Element sets for schools 2019

Final analysis

Prof. Stuart Batten, School of Chemistry, Monash University

Background

The year 2019 was declared the International Year of the Periodic Table, and to mark this occasion, and to enthuse and inspire school students about STEM subjects (chemistry in particular), I assembled 'sample sets' of pure chemical elements and distributed to secondary schools all around Australia. What follows is a summary and overview of that project, and its outcomes.

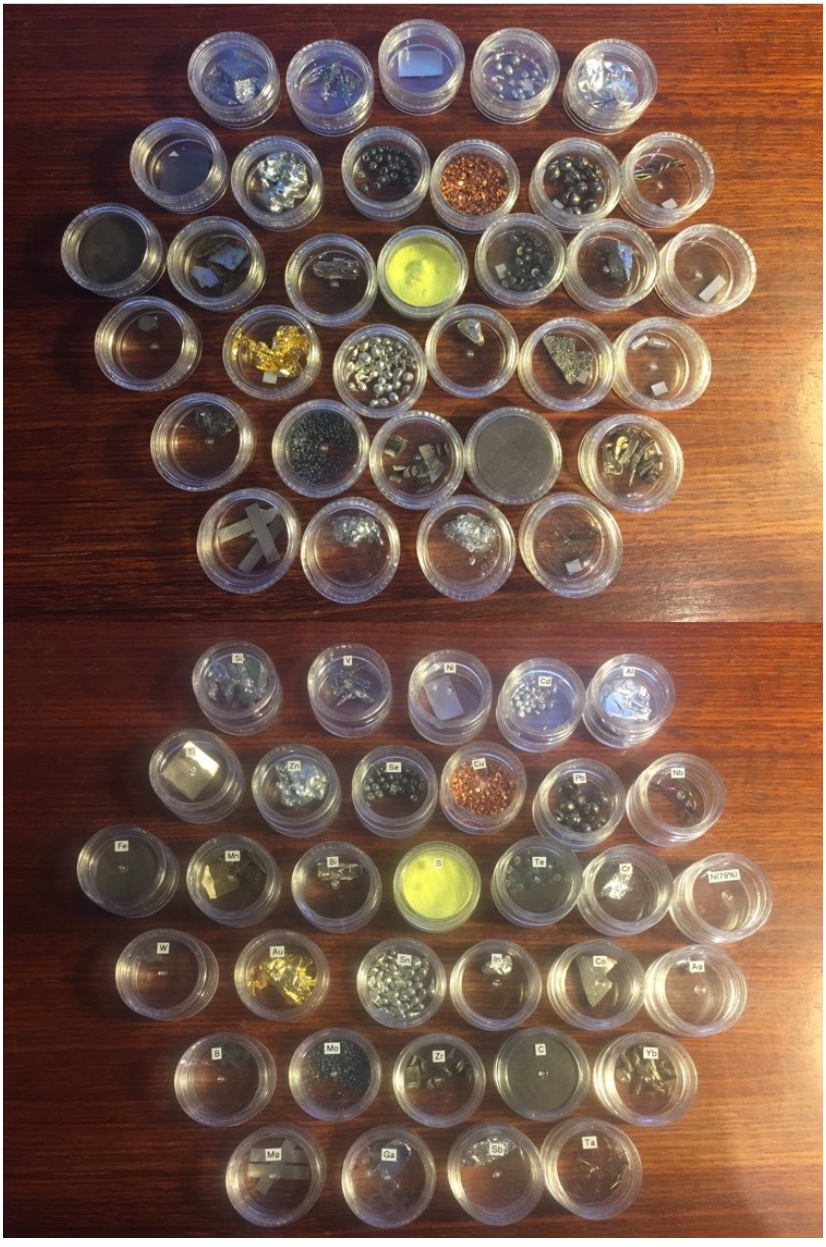
Notably, the sets were given out FREE to schools, and thus the project relied completely on sponsorship and donation of samples, and I am deeply appreciative of the generous sponsors listed below. In all, 600 sets were made and distributed all over Australia, where they will benefit an estimated 50,000 students *per year* (and the sets, if looked after, should be reusable for many years to come).

Set contents & assembly

Each set contained between 30 and 33 samples of pure elements (exact compositions varied from state to state, depending on local advice and regulations). Notably, this was a considerable expansion from the initial plans for 25 elements each. Individual samples in the sets were each contained in their own small, transparent containers to maximise the visibility and interactivity of the samples. The samples themselves were carefully chosen to show a range of physical forms to optimise the collection's visual attractiveness and ability to stimulate students. The containers are also able to be permanently sealed with glue, ensuring safety and longevity of the kits. Highly toxic elements such as arsenic, thallium and mercury were also avoided for safety reasons.

	Group 1 (1A)	Group 2 (2A)	Group 3 (3B)	Group 4 (4B)	Group 5 (5B)	Group 6 (6B)	Group 7 (7B)	Group 8 (8B)	Group 9 (8B)	Group 10 (8B)	Group 11 (1B)	Group 12 (2B)	Group 13 (3A)	Group 14 (4A)	Group 15 (5A)	Group 16 (6A)	Group 17 (7A)	Group 18 (8A)
Period 1	1 H																	2 He
Period 2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
Period 3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
Period 4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
Period 5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
Period 6	55 Cs	56 Ba		72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
Period 7	87 Fr	88 Ra																

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr



In the end, and over the course of several months, almost 20,000 individual samples were separated from the bulk samples and loaded into sample containers, which were then each individually labelled.

Each set also contained a specially written, 36-page booklet describing the properties and applications of each element in the set (as well as a prominent list of sponsors). The samples and booklets were then loaded into containers ready for distribution. Each set was also accompanied by a set of Teachers' Notes with information on safety and upkeep of the set, suggested classroom activities, and other information. This, along with an additional electronic copy of the booklet, were emailed to the schools for easy distribution amongst staff and students.

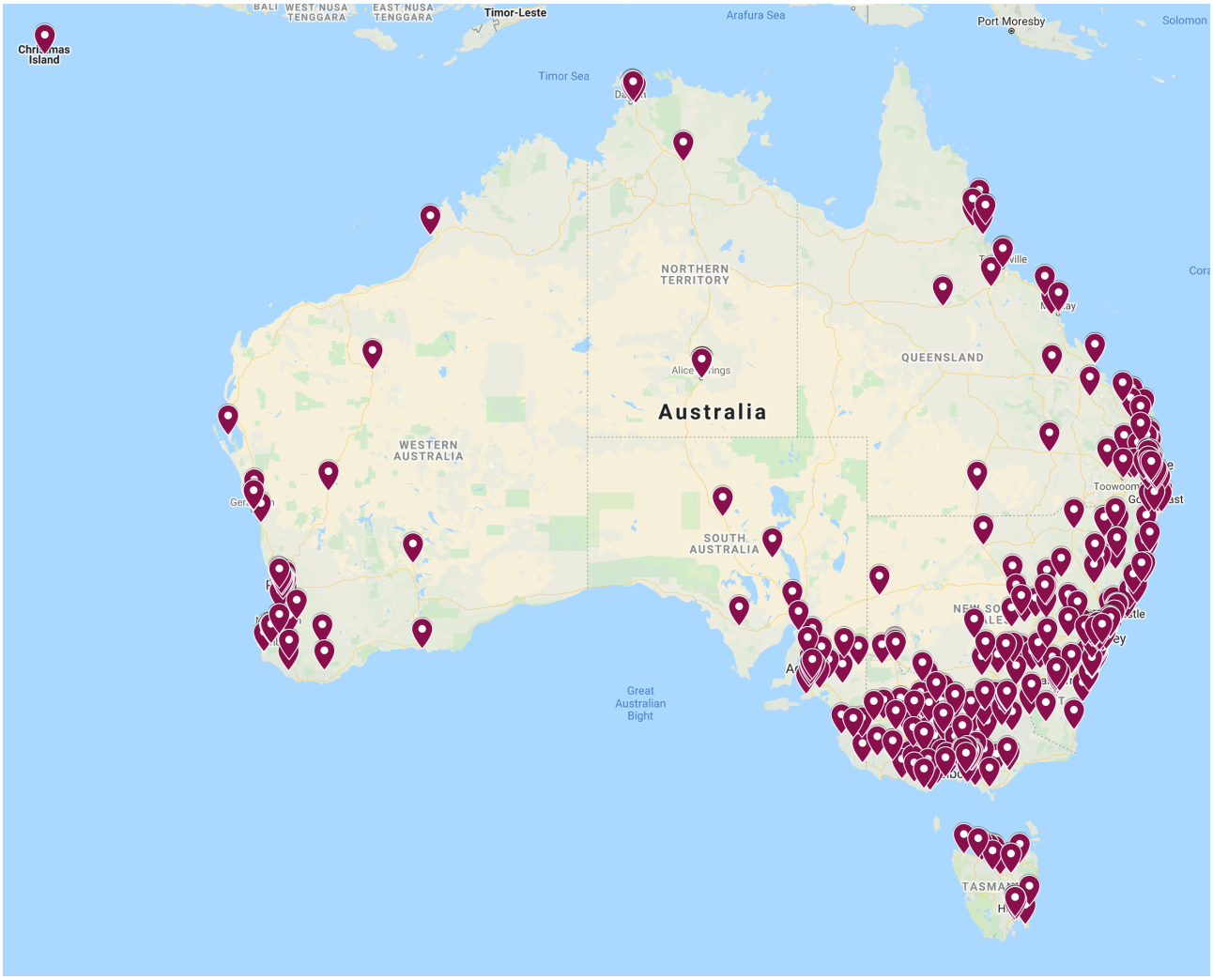
Another important part of the project was the use of social media platforms to engage the community with the project. Regular updates were posted on Facebook, LinkedIn and, in particular, Twitter (under its own hashtag #elementsets). All the photos given here were part of that social media strategy; the attractive visual nature of both the final sets and the process of creating the sets was particularly effective at building engagement. Some links are given later in this document.

Set distribution

To maximise both safety and contextual impact, the sets were offered only to secondary (or combined) schools. The distribution strategy deliberately targeted rural, regional and low SEO public schools, all across Australia. In general, country public schools were given first offer, followed by country private schools, capital-city public schools, then finally city-based private schools, up to the point where the allocated number for that state (based on population) was exhausted. Furthermore, only one set per school was available, to maximise reach and impact. This generally worked very well in getting the sets to schools (particularly remote schools) that usually do not have access to these types of resources; the overall distribution of the 600 sets is shown in the map below. I was particularly pleased whenever I was able to engage with very remote schools in outback WA/SA/Qld/NT and send them a set. Most sets were delivered by post, however I was able to personally deliver a significant number of the Melbourne and country Victoria sets myself.

Two notable exceptions the distribution allocation strategy occurred when some social media posts went ‘viral’ on NSW and Vic chemistry teacher Facebook pages; the latter resulted in me getting, suddenly and without warning, 58 emailed requests in two hours one evening, and

perhaps double that by the next morning! However, despite the general guidelines discussed above, if the schools were not already on my distribution list (via a different contact), I honoured these requests as I knew a set would be going into the hands of an engaged teacher who would make good use of the resource. Another 40 sets were also set aside from the NSW allocation and given to the community engagement people at ANSTO, Sydney. They regularly host school groups who come to visit the facility at Lucas Heights (which includes the nuclear reactor). The intention is to use those 40 sets in a 'lending library' arrangement whereby schools take a set back with them, use in their classroom activities, then return it to ANSTO for the next school to use, thereby increasing the 'reach' of the sets to even more schools.



Ultimately, more than 1300 schools were contacted and offered a set, which represent around half of all secondary (or combined) schools in Australia. Some of the final stats around the distribution are given below.

NT	Contacted	Accepted	%
NT country public	12	6	50.0%
NT country Pvte	11	4	36.4%
NT Darwin public	6	3	50.0%
NT Darwin Pvte	4	3	75.0%
total	33	16	48.5%

Tas	Contacted	Accepted	%
Tas country public	49	17	34.7%
Tas country Pvte	1	0	0.0%
Tas Hobart public	9	5	55.6%
Tas Hobart Pvte	0	0	
total	59	22	37.3%

ACT	Contacted	Accepted	%
ACT country public	0	0	
ACT country Pvte	0	0	
ACT Canberra public	15	5	33.3%
ACT Canberra Pvte	0	0	
total	15	5	33.3%

WA	Contacted	Accepted	%
WA country public	90	18	20.0%
WA country Pvte	28	9	32.1%
WA Perth public	70	28	40.0%
WA Perth Pvte	2	2	100.0%
total	190	57	30.0%

SA	Contacted	Accepted	%
SA country public	57	21	36.8%
SA country Pvte	7	2	28.6%
SA Adelaide public	10	7	70.0%
SA Adelaide Pvte	2	2	100.0%
total	76	32	42.1%

Qld	Contacted	Accepted	%
Qld country public	155	38	24.5%
Qld country Pvte	79	21	26.6%
Qld Brisbane public	76	20	26.3%
Qld Brisbane Pvte	0	0	
total	310	79	25.5%

NSW	Contacted	Accepted	%
NSW country public	250	104	41.6%
NSW country Pvte	26	13	50.0%
NSW Sydney public	54	51	94.4%
NSW Sydney Pvte	8	8	100.0%
total	338	176	52.1%

But...FB, ANSTO:	
NSW country public	5
NSW country Pvte	1
NSW Sydney public	45
NSW Sydney Pvte	7

So NSW %s really....	Contacted	Accepted	%
NSW country public	245	99	40.4%
NSW country Pvte	25	12	48.0%
NSW Sydney public	9	6	66.7%
NSW Sydney Pvte	1	1	100.0%
Total	280	118	42.1%

Vic	Contacted	Accepted	%
Vic country public	132	69	52.3%
Vic country Pvte	24	22	91.7%
Vic Melbourne public	111	80	72.1%
Vic Melbourne Pvte	42	40	95.2%
total	309	211	68.3%

But...FB:	
Vic country public	14
Vic country Pvte	8
Vic Melbourne public	33
Vic Melbourne Pvte	32

So Vic %s really....	Contacted	Accepted	%
Vic country public	118	55	46.6%
Vic country Pvte	16	14	87.5%
Vic Melbourne public	78	47	60.3%
Vic Melbourne Pvte	10	8	80.0%
Total	222	124	55.9%

Overall	Contacted	Accepted	%	% of all sent
Country Public	745	273	36.6%	56.0%
Country Private	176	71	40.3%	13.2%
City Public	351	199	56.7%	26.4%
City Private	58	55	94.8%	4.4%
Country	921	344	37.4%	69.2%
City	409	254	62.1%	30.8%
Public	1096	472	43.1%	82.4%
Private	234	126	53.8%	17.6%
Total	1330	598	45.0%	

Overall w/o FB, ANSTO	Contacted	Accepted	%	% of all sent
Country Public	726	254	35.0%	61.3%
Country Private	167	62	37.1%	14.1%
City Public	273	121	44.3%	23.0%
City Private	19	16	84.2%	1.6%
Country	893	316	35.4%	75.4%
City	292	137	46.9%	24.6%
Public	999	375	37.5%	84.3%
Private	186	78	41.9%	15.7%
Total	1185	453	38.2%	
FB, ANSTO total	145	145		

Feedback

The feedback received from schools and teachers was extremely positive; a number of recipients were genuinely excited when they received them, often showing them off to other teachers in the staff room! Particularly notable was that a number of rural and remote schools commented that they very much appreciated being contacted and offered a set as they are usually completely overlooked in such programs or don't usually have access to these types of resources. This was, personally, perhaps the most rewarding part of the program, and was a pleasing vindication of my distribution strategy, despite the fact that it would have been easier to just target larger schools in capital cities.

The impact of the project can also be measured in a number of other ways. I still get requests for sets, six months after the project finished. A number of schools asked about purchasing additional sets, even though I always specifically explained up front that they were free but that only one per school was available. This all certainly points to a considerable underlying unmet demand for further sets. I also fielded a number of queries on how the sets could be expanded, to include other elements from the periodic table. This is something I had anticipated, and thus I placed clear tips in the Teachers' Notes on how schools might source both samples and containers to expand the range of elements (at their own expense). The ability for schools to expand (or duplicate) the sets was also a key part of the thinking around the initial design of the sets.

Finally, a number of schools took the samples a step further, and designed displays to show off the samples. Some photos of these displays (and the sets in use) are shown below.

Further Information

Links to social media posts on Facebook and LinkedIn are given below; more regular updates were given in real time as the project progressed on Twitter, under the hashtag #elementsets. My contact details are also given below; feel free to contact me if you want any more information about this project or future projects.

https://www.facebook.com/stuart.batten1/posts/10157017020803318
https://www.facebook.com/stuart.batten1/posts/10156717175698318
https://www.facebook.com/stuart.batten1/posts/10156628106938318
https://www.facebook.com/stuart.batten1/posts/10156515559848318
https://www.facebook.com/stuart.batten1/posts/10156343329648318
https://www.facebook.com/stuart.batten1/posts/10156276914803318
https://www.facebook.com/stuart.batten1/posts/10156237952743318
https://www.linkedin.com/posts/stuart-batten-50817974_iypt2019-elementsets-activity-6547025817824833536-i6Cq/

Booklet: https://www.dropbox.com/s/kzq590fiia53ct4/Booklet.pdf?dl=0

Stuart Batten
School of Chemistry
19 Rainforest Walk
Monash University Vic 3800
Australia
stuart.batten@monash.edu
July 2020