the three weeks and adjust the lessons proportions. This does undo the simplicity and some opportunities presented by having the same lessons at the same time period everyday so it is once again a balancing of priorities. Figure 8 demonstrated this. It does ignore the times allocated for PE and other non-exam activities.

I also began adding a second member of staff for many subjects so earlier misgivings over class sizes and teacher workload can be assuaged.

Hours allocated and curriculum proportion	Original	Simplified	Scaled
English	24.75 (16.4%)	15 (12.5%)	21 (16.7%)
Maths	24.75 (16.4%)	15 (12.5%)	21 (16.7%)
Biology	13.75 (9.1%)	15 (12.5%)	12 (9.2%)
Chemistry	13.75 (9.1%)	15 (12.5%)	12 (9.2%)
Physics	13.75 (9.1%)	15 (12.5%)	12 (9.2%)
Spanish	22 (14.5%)	15 (12.5%)	18 (14.2%)
Humanities	19.25 (12.7%)	15 (12.5%)	15 (12.5%)
Option	19.25 (12.7%)	15 (12.5%)	15 (12.5%)
<b>Total</b>	<b>151.25</b>	<b>120</b>	<b>126</b>

Figure 7: Subject allocations in hours at IGCSE over 6 weeks

There is a deficit of 31.25 teaching hours in this scheme. That is 5 hours 13 minutes per week. This also ignores the hours lost on the intermission weeks. The exact number will depend on if the school chooses to continue online lessons during the intermission or offer the intermission weeks in lieu of term holidays. There is also a further 4 per week hours unallocated lesson which can reduce the deficit of lost hours from 17% to 11%. One should be mindful of the increased mental strain filling up these gaps will incur. It may look good mathematically but will probably be counter productive in reality. These extra periods are

there to serve the mental and emotional health of staff and students. We should not blindly pursue maintaining the standards and provisions of the schools old regular schedule at the expense of everything else.

## Advanced Classes

For the IB I realised we would have to break away from tetrads entirely. Highly efficient scheduling in the other years will allow for inefficiency in the IB Schedule.

The IB faces many challenges. This is also the level of most consequence to the students' futures so we should be prepared to prioritise resources into providing the best standard at this level, even at the expense of the other years. The complicating factors are as follows

1. **Necessity for specialists.** The IB is advanced and can allow students to skip introductory courses at some universities<sup>4</sup>. They require special knowledge and training so non-subject specialists teachers are not an option. The ultimate goal of limited teachers was always to limit the size of the contact cluster while delivering a good standard of education. Adding a few teachers for these critical years is a relatively small increase to cluster size.
2. **Variation in levels.** Each subject comes in two levels. It is recommended that Higher Level(HL) is taught over 240 hours and Standard Level(SL) over 150 hours. Normally they are also then provided with a proportionate number of hours on the timetable. I was able to keep most classes separate but for some schools this would not be possible. Fortunately there are many chapters common to both so we can choose to accept the compromise to teach both levels simultaneously with equal time provisioned for a short period.

Mathematics and languages also provide more challenge as there are multiple versions of each subject that are not interchangeable. These must be planned first and then the other subjects planned around them.

3. **Subject combinations.** The IB requires all students to take six subjects. They have to take a primary Language (English), an additional language<sup>5</sup>, a social science and an experimental science. For their sixth subject students may choose either an arts subject or a second subject from previous groups. Combined with point 2 we need to make sure the schedule allows all students to go from the correct variant of maths to their option and then onto the correct variant of english etc. In our school the english, spanish and maths teacher will be able to teach all the variations of those options but we may need to add a second specialist so that all combinations are provided.

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<sup>4</sup> At the University of British Columbia a high grade in Biology Higher is equivalent to "BIOL 1st-year level (8), with exemption from BIOL 111, BIOL121, and BIOL140"  
[https://you.ubc.ca/applying-ubc/applied/first-year-credit/#international\\_baccalaureate](https://you.ubc.ca/applying-ubc/applied/first-year-credit/#international_baccalaureate)

<sup>5</sup> Luckily for me the only second language I need to consider is Spanish since I teach in a spanish speaking country.

These combinations will be different for Grade 11 and 12 so while we can mirror the teachers we cannot mirror the schedule exactly.

IB Subject requirements						
English Literature	English Lang & Lit	English B	Math Analysis	Maths Applications	National Curriculum	Theory of Knowledge
Spanish Literature	Spanish Lang & Lit	Spanish B	Business 6	Biology	Physics	Chemistry 6
Economics	Geography	ITGS	History 6	Theatre	French	Computer Science
Business	History	Psychology	Psychology 6	Visual Arts	Music	Film

**Figure 8:** IB Subjects required. Higher and Standard Levels ignored for now. The “6” Indicates that it is delivered as part of the sixth option.

4. **Small class sizes.** While 24 or even 30 students in a class is a common feature of grade 6-10. At the IB level most classes have already been divided to contain fewer than 15. This makes many threshold decisions to combine classes or keep them separate difficult. Some rough calculations indicate that we would want to spread these students out over a minimum of six teachers. While I was luckily able to maintain the exact same class division, this may be an issue.

Some subjects only have three students and assigning the specialist teacher will then lock the teacher out of the rotation for the rest of the school. I tried to see if it was viable to have them teach both grade 11 and 12 in one rotation so that they were available to other years on the counter rotation. Unfortunately that compromises the separation between years that this whole scheme was founded upon. Combining the contact clusters for the IB is an option, but one I would rather avoid. These subjects should be planned so that teachers can also remotely support the IGCSE version of their subject. Alternatively they could be assigned to the IGCSE and support the IB during the scheduled online lesson. A third idea is since these classes are small they could sit in far flung corners of the rooms and maintain an exaggerated distance.

## In practice

We can no longer have the teachers be the one who moves. Therefore these classes should be held in the most open locations of the school. A situation we had tried to avoid but these students are of the age where most should be responsible enough to move sensibly with only a little supervision. In addition to the teaching rooms we will need to provide extra room to which staff can sequester and students to await their next class.

After adjusting the allocated lesson for the IB I was able to maintain 63% of the contact hours that our students would normally have with teachers. 70% at the higher level This is possible whilst preventing cross links between year groups, keeping teacher workload similar to before the crisis and maintaining a substantially low on site presence. These guidelines can vary from 25% to 75% dependent on local or national guidelines. Since these are advanced classes, students will need to bear some responsibility for making up for

logistical shortfalls. This coverage could be increased, however, it was uneven and would result in some classes benefiting more than others. This gap is caused by subject clashes and could be alleviated with more teachers. This gap did allow for the teachers to also offer a minimum of 7 hours of lessons online and can easily be scaled up to encompass other year groups until a reasonable workload threshold.

Hours allocated and curriculum proportion	Original over 6 weeks	Reduced over 6 weeks	Hours per week per subject in 1 rotation
Higher Level × 3	82.5 (51.7%)	63 (58.3%)	7
Standard Level × 3	57.75 (36.2%)	36 (33.3%)	4
National Curriculum	13.75 (8.6%)	9 (5.6%)	3
Theory of Knowledge	5.5 (3.4%)	3 (2.8%)	1
<b>Total</b>	<b>159.5</b>	<b>108</b>	

**Figure 9:** Subject allocations in hours at IB over 6 weeks

## Practical subjects

Since most lessons are taking place in isolated micro-sites it would be smart to make sure these primarily consist of non-specialised rooms. The various laboratories and music room can then be assigned on a rota of availability with pauses for cleaning in between. With as few as four laboratories we can maintain some semblance or separations as each may only be used by the designated year groups.

## A few other final numbers

I was ultimately able to balance teaching loads, subject coverage, specialisms, wider responsibilities and online provision for a school of 650 Students with 54 teachers. The timetables are shared in full in the appendix

# Unsolved problems and further concerns

## The Elephants Outside - Siblings, friends and housemates

This scheme has so far ignored the reality of families and analysed everything through a narrow lens of the school's structure. Perfect individuals who do not exist beyond the gates of the campus. The firewalls created by these myopic machinations do not extend to the homes of those who they affect or the communities they inhabit. As an international school we have many teachers who share housing, and in a normal school many teachers are married. Teachers have their own children attending the school. It may be possible to assign teachers so that shared houses align with the schedule.

Then there are siblings. There will not be a timetable permutation that will isolate the many combinations of ages into discrete clusters. We could try to address this by prioritising one sibling and have the others remain online. Or allow families to choose one sibling to go on Rotation A and the other on B. That still does not guarantee that teachers, students and their families are not visiting each other. It is a community.

Even simpler is we can just accept this major flaw. It is a flaw that will still exist in other reduction plans. We have mitigated the links over which we have control. Much of the purpose of this plan is in the effort so that in the worst we know we tried our best. While serious complications in children from this virus are tragic they are also extremely rare. These protocols are made as a service to the whole community, not just to safeguard the health of the children. There is no perfect solution. If a case is detected we should lock down all years regardless of source. This means our response is no different to if we had not made a plan with multiple buffers between clusters. Just like the combination of masks and social distancing against long exposure times seem counterproductive, the mitigation measures of this plan should not be considered as a wasted effort. These practices are not perfect and their reductive effects are cumulative.

## Serving the vulnerable

It is an essential characteristic of vulnerability that adverse events will have a greater effect. Heartbreaking situations were being lived everyday in the far better times before the lock down and it was a nigh impossible struggle. To vulnerable children and families a school is an essential safety. They can provide stability and support. School meals are sometimes the only hot meal a child will receive all day. Remote teaching has also meant the loss of witnesses to children at risk. The risk is also increased above the normal baseline due to a culmination of stresses and poor coping mechanisms that pervades through some households. This support network is now reduced to a glowing rectangle. Many do not even have a device or a connection.

I do not have the expertise to advise on what measure people should implement. Support will and should be highly individualised. I will only focus on the windows of opportunity that



my scheme presents. Crucially we have managed to ensure access between heads of years and their wards. We should prioritise training for these pastoral heads of years so that they are able to cover most required forms of support. They may be highly specialised support where short online training sessions are not an acceptable qualification. For these the heads of year may have the opportunity to arrange external support under strict protocols. We also have a daily window so that support sessions will not be at the expense of lessons time. If they have siblings there may be other opportune times due to the staggered start times. All the pertinent teachers are in close contact for coordination, discussion and planning. They should handle all academic support so that others can focus on more complex needs.

The final ultimately unfavourable but pragmatic solution might be to have some children come into school and take the online classes with members of special staff nearby to support them. Determining the threshold to isolate a child from their peers is best left to professionals.

Students of concern are not the only ones who should need mental and emotional support. All children are vulnerable as well and any adults. There should be a robust plan for the free periods to actually explore, discuss, confront and repair the many ways the crisis has reshaped us. I made sure to stagger the timetable so that the younger years start later. This is to allow staff to adapt, adjust, learn and share during this monumental transition. This is an event that has affected almost everyone in the world on a deep personal level. The effect from quarantine will be very slow to be recognized.

Schools should partner with mental healthcare providers to provide subsidised or free therapy sessions for both staff and students. I would even suggest schools insist that all staff have a few sessions to counteract reluctance.

## Uneven workloads

You will have some teachers with a full schedule and others fairly empty. I already pointed out the spare time that the grade 8 schedule. There are further examples in the advanced classes. For example IB physics needs specialists but there are only 20ish students in grade 11 and another 20ish in Grade 12. This would mean the teacher assigned to them would, at most, teach two classes per day. His workload could at a stretch be spread out to HL on site, HL online, SL on site, SL online. Even if this teacher were to have the same number of hours, their experience could not compare to other teachers who are having to contend with blended and crowded classes. Chemistry IB has an even lighter load resulting in only one class.

Even with the most professional and charitable workforce not addressing these gaps could foster feelings of guilt and envy. We should try to ensure that the teachers here are those with wider non-pastoral responsibilities who normally teach only a few classes as they are mostly concerned with the duties of management. Or they need to be assigned other responsibilities over this period. Another solution would be to ask them to provide some online sessions to other year groups or in class support to the other teachers.

## Comparison with other schemes

To appreciate the value of any scheme it will need to be compared to other measures already in effect worldwide. They were made in haste to serve a rapidly evolving situation and under the spectre of inexperience. If we continue to agonise over the deficiencies compared to regular provisions we risk losing sight of the benefits and what we can regain.

### The split timetable

In some alternative schemes the student body is split in half and comes in on an alternating schedule. There are proposals that alternate between morning and afternoon, between days and between weeks. Some of these preserve a full timetable. The teachers would reteach the same class the other half when they enter and set remote work for the time off. This immediately drops contact time to 50%. A split timetable is compatible with the cluster system and may be necessary to reduce some class sizes. The major flaw is that it fails to separate the student body effectively as the teaching staff is still cycling through different classes and acting as epidemiological links between groups.

### Primarily online school

Any and all timetables can be run in person or face to face. It is the split that becomes hard to manage as staff can only really focus their efforts on one channel at a time. So online and offline sessions should be distinct individual periods rather than an attempt to split the difference in response to unexpectedly low or high attendance. There can be a sliding scale of online to offline dictated by whom the school decides it desires to attend in person. This could be key workers or vulnerable children. While it may seem strange for staff to come in only to face a camera most of the time, it can provide benefits. A discreet work area, discussion with colleagues. Access to experimental and performance equipment to perform live demonstrations. A sense of normalcy and reassurance for the children.

# Universal considerations

There are many issues to consider that are not unique to the schedule and structure proposed in this scheme. They will be present in any attempt to open schools and will mention them here for the sake of diligence but not explore the issues in depth.

## General protocols

Keep the provisions of Masks, Distancing soap and gel Gel. Lots of air circulations. Speaking loudly seems to be a huge factor so teachers need to be mindful of how they project the voices. A common suggestion is one way corridors. I would not advise it with this scheme as that makes people move further distances. Entering school. Pickup and drop off

## Between thresholds and public transport

Between leaving their homes and their arrival at school is an unpredictable and uncontrollable aspect reopening school. Schools should liaise with local governments and transport departments for dedicated buses. They can only be asked to avoid crowds, avoid shops and to adhere to the recommendation. Compliance can never be guaranteed.

## Desks and Workstations

The science on surfaces is still evolving. This advice is that surface contamination remains unlikely to be a cause of transmission but to continue to take precautions. The nature of science and official advice will mean these cautions will remain in place regardless of effects.

Both the entering teacher and leaving teacher are responsible for cleaning the teachers work desks. Provide tissue and disinfectant spray or soap sprays for workstations. Asking students to also wipe down the desk at the beginning and end would result in crowds near the tissues and bins and a spray being passed between many people. Better to ask one cautious member of staff or volunteer to handle all the surfaces

## Bathrooms and Fountains

Give strict designated bathrooms and fountains to sections of the school. Consider providing bottled water or water coolers if fountains are far away. Cleaning staff can be assigned to these areas. The lack of student movement should mean the majority of the grounds are not dirtied to the usual degree.

## Enforcing distance

People can only be requested to be mindful. Those who consistently break the rules can be categorised into those who actively disregard the rule and those who struggle to remember them. The first should be required to stay home and only take the online classes. The second should be supported and may sadly have to move to specialised support away from the main body of their year group.

## Cafeterias

Shut for all except those on free school meals. These can be delivered or kept in the cafeteria with distance monitoring.

# Appendix

Sample timetable to show viability. Grade 6 & 7 will swap timetables. Same with 9 & 10. 8 & 12 have both weeks shown. 11 are not finalised but will be just as complex as 12.

	Monday					Tuesday					Wednesday					Thursday					Friday					
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
6A	Science SC1	IT IT2	Art AR3	Humanities HU1	Humanities HU1	Art AR3	Science SC1	IT IT2		Science SC1	Art AR3	Humanities HU1	IT IT2		Science SC1	Art AR3	Humanities HU1	IT IT2		Science SC1	Art AR3	Humanities HU1	IT IT2		Science SC1	
6B	Art AR3	Humanities HU1	Science SC1	IT IT2	Art AR3	IT IT2	Humanities HU1	Science SC1	Art AR3	Humanities HU1	IT IT2	Science SC1	Art AR3	Humanities HU1	IT IT2	Science SC1	Art AR3	Humanities HU1	IT IT2	Science SC1	Art AR3	Humanities HU1	IT IT2	Science SC1		
6C	IT IT2	Art AR3	Humanities HU1	Science SC1	Science SC1	Science SC1	IT IT2	Art AR3	Humanities HU1	Humanities HU1	IT IT2	Science SC1	Art AR3			IT IT2	Science SC1	Art AR3	Humanities HU1		IT IT2	Science SC1	Art AR3	Humanities HU1		
6O	Science SC2	IT IT2		Art AR3	IT IT2	Humanities HU1	Science SC2	Art AR3	IT IT2	Science SC2	Art AR3			Humanities HU1	IT IT2	Science SC2	Art AR3	Humanities HU1		IT IT2	Science SC2	Art AR3	Humanities HU1			
7A	English EN5	Spanish SP5	Maths MA5	Maths MA5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	
7B	Maths MA5	English EN5	Spanish SP5	Spanish SP5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	
7C	Spanish SP5	Maths MA5	English EN5	English EN5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	English EN5	Spanish SP5	Maths MA5	
7O	Maths MA6	English EN6	Spanish SP6	Spanish SP6	Spanish SP6	Maths MA6	English EN6	Spanish SP6	Maths MA6	English EN6	Spanish SP6	Maths MA6	English EN6	Spanish SP6	Maths MA6	English EN6	Spanish SP6	Maths MA6	English EN6	Spanish SP6	Maths MA6	English EN6	Spanish SP6	Maths MA6	English EN6	
8A		Humanities HU2	English EN7	English EN7	Humanities HU2		Maths MA7			English EN7	Humanities HU2	Maths MA7			Humanities HU2	Maths MA7	English EN7		Maths MA7	English EN7	Humanities HU2	Maths MA7	English EN7	Humanities HU2	Maths MA7	
8B	Maths MA7	Maths MA7	Humanities HU2		English EN7	English EN7	Humanities HU2	Maths MA7			Humanities HU2	English EN7			Humanities HU2	English EN7	Maths MA7		Maths MA7	Humanities HU2	English EN7	Maths MA7	English EN7	Humanities HU2	English EN7	
8C	English EN7	Humanities HU2	Maths MA7	Maths MA7		Humanities HU2	English EN7	English EN7	Maths MA7	English EN7	Humanities HU2	Maths MA7	English EN7	Humanities HU2	Maths MA7	English EN7	Humanities HU2		Humanities HU2	English EN7	Maths MA7	English EN7	Humanities HU2	Maths MA7	English EN7	
8D	Humanities HU2	English EN6		Maths MA6	Maths MA6	Maths MA6	English EN6	Humanities HU2	Humanities HU2	Maths MA6	Maths MA6	English EN6		English EN6	Humanities HU2		Maths MA6		Humanities HU2	English EN6	Maths MA6	English EN6	Humanities HU2	Maths MA6	English EN6	
*8A	Science SC3	Spanish SP7			Spanish SP7	Science SC3	Creative CR1	Creative CR1	Creative CR1	Science SC3	Spanish SP7			Spanish SP7	Science SC3		Spanish SP7	Science SC3		Spanish SP7	Science SC3		Creative CR1		Creative CR1	
*8B		Creative CR1	Science SC3	Science SC3	Science SC3	Spanish SP7	Spanish SP7	Spanish SP7	Spanish SP7	Science SC3	Creative CR1			Creative CR1	Science SC3	Spanish SP7	Science SC3	Spanish SP7		Spanish SP7	Science SC3		Spanish SP7	Science SC3	Spanish SP7	
*8C	Spanish SP7	Science SC3		Spanish SP7	Creative CR1	Science SC3	Spanish SP7	Science SC3		Spanish SP7			Science SC3	Spanish SP7	Science SC3	Spanish SP7	Creative CR1	Science SC3	Spanish SP7	Creative CR1	Science SC3	Creative CR1	Spanish SP7	Science SC3	Spanish SP7	
*8O	Science CH1	Spanish SP6	Creative CR1		Science CH1	Spanish SP6		Spanish SP6	Science CH1	Creative CR1	Spanish SP6	Creative CR1	Science CH1	Spanish SP6	Creative CR1	Science CH1	Creative CR1	Science CH1	Spanish SP6	Creative CR1	Science CH1	Spanish SP6	Creative CR1	Science CH1	Spanish SP6	
9A	English EN4	Geography GE2	Chemistry CH2	Physics PH2		Geography GE2	English EN4		Geography GE2	Chemistry CH2	Physics PH2	English EN4		Geography GE2	Chemistry CH2	Physics PH2	English EN4		Geography GE2	Chemistry CH2	Physics PH2	English EN4	Chemistry CH2	Physics PH2	Geography GE2	
9B		Chemistry CH2	Economics EC1	Physics PH2	English EN4	English EN4	Physics PH2	Chemistry CH2	Economics EC1	Physics PH2	English EN4		Economics EC1	Chemistry CH2		English EN4		Economics EC1	Physics PH2	Chemistry CH2	English EN4	Economics EC1	Physics PH2	Chemistry CH2	English EN4	
9C	Chemistry CH2	Physics PH2	English EN4	History H12		English EN4		English EN4	History H12		Chemistry CH2	Physics PH2	English EN4	English EN4	Physics PH2	History H12	Chemistry CH2	English EN4	History H12	Chemistry CH2	English EN4	History H12	Chemistry CH2	Physics PH2	English EN4	
9O	English EN1	Physics PH2	Option 1 EC1 HI2 GE2	Chemistry CH2	Chemistry CH2	English EN1	Physics PH2		Physics PH2	English EN1	Chemistry CH2	Option 1 EC1 HI2 GE2	Option 1 EC1 HI2 GE2	Option 1 EC1 HI2 GE2		English EN1	Physics PH2	Chemistry CH2	Option 1 EC1 HI2 GE2	English EN1	Physics PH2	Chemistry CH2	Option 1 EC1 HI2 GE2	English EN1	Physics PH2	
10A	Maths MA4	Spanish SP4	Comput CO1 French FR2 Art AR2	Biology BI3	Comput CO1 French FR2 Art AR2	Maths MA4		Spanish SP4	Comput CO1 French FR2 Art AR2	Spanish SP4	Biology BI3	Maths MA4		Geography GE3 Music MU2	Biology BI3	Maths MA4	Biology BI3	Spanish SP4	Maths MA4	Biology BI3	Maths MA4	Biology BI3	Maths MA4	Comput CO1 French FR2 Art AR2	Spanish SP4	
10B	Spanish SP4	Geography GE3 Music MU2	Biology BI3	Maths MA4	Maths MA4	Biology BI3	Spanish SP4	Geography GE3 Music MU2	Spanish SP4	Maths MA4	Geography GE3 Music MU2	Biology BI3	Maths MA4	Geography GE3 Music MU2	Biology BI3	Maths MA4	Biology BI3	Spanish SP4	Maths MA4	Biology BI3	Spanish SP4	Maths MA4	Geography GE3 Music MU2	Spanish SP4	Maths MA4	
10C	Biology BI3	Spanish SP4	Maths MA4	History H13 Drama DR1	Spanish SP4	History H13 Drama DR1	Maths MA4		Biology BI3		History H13 Drama DR1	Spanish SP4	Maths MA4	Maths MA4	Spanish SP4	History H13 Drama DR1	Biology BI3	Maths MA4	Biology BI3	Maths MA4	Biology BI3	Spanish SP4	History H13 Drama DR1	Spanish SP4	History H13 Drama DR1	
10O	Maths MA3	Option 2 GE3 HI3 MU2 DR1 FR2 AR2 CO1	Biology BI3	Spanish SP3	Option 2 GE3 HI3 MU2 DR1 FR2 AR2 CO1	Maths MA3		Biology BI3	Option 2 GE3 HI3 MU2 DR1 FR2 AR2 CO1	Spanish SP3	Spanish SP3	Maths MA3	Maths MA3	Biology BI3	Spanish SP3	Option 2 GE3 HI3 MU2 DR1 FR2 AR2 CO1	Spanish SP3	Biology BI3	Maths MA3	Spanish SP3	Biology BI3	Maths MA3	Option 2 GE3 HI3 MU2 DR1 FR2 AR2 CO1	Spanish SP3	Maths MA3	

12			Geography GE1	Humanities Online	ITGS IT1 Business BU1 History HI1 Geography GE1 Psychology PS1 Economics EC1		Geography GE1	Humanities Online	ITGS IT1 Business BU1 History HI1 Geography GE1 Psychology PS1 Economics EC1		Geography GE1	Humanities Online	ITGS IT1 Business BU1 History HI1 Geography GE1 Psychology PS1 Economics EC1		Geography GE1	Humanities Online	ITGS IT1 Business BU1 History HI1 Geography GE1 Psychology PS1 Economics EC1		Geography GE1	Humanities Online	ITGS IT1 Business BU1 History HI1 Geography GE1 Psychology PS1 Economics EC1		
	Art AR1 Chemistry CH1 Comput CO1 Drama DR1 Film S FI1 French FR1 Psychology PS1 History HI1 Business BU1			Group 6 online		Art AR1 Chemistry CH1 Comput CO1 Drama DR1 Film S FI1 French FR1 Psychology PS1 History HI1 Business BU1			Group 6 Online		Art AR1 Chemistry CH1 Comput CO1 Drama DR1 Film S FI1 French FR1 Psychology PS1 History HI1 Business BU1			Group 6 Online		Art AR1 Chemistry CH1 Comput CO1 Drama DR1 Film S FI1 French FR1 Psychology PS1 History HI1 Business BU1			Group 6 Online		Art AR1 Chemistry CH1 Comput CO1 Drama DR1 Film S FI1 French FR1 Psychology PS1 History HI1 Business BU1		
	Maths Online MA2	Maths Application s SL 2 MA2	Maths Application s SL1 MA6 Maths Application s SL3 MA2		Maths Online MA2	Maths Application s SL2 MA2	Maths Application s SL3 MA2		Maths Online MA2	Maths Application s SL2 MA2	Maths Application s SL1 MA6		Maths Online MA2	Maths Application s SL1 MA6	Maths Application s SL3 MA2		Maths Online MA2	Maths Application s SL1 MA6	Maths Application s SL3 MA2		Maths Online MA2	Maths Application s SL1 MA6	Maths Application s SL3 MA2
*12	Physics online PH1	Biology SL BI1	Biology HL BI1		Physics PH1	Biology SL BI1	Biology HL BI1		Physics online PH1	Biology SL BI1	Biology HL BI1		Physics PH1	Biology HL BI1		Physics PH1	Biology HL BI1		Physics PH1	Biology HL BI1	Biology SL BI1		
	Biology online BI1	Physics HL PH1	Physics SL PH1		Biology BI1	Physics HL PH1	Physics SL PH1		Biology online BI1	Physics HL PH1			Biology BI1	Physics HL PH1	Physics SL PH1		Biology BI1	Physics SL PH1	Physics HL PH1				
	Maths Online MA1	Maths Application s 4 MA1	Maths Analysis HL MA1	Maths Analysis SL MA1	Maths Online MA1	Maths Analysis SL MA1		Maths Analysis HL MA1		Maths Online MA1	Maths Analysis MA1	Maths Analysis SL MA1	Maths Application s 4 MA1	Maths Online MA1	Maths Analysis MA1	Maths Analysis SL MA1		Maths Application s 4 MA1	Maths Analysis MA1	Maths Application HL MA3	Maths Online MA1	Maths Application s 4 MA1	
				Maths Application SL MA3	Maths Application HL MA3			Maths Application SL MA3		Maths Application HL MA3	Maths Application SL MA3				Maths Application SL MA3	Maths Application HL MA3							
	Biology BI2	Biology SL4 BI2		Biology HL4 BI2	Biology HL4 BI2	Biology Online BI2	Biology SL2 BI2			Biology Online BI2	Biology HL4 BI2	Biology SL2 BI2	Biology SL4 BI2	Biology Online BI2	Biology SL4 BI2	Biology HL4 BI2	Biology SL2 BI2	Biology Online BI2	Biology HL4 BI2	Biology SL2 BI2	Biology SL2 BI2	Biology SL4 BI2	
			English B HL EN1		English B SL EN1				English B HL EN1	English B SL EN1	English B SL EN1				English B SL EN1		English B SL EN1	English B SL EN1					
	English EN2 English EN3	English Literature SL2 EN2		English EN2 English EN3	English Literature HL EN2	English EN2 English EN3	English Literature SL2 EN2	English EN2 English EN3		English EN2 English EN3	English Literature HL EN2		English EN2 English EN3		English Literature HL EN2	English EN2 English EN3	English Literature HL EN2	English Literature SL2 EN2	English Literature HL EN2	English Literature HL EN2	English EN2 English EN3	English EN2 English EN3	English Literature SL2 EN2
		English Lit Lang SL3 EN3	English Lit Lang HL EN3	English Lit Lang SL1 EN3	English Lit Lang HL EN3	English Lit Lang HL EN3	English Lit Lang SL3 EN3		English Lit Lang SL1 EN3	English Lit Lang SL1 EN3	English Lit Lang HL EN3			English Lit Lang SL1 EN3		English Lit Lang HL EN3	English Lit Lang SL3 EN3	English Lit Lang SL3 EN3	English Lit Lang HL EN3				English Lit Lang SL3 EN3
	Spanish HL1 SP1	Spanish Online SP1	Spanish HL2 SP1		Spanish HL1 SP1	Spanish HL2 SP1	Spanish Online SP1	Spanish HL2 SP1	Spanish HL2 SP1	Spanish HL1 SP1	Spanish Online SP1		Spanish HL2 SP1		Spanish Online SP1	Spanish HL1 SP1			Spanish HL1 SP1		Spanish Online SP1	Spanish Online SP1	
	Spanish Literature SL SP2	Spanish Literature SL1 SP2	Spanish Online SP2	Spanish Ab Inicio SP2	Spanish B SP2		Spanish Literature SL1 SP2	Spanish B SP2	Spanish Online SP2	Spanish Literature SL SP2	Spanish Online SP2	Spanish B SP2	Spanish Literature SL1 SP2	Spanish Literature SL SP2	Spanish B SP2	Spanish Online SP2			Spanish Online SP2	Spanish Ab Inicio SP2	Spanish Literature SL SP2	Spanish Literature SL1 SP2	
Spanish Lit Lang 3 SP3		Spanish Ab Inicio SP3			Spanish Lit Lang 3 SP3	Spanish Lit Lang 3 SP3	Spanish Ab Inicio SP3	Spanish Lit Lang 3 SP3				Spanish Lit Lang 3 SP3	Spanish Lit Lang 3 SP3			Spanish Ab Inicio SP2			Spanish Lit Lang 3 SP3	Spanish Lit Lang 3 SP3			