

Sciences Curriculum Improvement Cycle

Collaboration Group Day 2

12 June 2025



Full report and analysis

Executive summary

This report captures the detailed output and analysis from the second in-person Sciences Curriculum Improvement Cycle (CIC) Collaboration Group meeting which was held on 12 June 2025 in Glasgow. **A summary version of this report can be accessed via the [event Padlet](#).**

The Collaboration Day 2 event included 108 participants, representing 26 local authorities and key national partner organisations.

This event built on the first Sciences CIC Collaboration Day which was held on 28 November 2024, and also the work of the first Sciences CIC Core Group Workshop which took place over a four-day period from 13 to 16 March 2025.

The aims of Collaboration Day 2 were to:

- Develop a further iteration of the draft 3-18 sciences curriculum rationale
- Develop initial thinking around core knowledge, concepts and big ideas for the 3-18 sciences curriculum.

The Collaboration Group is designed to be representative of Scottish education with approximately 76% of participants being practitioners. The involvement of practitioners helps to ensure that the revised curriculum is grounded in classroom reality, is inclusive of diverse learners, and provides clarity for practitioners.

It is important to note that the CIC process is designed to be iterative and that the activities introduced at Collaboration Day 2 represented an initial pass to establish the thinking of group members in relation to the knowledge, concepts and big ideas for the new curriculum. The day provided a valuable opportunity to get some ideas down on paper which could then be revisited and refined in further detail in the months ahead.

The focus of the Collaboration Group is to support the review of the 3-18 sciences curriculum. It was agreed with the Core Group that Collaboration Day 2 would not afford the opportunity to consider senior phase arrangements for science in the detail required. This is due to the complexity of sciences pathways in the senior phase. A separate focus group was, therefore, held on the 20 June 2025 to consider senior phase matters in greater detail, within the context of a coherent 3-18 curriculum.

A two-day workshop of the Sciences CIC Core Group has been planned for the 28 and 29 August to build on the output from Collaboration Day 2 and to further iterate.

Summary of activities and outputs

The day was built around four sessions as outlined below.

Session	Focus	Table groupings	Key outputs
Session 1	Curriculum rationale	Cross-sector	Each of the 14 groups discussed and annotated the draft rationale that was the output from Core Group Workshop 1 (March 2025). The feedback has helped to develop a further iteration of the rationale.
Session 2	Core knowledge and concept headers	Sector specific	Each of the 14 groups reviewed and annotated curated draft knowledge cards developed during Core Group Workshop 1 (March 2025). Each table then grouped knowledge cards into concepts for their respective sector.
Session 3	Merging of concept headers (one version for each sector)	Sector specific	The tables came together in sector groupings and sought to align and merge their outputs from session 2 to produce one list of concept headers for each sector.
Session 4	Big ideas	Cross-sector	Each of the 14 cross-sector groups grouped concepts into 3–6 overarching big ideas and proposed titles for their big ideas.
Event task	Science – mathematics alignment	Cross-sector	Event participants were asked to add further suggestions to the output from the science and mathematics alignment focus group held on 09.06.25. This captured the key ideas and thinking to ensure the future sciences and mathematics curricula are strongly aligned.

Evaluation	Event review	Cross-sector	Participant feedback was captured on an online evaluation form to inform next steps.
Bike park	Comments and reflections from bike park	Cross-sector	Participant feedback was captured informally on the day through a bike park activity.

Emerging consensus

The day's collaborative outputs indicate emerging consensus around:

- A sciences curriculum rationale which emphasises curiosity, global citizenship, and relevance to real-world contexts
- Anchoring curriculum design in learner equity, inclusion, identity and themes such as sustainability and climate change
- Certain core knowledge, concepts and big ideas.

The structure of the activities in sector grouping allowed us to identify the following emerging sector-specific characteristics when considering the curriculum, particularly in terms of the emphases and what should and should not be included.

Sector	Emphases	Distinctive additions/removals
ASN	Accessibility, independence, safety	Removed abstract theory; added sensory engagement concepts
ELC	Curiosity, play, connection to environment	Removed formal abstractions; added sensory and nature topics
Primary	Breadth with sustainability focus	Added climate change and renewable energy topics
Secondary	Ethical and global perspectives, disciplinary rigour	Added AI, bioethics, systems thinking

The distribution of priorities shows developmental progression. ASN and ELC concentrate on concrete, sensory learning, while primary and secondary emphasise more abstract, systemic, and ethical dimensions. Maintaining coherence between these emphases is critical for a progressive learner journey from early years through to qualification stages.

Next steps

Collaboration Day 2 was positively evaluated with the headlines as follows:

- Of the **79** people who completed the evaluation, **76 (96%)** rated the event as very good or good – with **very good (70%)** and **good (26%)**.

- **74** out of the 79 respondents **(94%)** stated they felt their opinions and suggestions are being heard in the CIC process – with **strongly agree (55%) and agree (39%)**.

The output from Collaboration Day 2 will be further considered by the Sciences CIC Core Group members who are meeting for their second workshop on 28 and 29 August 2025. The Core Group is a sub-set of the Collaboration Group and comprises approximately 30 members of the Collaboration Group.

The Core Group will:

- Further refine the draft **sciences curriculum rationale** using Collaboration Day 2 feedback
- Revisit the output from Collaboration Day 2 to further refine emerging concepts and big ideas.

This work will be supported on an ongoing basis by Education Scotland's Sciences CIC Critical Friends network which includes a wide range of stakeholders including ASN specialists, learners, parents/carers, Academia (FE/HE) and industry stakeholders.

A third Sciences CIC Collaboration Group is being planned for November/December 2025.

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1. Introduction

The Sciences Curriculum Improvement Cycle (CIC) is a collaborative process based on the [Scottish approach to service design](#). The involvement of key stakeholders is designed to ensure Scotland's 3-18 sciences curriculum is coherent, inclusive, future-oriented and meets the needs of learners, educators and parents.

Day 2 of the Collaboration Group, held in Glasgow on 12 June 2025, built on the output from the first Collaboration Group event held on 28 November 2024 and also the four-day Core Group Workshop held between 13 and 16 March.

The purpose of Collaboration Group Day 2 was to:

- Review the draft sciences **curriculum rationale** that had been developed by the Core Group members at the workshop in March 2025.
- Review the **core knowledge** that had been identified by the Core Group and organise these into initial concept headers.
- Idea **overarching big ideas** for the revised sciences curriculum.

Collaboration Day 2 brought together 108 participants from across 26 local authorities, spanning additional support needs (ASN), early learning and childcare (ELC), primary, secondary and community learning and development sectors.

The event structure involved a mix of sector-specific and cross-sector exchanges. This allowed for both quantitative tracking (such as knowledge card retention rates by sector) and qualitative insights into how different education stages interpret and prioritise curriculum aims.

This report summarises the activities and key outputs from the 12 June 2025.

All stimulus materials, participant annotations, knowledge cards, and photographic records are available via the event Padlet: [Sciences CIC Collaboration Group Day 2 12.06.25](#)

Further details and analysis are provided in the appendices.

1.1 Participant overview

A total of 108 participants attended, including 93 practitioners and representatives from STEM partner organisations. The remaining 15 participants were from Education Scotland (ES) and Scottish Government (SG) staff, who attended to support table facilitation. Representation covered 26 of Scotland's 32 local authorities, ensuring geographical diversity and a spread of perspectives. Practitioners comprised 76% of participants, with the remainder representing local authority leads, policy makers, and other strategic stakeholders and partners.

Area	Number
Invited	123
Confirmed	102
Attended (total)	108
Attended (excluding ES & SG)	93
Local authorities represented	26 of 32
Practitioners	76%
Partners	24%

Table 1: Participant overview

The balance of practitioners and strategic leaders created an environment where discussion was rooted in classroom reality while also addressing policy and system-level concerns. The strong local authority spread reduces regional bias and enhances the representativeness of the group's outputs.

The breakdown per sector is show in Table 2 below.

Sector	Number of attendees
ASN	5
ELC	12
Primary	22
Secondary	54
Total	93

Table 2: Overview of participants per sector

Figure 1 below shows the breakdown per table of practitioners and partners for workshop sessions 1 and 4.

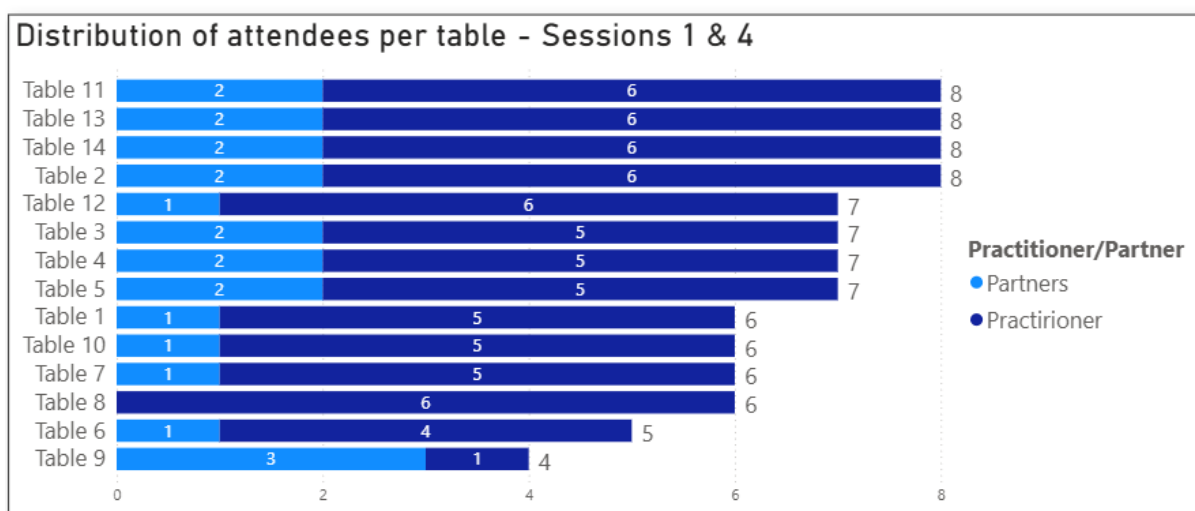


Figure 1: Distribution of attendees per table – Sessions 1 & 4

Figure 2 below shows the breakdown per table of practitioners and partners for workshop sessions 2 and 3.

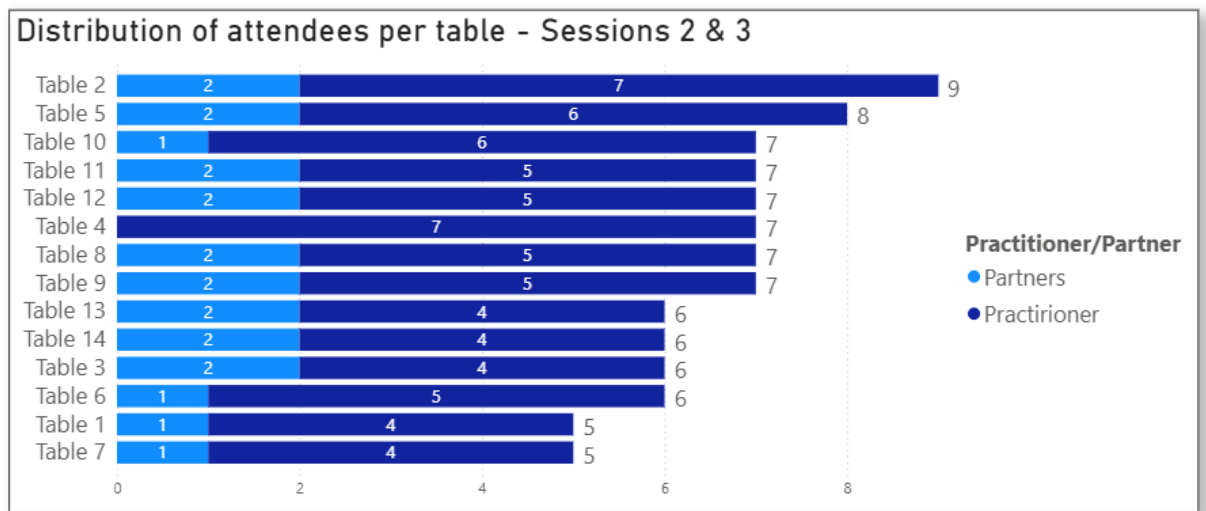


Figure 2: Distribution of attendees per table – Sessions 2 & 3

2. Session 1 – Sciences curriculum rationale

The first session focused on reviewing the draft sciences curriculum rationale. Participants worked line-by-line through the draft rationale text that had been developed by Core Group members at their four-day workshop in March 2025. (See Appendix A for the draft sciences curriculum rationale used during the session).

Participants were asked to work in cross-sector groups to mark statements for *retention*, *rewording*, *merging*, or *removal*. They were encouraged to develop new statements where they felt that gaps existed.

The following provides an overview of the extent to which half or more of the tables suggested the draft text was kept, amended or deleted:

- **61% of the draft rationale text was retained as written**
- **39% of the draft text was either reworded or removed** – *For example, “All learners should enjoy and feel they are good at science” was rephrased as “All learners should enjoy science and feel confident in science.” Groups suggested the word ‘beliefs’ was removed from the statement ‘have secure values and beliefs.’*

Broad agreement existed across tables on the *values and purposes* underpinning sciences education. Participants sought a rationale that is **concise, accessible, and avoids duplication** with the **overarching curriculum rationale**. The mixed-sector table structure ensured that voices from all learner stages were represented, shaping a rationale that balances inclusivity with academic rigour.

Note: In the table below, statements highlighted in red represent text suggested by Education Scotland.

Section of rationale	Line number	Line statement	Feedback
The principles that guide us	1	Science is for everyone. <i>'Saidheans do na h-uile'</i>	All tables either highlighted, agreed, or did not annotate. Gaelic translation has been updated
	2	All learners should enjoy and feel they are good at science	• 10 of 14 tables reworded this statement, specifically 'feel they are good at science'. • 3 tables suggested it be removed. • 2 tables suggested rewording with the word 'confidence'. • 2 others suggested 'access'.
	3	Science learning should be connected to real-life issues and the world of work	• 6 of 14 tables reworded, specifically the word 'issues'. • 5 groups highlighted/agreed. • 2 tables replaced the word 'issues' with 'contexts'.
	4	Science provides solutions to help us build a better world	7 of 14 tables either highlighted, agreed, or did not annotate this statement.
What should learning in science feel like?	5	Learning in the sciences inspires a sense of curiosity, awe, fascination and wonder about our world and the universe.	2 of 14 groups suggested this was too many words and both highlighted 'wonder' as the preferred option to keep.
	6	Through science, learners will have fun, discover exciting new things and experience joyful learning.	• 7 of 14 groups reworded this sentence - specifically the words 'will' and 'joyful'. • 2 groups replaced 'will' with 'have opportunity to'. • 2 replaced 'joyful' with 'meaningful'.
	7	They should feel a sense of connection and belonging to science. Learning should build on what learners already know.	None of the groups suggested amendments, other than running the sentences together.
	8	It should encourage them to challenge themselves and deepen their knowledge.	2 of 14 groups reworded (and did so differently).
What we want for learners in science	9	Learning about science helps learners to develop the four capacities and to be: • curious, creative, analytical, inventive and adaptive	8 of 14 tables did not annotate or highlight.

	10	ethical and well-informed	8 of 14 tables did not annotate or highlight.
	11	have secure values and beliefs	7 of the 14 groups suggested either rewording (3 groups) or removing (4 groups). Specifically, around 'beliefs'.
	12	committed to equality, diversity and justice	8 of 14 groups did not annotate or highlighted this statement. 3 groups questioned whether this is specific to science/placement in this section.
	13	global citizens committed to Learning for Sustainability	9 of 14 groups did not annotate or highlight. 1 group suggested it should be higher on the list.
	14	hopeful and resilient	7 of 14 groups suggested rewording. 3 groups questioned the word hopeful - is it open to interpretation? 5 groups suggest merging with bullet point below.
	15	empowered to take action to shape a better future.	5 of 14 groups suggested merging with previous bullet point.
Through science, learners should be able to	16	understand the big ideas of science.	8 of 14 groups suggested rewording or moving. 2 groups replaced 'understand' with 'explore'. 3 groups questioned 'big ideas' and 2 replaced this with 'core concepts'.
	17	recognise the impact that science makes on their lives, wellbeing, the environment, their community and world.	10 of 14 groups either did not annotate or highlight this.
	18	communicate, collaborate, question, inquire, investigate, innovate, iterate and discover.	10 of 14 groups suggested removing (4 groups) or rewording/shortening.
	19	develop creative solutions to real world issues.	9 of 14 groups either did not annotate or highlight this statement.
	20	develop skills for learning, life and work, including practical science skills and transferrable skills.	9 of 14 groups either did not annotate or highlight this statement.

	21	accurately use scientific language, formulae and equations.	9 of 14 groups either did not annotate or highlight this statement.
	22	recognise the contribution of many cultures and peoples, past and present, to scientific discovery.	11 of 14 groups either highlighted, starred, or did not annotate this statement.
	23	feel a sense of belonging in science and promote a science and STEM for all approach.	9 of 14 groups reworded or removed this statement (or parts of it). 3 groups questioned if STEM would feature in other curricular areas' rationale statements.
	24	develop a love for the natural world and desire to protect it for future generations.	9 of 14 groups either did not annotate or highlight this statement.
	25	take action locally and globally, especially relating to the climate and nature emergencies.	7 of 14 groups suggested rewording this or combining with other statements. 2 groups suggested removing 'emergencies'.
	26	understand how science builds knowledge we can trust.	7 of 14 groups suggested rewording. 2 groups used the term 'bias'.
	27	use the science they have learned to progress into a wide range of pathways and careers.	10 of 14 groups highlighted or did not annotate this statement. 2 groups highlighted that this could be combined with bullet 5 to make this more succinct.
A partnership approach	28	Families, communities, employers and partner organisations play a vital role in supporting learning in science and building science capital.	7 of 14 groups did not annotate. 3 groups suggested science capital is defined.

Table 3: Curriculum rationale overview of feedback

In addition to the specific annotations noted above, there were other points worth noting.

- 9 of the 14 tables** attempted to combine various bullet points to make the document more concise. Table 13 specifically stated that they felt the statement was too long, and that efforts should be made to reduce the length for the benefit of primary colleagues who will have eight rationale documents to consider.
- 5 of the 14 tables** made reference to aspects of the rationale they felt were too generic, and not necessarily specific to science. It was suggested by group 14 that a separate overarching curriculum rationale be created, allowing for this to be a more succinct, science-specific rationale statement.

The review of the draft sciences curriculum rationale highlights both the strength of shared values across sectors and the importance of refining the language to ensure clarity, inclusivity, and purpose. While much of the rationale was endorsed, participants emphasised the need for concise, accessible statements that balance ambition with practicality and avoid duplication with the overarching curriculum rationale. This collaborative process has reinforced the central role of science in inspiring curiosity, fostering critical thinking, and preparing learners to engage meaningfully with the world. The feedback gathered provides a strong foundation for finalising a rationale that is both aspirational and grounded, supporting learners to thrive as informed, ethical, and empowered global citizens.

3. Session 2 – Core knowledge and concepts

This session was split into two main tasks:

Task 1: Participants were asked to work with a set of knowledge cards (96) and were asked to retain, remove, modify or added knowledge cards to fill gaps.

Task 2: Participants were asked to group the knowledge cards into themes and create concept headers.

In this session, participants worked with **a range of cards outlining key knowledge that could potentially be included in the revised sciences curriculum**. These knowledge cards had been generated by the Sciences CIC Core Group at their four-day workshop in March 2025. As with other activities, these knowledge cards were intended as a ‘starter’ for ten to support initial thinking and discussions.

In addition to the 62 knowledge cards generated by the Core Group, a further 34 had been refined/added which included some suggested by the Education Scotland team following a gap analysis that had been conducted in the intervening period. These were clearly marked for transparency and had been drawn from a review of PISA 2025 Framework, Learned Society reports and international curricula. Each sector worked in groups to review the cards and decided which to retain, remove or modify. Groups were given the option of adding additional knowledge cards to address any identified gaps. Cards were then grouped under provisional concept headers to identify thematic clusters.

On the day participants were grouped into 14 sector groups with the breakdown being ASN (1 table), ELC (2 tables), Primary (3 tables), and Secondary (8 tables). At the start of the session, each table was issued with the same set of 96 knowledge cards (62 generated by the Core Group + 34 refined/added). Through retaining, modifying, removing and adding cards, the combined set of knowledge cards expanded to **165 cards** by the end of the activity – evidence of both consolidation of fundamentals and thoughtful extension into contemporary themes. A full listing of the knowledge cards retained, modified and added are shown in Appendix B.

How to read the lists below: “Number of tables” = how many of the 14 sector-based tables retained/removed that card. Because there are more secondary tables than other sectors, high totals often reflect broad consensus across sectors plus a high rate of selection by the secondary sector tables.

In the tables and analysis below, the following definitions have been used:

- *Retained* = cards kept from the original 96-card set.
- *Added* = new cards created during the activity (Knowledge card numbers 97 and above).
- *Modified* = cards kept but adapted (e.g., marked “b”, “c”, “d” suffix) to suit sector needs.
- *Removed* = cards removed from the selection to indicate an initial first pass and these may need to be reviewed in future iterations.

3.1 Analysis of activity – retained and removed cards

The table below provides an overview of the percentage of cards that were either retained, removed or added by each sector. (A full listing is shown in Appendix C).

Sector	Retained	Removed	Added
ASN	38%	61.5%	0.5%
ELC	80%	15%	5%
Primary	85%	10%	5%
Secondary	92%	6%	2%

Table 4: Knowledge card retention and removal

The breakdown per table is shown below.

Sector	Table	Number of knowledge cards retained	Number of Core group cards retained	Number of refined and added knowledge cards retained - the asterix cards	Number of modified cards	Number of cards added	Number of knowledge cards removed
ASN	Table 1	37	19	3	13	2	61
ELC	Table 13	80	56	24			16
ELC	Table 14	63	45	17		1	33
Primary	Table 2	64	42	18	2	2	31
Primary	Table 3	58	45	13			38
Primary	Table 4	44	31	13			36
Secondary	Table 10	71	36	24	4	7	26
Secondary	Table 11	85	48	26	4	7	16
Secondary	Table 12	53	19	21	9	4	42
Secondary	Table 5	79	45	31		3	20
Secondary	Table 6	86	53	32		1	12
Secondary	Table 7	79	44	31	3	2	18
Secondary	Table 8	64	35	29			35
Secondary	Table 9	80	47	28	4	1	13

Table 5: Knowledge card distribution per table and sector

The table below shows the knowledge cards most commonly retained by the groups.

Cards marked by an * indicate those that were retained by at least one table in ASN, ELC, primary, and secondary.

Knowledge card number	Knowledge card title	Number of tables that retained the knowledge card
43	Friction	14/14
32	Properties and uses of materials	14/14
5	Ecosystems	13/14
24	Heat and temperature	13/14 *
41	Sound	13/14 *
29	(Chemical) reactions	12/14 *
12	Biodiversity	12/14 *
67	Energy transfer	12/14 *
35	Gravity	12/14 *
19	Human impact on the environment	12/14
34	Light	12/14 *
44	Magnetism	12/14 *
90	Motion	12/14 *
57	Organ systems (various)	12/14

22	Response to climate change	12/14
74	Space exploration	12/14
52	Disease	11/14
64	Elements, mixtures and compounds	11/14
49	Ethics	11/14
53	Future pathways	11/14
88	Global contributions to scientific thinking	11/14
77	Non-renewable energy	11/14
66	Physical and chemical changes	11/14
25	Renewable energy	11/14
93	Risk assessment and safety	11/14 *

Table 6: Most commonly retained knowledge cards

The table below shows the knowledge cards that were most commonly removed and do not include any modifications. Any modified cards are not counted in this table and are reviewed in the main report. The table is not an exhaustive list and only shows the top number of cards removed. (See appendices D and E for further details).

Knowledge card number	Knowledge card title	Number of tables that removed the knowledge card	Most common rationales (summarised from table notes)
17	Rock cycle/erosion	12/14	Typically classed as Geography/ rather than core science; sometimes context, not core knowledge.
85	Earth science and geology	10/14	Often routed to Geography; some tables noted too abstract/conceptual for a broad BGE curriculum.
68	Radiation	8/14	Frequently flagged too advanced for broad BGE curriculum and/or lacking accessible context. (Sectors ASN, ELC and primary)
27	Carbon cycle	7/14	Mixed reasons: too abstract for earlier phases; sometimes duplicate/covered elsewhere. (Sectors ASN, ELC and primary).
71	DNA	7/14	Commonly considered too advanced/not stage-appropriate across early/middle phases. (Sectors ASN, ELC and primary).
10	Emotional wellbeing, resilience & mental health	7/14	Routed to Health and Wellbeing (HWB) or Personal and Social Education (PSE) rather than core science content.
38	Evolution	7/14	Mixed: some saw it as too advanced or overlapping with inheritance strands.
8	Food and drink	7/14	Often treated as HWB/Home Economics (context is not core science knowledge).

58	Genetics	7/14	Frequently seen as too advanced/too abstract for core knowledge.
21	Horticulture	7/14	Seen as contextual/duplicate or too niche for the national core.
76	Resistance	7/14	Typically, too advanced/specialised for broad BGE curriculum coverage.
63	Robotics	7/14	Sometimes seen as technology/engineering context without a clear science knowledge focus.
45	Seasons	7/14	Some tables sighted that this knowledge is appropriate at ELC and primary stages.
39	Space and planets	7/14	Some tables sighted that this knowledge is appropriate at primary stages.
47	Types of electrical circuits	7/14	Seen as not relevant or abstract for some sectors such as ASN and ELC.
16	Water cycle	7/14	Mixed response sighting that this knowledge is appropriate at primary stage. Additionally, a few tables felt that it could be covered in Geography.

Table 7: Most common removed knowledge cards with rationale

Removals cluster around content judged non-core to science (e.g., Geography/HWB contexts) or too advanced/abstract to be considered core knowledge to support progression in learning from 3-18 years.

There are 19 cards that were removed in every sector (at least one ASN, ELC, Primary and Secondary table removed them), led by Rock cycle/erosion (card 17) and Earth science and geology (card 85).

3.2 Activity analysis – added and modified cards

An additional 31 knowledge cards were created and added by the groups (in the text below these cards are numbered 97 and upwards). The sectors created additional cards as follows: ASN (2), ELC (1), Primary (2), Secondary (26).

A total of 38 cards were modified. In the tables below these are denoted with suffixes like *b/c/d* or “Modified card”. The sectors modified the following number of cards: ASN (13), ELC (0), Primary (2), Secondary (23).

Additions largely respond to currency/relevance and clarity of physics concepts, with most proposals emerging from secondary tables. Examples include:

- Knowledge card number 97 — Workplace applications
- Knowledge card number 98 — Movement between states of matter
- Knowledge card number 124 — Electricity (circuits)

- Knowledge card number 119 — Speed, distance and time
- Knowledge card number 118 — Chemical energy
- Knowledge card number 117 — Sources of energy (renewable and non-renewable)
- Knowledge card number 116 — Science in the media
- Knowledge card number 115 — Social justice and taking action.

Note: New cards typically begin in the table/sector that authored them, so initial retention counts are (by design) low. They now need quality assurance to decide which migrate into the national core vs. remain as optional/extension.

Modifications were made for a variety of reasons: simplifying language, clarifying scientific terms, and making safety and practical usage explicit — with the largest volume of edits in ASN and secondary. Examples include:

- Knowledge card number 3b — Plants and photosynthesis (retained by 2 tables): clarifies photosynthesis link to “Plants”.
- Knowledge card number 62b — Use of technology in science (1): reframes as application of tools rather than a general “technology” context.
- Knowledge card number 66b/c — Physical & chemical changes / Potions & sensory play (1 each): merges scope, emphasises concrete investigation contexts.
- Knowledge card number 75b/c — Types of energy (stores/transforms; heat/light/sound) (1 each): clarifies energy store language and observable forms.
- Knowledge card number 76b — Forces instead of resistance? (1): redirects “resistance” into the broader forces line to avoid premature specialism.

The rationale given for adding cards was to create a future-orientated knowledge base (e.g., media literacy, justice/action, workplace) or to clarify building blocks for all areas of science. (e.g., circuits, speed–distance–time).

Cards were modified to ensure core ideas are clear, teachable, and developmentally appropriate, with ASN edits demonstrating how accessibility can be embedded without losing disciplinary integrity. These are initial thinking from individual tables and is a starting point.

3.3 Sector-specific insights (from sector-based tables)

Table 8 below shows some sector insights regarding knowledge card retention, additions and modifications to the cards and rationale for card removals. These are only some examples.

Sector	Retention pattern	Additions and modifications	Removals
ASN	Favoured practical, concrete knowledge.	Sensory and daily-living science concepts. Using AI, weather and seasons	Removed abstract and complex theories.
ELC	Focused on nature and environment.	Water	Removed high-level topics (e.g., genetics).

Primary	Balanced mix across disciplines.	Electricity (circuits), The Ocean	Removed niche, advanced content.
Secondary	Kept core knowledge and some more complex topics.	Plants and photosynthesis, Future energy security, Climate, Periodic table	Minimal removals, mainly language edits.

Table 8: Sector specific insights

Overview – ASN (1 table)

ASN retained 37 cards (38%), added 2, and modified 13 for accessibility and developmental appropriateness. Higher removals (61.5%) reflect a focus on concrete, sensory-based learning experiences tailored to individual learner needs. Focus on **concrete, sensory-rich fundamentals**. High **modification** rate (**13**) shows deliberate wording changes for accessibility and developmental appropriateness. **2** additions extend relevance to daily life and safety.

Overview – ELC (2 tables)

ELC retained 80% of cards, with small additions linked to environmental and sensory exploration. Strong retention of **immediate-experience** concepts (materials, light/sound, plants, habitats) and **safety**. Few modifications or additions at this stage; advanced molecular/genetic topics are excluded as **not developmentally appropriate**.

Overview – Primary (3 tables)

Primary retained 85%, reflecting a balance between breadth and age-appropriate depth, and added content connected to local contexts. Broad retention across **ecosystems, energy/heat, forces, reactions**. Limited modifications (**2**) and additions (**2**) and identifying some knowledge cards that are applicable to **HWB/Geography** contexts.

Overview – Secondary (8 tables)

Secondary retained 92%, making only minor removals and additions, signalling strong alignment with the full set and preparation for qualifications. High retention of **disciplinary fundamentals** and the **majority of additions (25)** to clarify science/mathematics interfaces and contemporary applications. Modifications (**2**) sharpen terminology and progression towards qualifications.

3.4 Concept headers – Cross-sector insights

Once groups had finalised their selection of knowledge cards, they were asked to cluster knowledge cards into concept headers to show how disciplinary knowledge might be structured into thematic categories. Across all sectors, groups generated a total of **97 concept headers**, with **88 unique distinct concept headers** which reveal both commonalities across ELC, primary, secondary, and ASN sector-specific emphases that reflect developmental stages and learner needs. Table 11 below shows the number of concept headers per table.

Appendix F shows the concept header and knowledge card numbers per sector and table.

Appendix G shows the concept headers per table and knowledge card.

Appendix H shows concept header and knowledge mapping per table.

Sector	Table	Number of Concept headers
ASN	Table 1	7
ELC	Table 13	9
ELC	Table 14	4
Primary	Table 2	7
Primary	Table 3	5
Primary	Table 4	5
Secondary	Table 10	5
Secondary	Table 11	5
Secondary	Table 12	10
Secondary	Table 5	11
Secondary	Table 6	9
Secondary	Table 7	10
Secondary	Table 8	10
Secondary	Table 9	11

Table 9: Number of concept headers per table

Themes and patterns

- **Core scientific domains:** Recurring headers across sectors include *Forces*, *Energy*, *Living things*, *Materials*, *Earth & space*, and *Being scientific*. These reflect fundamental disciplinary anchors.
- **Societal & applied science:** Especially in secondary and primary, headers such as *Sustainability*, *Climate literacy*, *Science in society*, and *Technology* emphasised real-world applications.
- **Learner-centred & experiential concepts:** ASN and ELC frequently generated concept headers such as *Living independently*, *Cause and effect*, and *Senses +*, reflecting accessibility and relevance to daily life.
- **Interdisciplinary & identity-focused headers:** Themes such as *Science identity* and *Being a scientist*, emerged particularly in secondary, highlighting equity, the scientific method and identity.

Examples of concept headers generated by each sector grouping

- **ASN:** *Living independently*, *Senses +*, *Materials*, *Future*, *Forces*.
- **ELC:** *Cause & effect*, *Food & drink*, *Our world*, *Interconnections*, *Technology*.
- **Primary:** *Living and growing*, *Energy and forces*, *Our Universe*, *Our scientific environment*, *Science of science*.

- **Secondary:** *Chemical & physical changes, Circuits, Energy & vibrations, Life on Earth, Science & society, Climate literacy, Human health.*

These examples illustrate the progression from sensory and experiential framing (ASN/ELC), through breadth of natural and social systems (Primary), to specialised and abstract disciplinary structures (Secondary).

Working in sector-based tables surfaced genuine sector preferences while still revealing strong cross-sector agreement on fundamental disciplinary ideas.

4. Session 3 – Concept header alignment

After knowledge cards were grouped into concepts in Session 2, the specific sector tables were brought together to review collectively their concept headers for clarity, distinctiveness, and sector relevance. Groups were invited to:

- Merge overlapping or duplicate headers.
- Rename vague or overly broad headers.

This process aimed to distil multiple versions of concept headers for each sector into a single set of sectoral concept headers.

The table below shows the change in the number of concept headers as sectors worked collaboratively to review the concepts generated within each of the individual sector groups.

- Note 1 that the number of concept headers pre-merge are a total count from all of the sector specific tables.
- Note 2 There was only one table for ASN. The ASN participants joined other sectors and took part in the alignment process with the other sectors.

Sector	Number of concept headers pre-merge	Number of concept headers post-merge
ASN	7	-
ELC	13	4
Primary	17	15
Secondary	60	16

Table 10: Concept header reduction

The information captured during this session is shown in Figure 11 below.

ASN	ELC	Primary	Secondary
Delivery and key elements	How things work	The Universe - Planet Earth - Beyond Planet Earth - Science for climate change & sustainability	Role of science in society / Being scientific
Forces	Science identity	Life - Living things - Ecosystems - Interdependence	Living and growing / Living organisms
Future	Living things	Energy & forces - Cause & effect - Movement	Sustainability / Climate

Living independently	Our world	Becoming a scientist - Skills - Society - Equity and equality	The environment / ecosystems
Materials			Matter and its interactions / Chemical changes
Plants			Energy
Senses+			Forces
			Being a scientist
			Material Science
			Physical Science
			Life Science
			Science of sustainability
			Community
			Body
			Home
			World & Universe

Table 11: Aligned concept headers

Insights

- During this session the participants in sector groups aligned the 97 concept headers from the output of session 2 to create a final listing of 35 concept headers.
- All sectors achieved a reduction in total headers, streamlining the number without significant content loss.
- Several headers (e.g., *Sustainability*) appeared in multiple sectors, signalling opportunities for cross-stage progression.

- Some headers remained sector-specific, reflecting distinct learning priorities – these will need careful sequencing in the national framework.

Sector-specific themes

ASN (Additional support needs)

ASN sector was only one table and had agreed their concept headers as part of Session 2 Task 2. During Session 3 the participants at the ASN sector table took part in discussions with other sector groupings.

ELC (Early learning and childcare)

The ELC concepts centre around early curiosity, observational learning, and social-emotional connections to the environment and community. There is a strong foundation for fostering *science identity* early, emphasising exploration, inclusivity, and sensory experiences.

Primary sector

Primary education builds on curiosity by introducing conceptual frameworks – how things work, where we are in the Universe, and basic causal reasoning. Notably, climate change and sustainability are referenced.

Secondary sector

Secondary education reflects a more formalised structure, aligning closely with disciplinary strands. The inclusion of *Being a scientist* alongside content headers suggests a dual focus on knowledge acquisition and understanding of how science works.

5. Session 4 – Big ideas

In session 4, participants were invited to work in mixed sector groups to cluster concepts together into 3 to 6 themes, or big ideas. These were designed as overarching thematic statements that:

- Establish what we want learners to understand.
- Connect multiple science concepts under a unifying theme.
- Allow for progression across the 3 –18 learning journey.

A total of 49 distinct big ideas were identified.

- These big ideas were connected to 35 concept headers after the alignment process in session 3. (Note: These 35 concept headers were created from a total of 97 concept headers.
- The top three big ideas (i.e., in terms of those with the most concept headers listed underneath them):
 - How things work – 11 headers across all sectors.
 - Living things – 11 headers (heavily represented in primary).
 - Being a scientist – 11 headers across all sectors
- Analysis of the findings shows a clustering of suggestions around a further two big ideas, broadly framed as: Our world and beyond; and Sustainable futures.

A mapping of big ideas, concepts and emerging themes is shown in Appendix I.

Points to note:

- Cross-sector continuity: Several big ideas are carried from ELC to Secondary, such as *How things work*, *Living things*, and *Being a scientist*, enabling progressive learning.
- Thematic variety: Big Ideas range from concrete (e.g., *Materials*, *Movement*) to conceptual (e.g., *Science identity*, *Sustainability*).
- Under-developed ideas: A few big ideas (e.g., *Interactions*, *Energy and forces*) have only 1 concept header, suggesting a need for enrichment.
- Clarification: Some ideas with similar meanings are spread across different labels (*Our planet*, *Our unique world*), which could be merged or clarified.
- *Sustainability* emerged as the only theme in *Our living planet*, *Sustainability*, *Climate literacy* and *Looking after our planet* which was present across all sectors, suggesting its importance as a theme within the sciences rationale.

6. Science – mathematics alignment

Prior to Collaboration Day 2, Education Scotland organised a focus group of practitioners from various sectors and STEM subjects to discuss the alignment of science, mathematics and also technologies curriculum areas. This involved an online discussion which was held on 9 June 2025. The session invited practitioners to identify areas where alignment of these curriculum areas could be improved as we progress into a revised curriculum.

The notes from the focus group were captured and analysed and displayed on the wall in the Collaboration Day 2 venue. Over the course of the day, practitioners were invited to review the list informally and annotate it to suggest additions and amendments.

Five main overlap areas were consistently noted across sectors:

1. Graphing and data interpretation – including reading, plotting, and analysing graphs.
2. Measurement and scale – using appropriate units and conversions.
3. Number sense and proportional reasoning – ratios, percentages, and scaling.
4. Algebraic reasoning in scientific formulae – particularly relevant in physics and chemistry.
5. Sequencing and ordering – essential for experimental design and data organisation.

The table below provides sector-specific observations.

Sector	Observations & needs
ASN	Explicit, scaffolded links between maths skills and science applications. Consistency in terminology benefits all learners but is especially critical for ASN groups.
ELC	Introduce measurement concepts through play-based activities.
Primary	Sequence science content to match numeracy development.
Secondary	Coordinate advanced calculations with concurrent maths topics.

Education Scotland has compiled the detailed feedback from this activity and will use it in the months ahead to guide developments and to support coherence across these curriculum areas. See Appendix J for further details.

7. Evaluation overview

Of the 93 participants (practitioners and partner representatives) that attended the event, there were 79 completed evaluation forms (**84.9%** response rate). The evaluation showed very high participant satisfaction with 100% of respondents indicating that they wanted to remain in the Collaboration Group.

- Of the **79** people who completed the evaluation, **76 (96%)** rated the event as very good or good – with **very good (70%)** and **good (26%)**.
- **74** out of the 79 respondents (**94%**) stated they felt their opinions and suggestions are being heard in the CIC process – with **strongly agree (55%)** and **agree (39%)**.
- **73** out of the 79 respondents (**92%**) stated they trust the Sciences CIC process – with **strongly agree (52%)** and **agree (40%)**.

Sector insights

- ASN & ELC: Valued accessibility of discussion formats and the concrete, hands-on activities.
- Primary: Appreciated the use of tangible resources and clear links to practice.
- Secondary: Valued the disciplinary challenge and science – mathematics alignment task.

Evaluation questions

The evaluation form asked the following questions:

- Question 1: Data consent questions
- Question 2: Please state your name
- Question 3: Please confirm your email address
- Question 4: Are you interested in still being part of the Sciences CIC Collaboration group?
- Question 5: Would you be interested in being part of a focus group to look at senior phase?
- Question 6: Which sector do you work in?
- Question 7: Overall, how would you rate the quality of the event?
- Question 8a: I feel that my opinions and suggestions are being heard and included in the Sciences Curriculum Improvement Cycle
- Question 8b: I trust the Sciences Curriculum Improvement Cycle process to deliver better outcomes for learners in Scotland?
- Question 9: Please provide more details or suggestions with regards your answer to question 8
- Question 10: What aspect(s) of the event did you find most valuable?
- Question 11: What could we do to improve future events?

Participation and trust in the process

- Participants generally **felt heard and included**, with a majority (**94%**) agreeing that their opinions were valued within the CIC process. (Question 8a: I feel that my opinions and suggestions are being heard and included in the Sciences Curriculum Improvement Cycle)

- Participants have trust in the Curriculum Improvement Cycle as a mechanism for delivering better learner outcomes in Scotland was high **(92%)** (Question 8b: I trust the Sciences Curriculum Improvement Cycle process to deliver better outcomes for learners in Scotland?)

Comparison from Collaboration Day 1 and Day 2 evaluations

Evaluation statements	Collaboration Day 1 (28.11.25)	Collaboration Day 2 (12.06.25)
I feel that my opinions and suggestions are being heard and included in the Sciences Curriculum Improvement Cycle	100%	94%
I trust the Sciences Curriculum Improvement Cycle process to deliver better outcomes for learners in Scotland?	100%	92%

Trust remains high, suggesting broad endorsement of the direction and structure of the Sciences CIC process.

8. Next steps

Collaboration Day 2 has provided a great deal of insight and analysis to guide the next steps of the Sciences CIC Process. Similarly, the Sciences CIC Senior Phase Focus Group, which was held on 20 June, following Collaboration Day 2, also proved to be a fruitful and productive meeting. This provided the opportunity to look at the high-level findings from Collaboration Day 2 through a senior phase lens to see if they would be compatible with this stage in the learner journey.

Sector summaries are contained in Appendix K.

The detailed findings from both events will form the basis of the two-day Sciences CIC Core Group Workshop taking place on 28 and 29 August 2025. The focus for this Core Group workshop will be to further iterate the draft sciences curriculum rationale and to do more detailed work on the concepts and big ideas. The target is for a refined draft of the sciences big ideas to be published by October 2025 to allow for wider consultation with networks and stakeholders.

Core Group members will likely meet again to look in more detail at curricular knowledge before the Collaboration Group reconvenes again in December 2025.

In June 2025, Scottish Government published a [timeline for the CIC process](#) setting out key dates and milestones. This document sets a timeline for the draft evolved curriculum technical framework for the sciences curriculum to be published in June 2026.

If you have any questions about the Sciences CIC process, then please contact Education Scotland's Sciences Team on email: science@educationscotland.gov.scot

Appendices

Appendix A – 3-18 Sciences curriculum - Draft rationale Version 3 10.06.25

The draft Sciences 3-18 curriculum rationale is version 3 is shown below. This draft rationale was reviewed by the Collaboration Day 2 attendees and the following analysis highlights the feedback.

Draft rationale

- ❖ *Text in black captures the suggestions from the draft rationales produced by the Sciences CiC Core Group.*
- ❖ *Text in red has been suggested by EdScot Sciences Team.*
- ❖ *Aiming for 400 words max – keep language simple and accessible.*

The principles that guide us

- Science is for everyone. ‘Saidheans do na h-uile’.
- All learners should enjoy and feel they are good at science.
- Science learning should be connected to real-life issues and the world of work.
- Science provides solutions to help us build a better world.

What should learning in science feel like?

Learning in the sciences inspires a sense of curiosity, awe, fascination and wonder about our world and the universe. Through science, learners will have fun, discover exciting new things and experience joyful learning. They should feel a sense of connection and belonging to science. Learning should build on what learners already know. It should encourage them to challenge themselves and deepen their knowledge.

What we want for learners in science

Learning about science helps learners to **develop the four capacities and to be:**

- curious, creative, analytical, inventive and adaptive
- ethical and well-informed
- **have secure values and beliefs**
- committed to equality, diversity and justice
- global citizens committed to Learning for Sustainability
- **hopeful** and resilient
- empowered to take action to shape a better future.

Through science, learners should be able to

- understand the big ideas of science.
- recognise the impact that science makes on their lives, wellbeing, the environment, their community and world.
- communicate, collaborate, question, inquire, investigate, innovate, iterate and discover.
- develop creative solutions to real world issues.
- develop skills for learning, life and work, including practical science skills and transferrable skills.
- accurately use scientific language, formulae and equations.
- **recognise the contribution of many cultures and peoples, past and present, to scientific discovery.**
- feel a sense of belonging in science and promote a science and STEM for all approach.
- develop a love for the natural world and desire to protect it for future generations.
- take action locally and globally, especially relating to the climate and nature emergencies.
- understand how science builds knowledge we can trust.
- use the science they have learned to progress into a wide range of pathways and careers.

A partnership approach

Families, communities, employers and partner organisations play a vital role in supporting learning in science and building science capital.

Appendix B Knowledge card distribution showing retained cards

Knowledge card number	Knowledge card description	Asterix	Modified card	Added card	Table 1 ASN	Table 2 Primary	Table 3 Primary	Table 4 Primary	Table 5 Secondary	Table 6 Secondary	Table 7 Secondary	Table 8 Secondary	Table 9 Secondary	Table 10 Secondary	Table 11 Secondary	Table 12 Secondary	Table 13 ELC	Table 14 ELC
1	Living things and non-living things				Yes	Yes	Yes			Yes	Yes	Yes	Yes		Yes		Yes	Yes
2	Life processes				Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		Yes	
3	Plants				Yes	Yes	Yes	Yes	Yes	Yes	Yes			Yes			Yes	Yes
3b	Plants and photosynthesis		Yes												Yes	Yes		
4	Animals				Yes	Yes	Yes	Yes	Yes		Yes				Yes		Yes	Yes
5	Ecosystems					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	Food webs and food chains					Yes	Yes	Yes		Yes	Yes	Yes	Yes		Yes		Yes	Yes
6b	Food webs		Yes													Yes		
6c	Food webs and food chains - basic level		Yes		Yes													
7	Agriculture					Yes	Yes	Yes	Yes	Yes		Yes		Yes		Yes	Yes	Yes
8	Food and drink						Yes			Yes	Yes	Yes					Yes	Yes
9	Life cycles				Yes	Yes	Yes	Yes			Yes	Yes			Yes		Yes	Yes
10	Emotional wellbeing, resilience and mental health				Yes				Yes	Yes			Yes				Yes	
11	Habitats				Yes	Yes	Yes	Yes		Yes	Yes		Yes		Yes		Yes	Yes
12	Biodiversity					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
12b	Different living things (not Biodiversity)		Yes		Yes													
13	Interdependence					Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes		Yes	Yes
14	Adaptations					Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes		Yes	
15	Sustainability of natural resources						Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes		Yes	Yes
16	Water cycle					Yes	Yes	Yes		Yes		Yes	Yes				Yes	Yes
17	Rock cycle/erosion					Yes												
18	Energy security	Yes							Yes	Yes		Yes		Yes	Yes	Yes	Yes	
18b	Future energy security		Yes										Yes					
19	Human impacct on the environment					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
19b	Human impacct on the environment - Incorporate pollution, carbon footprint and carbon cycle		Yes													Yes		
20	Carbon footprint					Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes		Yes	
21	Horticulture				Yes	Yes	Yes			Yes				Yes			Yes	Yes
22	Response to climate change					Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
23	Healthy living						Yes		Yes	Yes	Yes	Yes					Yes	Yes
23b	People who can help me		Yes		Yes													
24	Heat and temperature				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
25	Renewable energy					Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes		Yes	Yes
26	Climate change					Yes	Yes	Yes	Yes	Yes	Yes		Yes		Yes		Yes	Yes

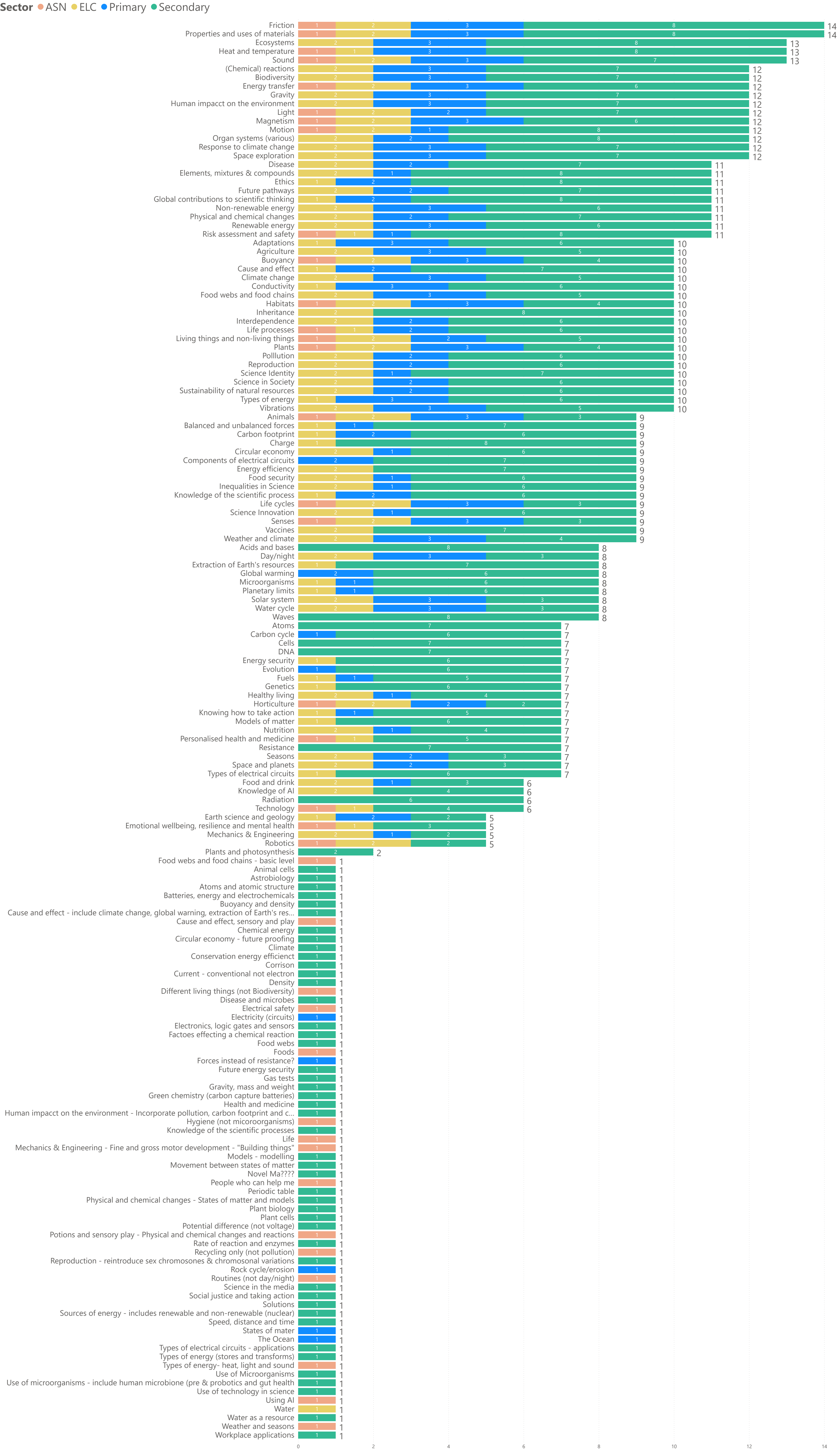
26b	Climate		Yes										Yes					
27	Carbon cycle							Yes	Yes	Yes	Yes	Yes		Yes	Yes			
28	Circular economy						Yes		Yes	Yes		Yes	Yes	Yes	Yes		Yes	Yes
28b	Circular economy - future proofing		Yes													Yes		
29	(Chemical) reactions					Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
30	Fuels						Yes		Yes	Yes			Yes	Yes	Yes		Yes	
31	Models of matter								Yes		Yes	Yes	Yes	Yes	Yes		Yes	
31b	States of mater		Yes			Yes												
32	Properties and uses of materials				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
33	Atoms								Yes	Yes	Yes	Yes	Yes	Yes	Yes			
33b	Atoms and atomic structure		Yes													Yes		
34	Light				Yes		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
35	Gravity					Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
35b	Gravity, mass and weight		Yes								Yes							
36	Buoyancy				Yes	Yes	Yes	Yes		Yes		Yes	Yes		Yes		Yes	Yes
36b	Buoyancy and density		Yes											Yes				
37	Mechanics & Engineering					Yes			Yes	Yes							Yes	Yes
37b	Mechanics & Engineering - Fine and gross motor development - "Building things"		Yes		Yes													
38	Evolution	Yes					Yes		Yes	Yes	Yes	Yes	Yes		Yes			
39	Space and planets					Yes	Yes				Yes		Yes		Yes		Yes	Yes
40	Waves								Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
41	Sound				Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
42	Balanced and unbalanced forces	Yes				Yes			Yes	Yes	Yes		Yes	Yes	Yes	Yes		Yes
43	Friction				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
44	Magnetism				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes		Yes	Yes
45	Seasons					Yes	Yes					Yes	Yes		Yes		Yes	Yes
46	Day/night					Yes	Yes	Yes				Yes	Yes		Yes		Yes	Yes
46b	Routines (not day/night)		Yes		Yes													
47	Types of electrical circuits	Yes							Yes	Yes		Yes	Yes	Yes		Yes		Yes
47b	Types of electrical circuits - applications		Yes												Yes			
48	Vibrations					Yes	Yes	Yes		Yes	Yes	Yes		Yes	Yes		Yes	Yes
49	Ethics					Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
50	Senses				Yes	Yes	Yes	Yes			Yes		Yes		Yes		Yes	Yes
51	Personalised health and medicine				Yes				Yes	Yes			Yes	Yes	Yes		Yes	
51b	Health and medicine		Yes								Yes							
52	Disease					Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
52b	Disease and microbes		Yes											Yes				
53	Future pathways					Yes		Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes

[illegible]

77	Non-renewable energy	Yes				Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes		Yes	Yes
78	Inheritance	Yes							Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
79	Microorganisms	Yes					Yes		Yes	Yes	Yes	Yes	Yes		Yes		Yes	
79b	Use of Microorganisms		Yes											Yes				
79c	Use of microorganisms - include human microbione (pre & probiotics and gut health		Yes													Yes		
79d	Hygiene (not micoroorganisms)		Yes		Yes													
80	Conductivity	Yes				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes		Yes	
80b	Electrical safety		Yes		Yes													
81	Knowing how to take action	Yes				Yes			Yes	Yes	Yes	Yes	Yes				Yes	
82	Inequalities in Science	Yes						Yes	Yes	Yes	Yes	Yes	Yes		Yes		Yes	Yes
83	Cells	Yes							Yes	Yes	Yes	Yes	Yes	Yes		Yes		
83b	Animal cells		Yes												Yes			
84	Weather and climate	Yes				Yes	Yes	Yes	Yes	Yes	Yes	Yes					Yes	Yes
85	Earth science and geology	Yes				Yes	Yes							Yes		Yes	Yes	
86	Extraction of Earth's resources	Yes							Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	
87	Science Identity	Yes				Yes			Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
88	Global contributions to scientific thinking	Yes				Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
89	Acids and bases	Yes							Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
90	Motion	Yes			Yes		Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
91	Food security						Yes		Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes
92	Global warming					Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes			
93	Risk assessment and safety	Yes			Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
94	Knowledge of the scientific process	Yes				Yes		Yes	Yes	Yes	Yes	Yes	Yes			Yes	Yes	
94b	Knowledge of the scientific processes		Yes												Yes			
95	Cause and effect	Yes				Yes		Yes	Yes	Yes	Yes	Yes	Yes		Yes			Yes
95b	Cause and effect - include climate change, global warning, extraction of Earth's resources and sustainability of natural resources		Yes													Yes		
95c	Cause and effect		Yes								Yes							
95d	Cause and effect, sensory and play		Yes		Yes													
96	Charge	Yes							Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
97	Workplace applications			Yes									Yes					
98	Movement between states of matter			Yes						Yes								

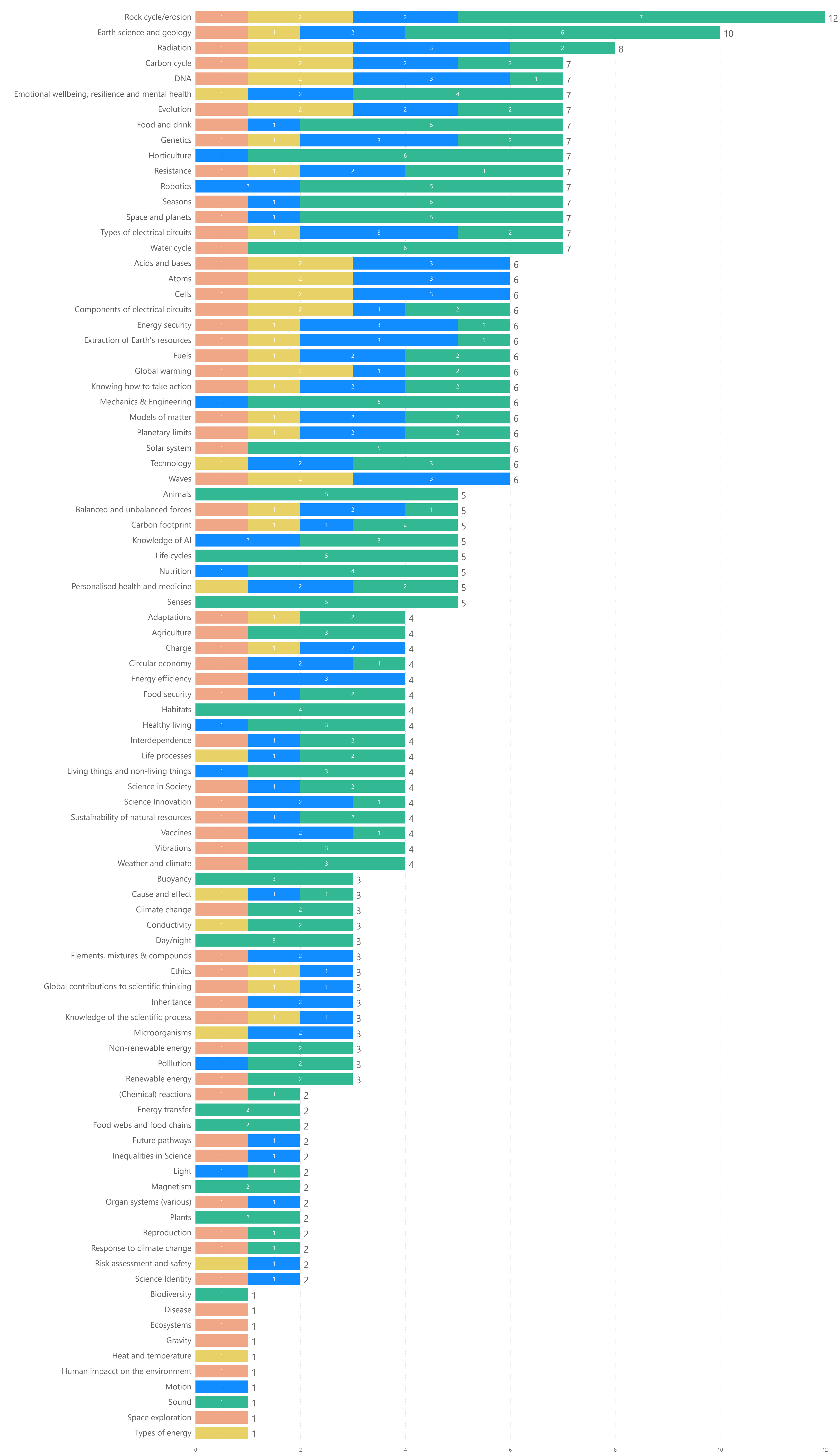
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Appendix C - Number of knowledge cards (retained and/or added or modified) per sector



Appendix D - Number of knowledge cards removed per sector

Sector ● ASN ● ELC ● Primary ● Secondary



Appendix E – Rationale for knowledge card removal per table and sector

Knowledge card number	Knowledge card description	Table 1 Rationale for removal	Table 2 Rationale for removal	Table 3 Rationale for removal	Table 4 Rationale for removal	Table 5 Rationale for removal	Table 6 Rationale for removal	Table 7 Rationale for removal	Table 8 Rationale for removal	Table 9 Rationale for removal	Table 10 Rationale for removal	Table 11 Rationale for removal	Table 12 Rationale for removal	Table 13 Rationale for removal	Table 14 Rationale for removal
1	Living things and non-living things				Covered by other cards	Primary phase					Primary science		Primary phase		
2	Life processes				This is a concept not knowledge						Primary science		Primary phase		Concept
3	Plants								Across all biology topics	Covered in other topics such as cells, life processes					
4	Animals						ELC/Primary phase - at a base level		Across all biology topics	Covered in other topics such as cells, life processes	Primary science		Primary phase		
5	Ecosystems	Too complex													
6	Food webs and food chains					This will be covered by Ecosystems and interdependency cards					Primary science				
7	Agriculture	Abstract						Context not knowledge		Covered by plants. Workplace applications?		Should this be Geography?			
8	Food and drink	Abstract	No rationale provided			Primary phase				Covered by other topics	Primary science	Should this HWB or Food Technology?	This is included in Home Economics (Food Technology)		
9	Life cycles					Primary phase	Primary phase			No rationale provided	Primary science		Primary phase		
10	Emotional wellbeing, resilience and mental health		No rationale provided	Removed from primary phase - Group did not have time to assign a rationale for why it should be removed				Health and Wellbeing	This is covered by card 23 - Health Living			Should this be HWB?	Included in PSHE		More HWB
11	Habitats					This is covered in card 5 Ecosystems			This is covered in card 5 Ecosystems		Primary science		This is covered in card 5 Ecosystems		
12	Biodiversity												No rationale provided		
13	Interdependence	Abstract			Cover under Ecosystems				This is a heading (concept)				No rationale provided		
14	Adaptations	Abstract							This is covered by card 38 - Evolution				Senio phase - Nat 4/5		Under heading 4
15	Sustainability of natural resources	Abstract	No rationale provided					This is physical geography					Covered by card 95 - Cause and effect		
16	Water cycle	Abstract				Primary phase	Primary phase	Primary phase			Primary science	Should this be Geography?	This is included in Geography		
17	Rock cycle/erosion	Abstract		Is this STEM, IDL, HWB? Not core science knowledge	Not at primary	Boring and covered elsewhere	Included in geography	This is physical geography	This is included in card 85 (Earth science/geology)	Included in social studies	In Geography	Should this be geography?	This is included in Geography	Not stage relevant for every child	Not for ELC. Social subjects?

18	Energy security	Abstract	No rationale provided	Removed from primary phase - Group did not have time to assign a rationale for why it should be removed	Level above primary			What does this mean?							Not at ELC
19	Human impact on the environment	Abstract													
20	Carbon footprint	Abstract			Not needed at primary - generally misunderstood				This is covered by card 26 - Climate change				Covered by card 19 - Human impact on the environment		Not for ELC
21	Horticulture				Too niche for primary	Could be covered at another point if linked to the community		Context not knowledge	This is covered by card 3 - Plants	Covered by plants. Workplace applications?		Should this be Geography?	Senior phase		
22	Response to climate change	Abstract							This is covered by card 26 - Climate change						
23	Healthy living		No rationale provided								Primary science	Should this be HWB, Food Technology?	Included in HE, PE and PSHE		
24	Heat and temperature														This is overarching
25	Renewable energy	Abstract							This is included in card 75 - Types of energy				This is covered by new card 117 - Sources of energy		
26	Climate change	Abstract							This is a heading (concept)				This is covered by card 95 - Cause and effect		
27	Carbon cycle	Abstract	No rationale provided	Secondary phase						Covered in conservation of mass/energy			Covered by card 19 - Human impact on the environment	Too abstract	Not for ELC
28	Circular economy	Abstract	No rationale provided		Not for primary science			Not fundamental for BGE science							
29	(Chemical) reactions	Include in Physical and Chemical changes (Card 66) Rename as potions?							This is included in card 66 (physical and chemical changes)						
30	Fuels	Abstract	No rationale provided		Not at primary			Outdated knowledge	This is included in card 75 - Types of energy						More context Covered in other areas
31	Models of matter	Abstract		Secondary phase	Not at primary		Primary phase						This is covered by card 66 - Physical and chemical changes)		Not for ELC - more Level 2/3
32	Properties and uses of materials														
33	Atoms	Abstract	No rationale provided	Secondary phase	Not at primary									Not level appropriate	Not at ELC

[illegible]

54	Science Innovation	Abstract		Important but are theses a Golden thread - Are these skills or values?	Not core knowledge							What is this? What knowledge?			
55	Knowledge of AI		No rationale provided	Removed from primary phase - Group did not have time to assign a rationale for why it should be removed				Not for science. It is another curricular area			Overarching knowledge for curriculum		This is included in Technologies		
56	Science in Society	Abstract		Important but are theses a Golden thread - Are these skills or values?		This is a concept (theme)			This is heading (concept)						
57	Organ systems (various)	Complex		Important but are theses a Golden thread - Are these skills or values?											
58	Genetics	Abstract	No rationale provided	Secondary phase	Not at primary	No need for genetics and inheritance			This is covered in card 78 - Inheritance						Not at ELC
59	Vaccines	Abstract	No rationale provided	General intro to vaccines at primary phase. More detailed explanation in secondary phase											
60	Nutrition		No rationale provided						This is included by card 23 - Healthy Living		In Home economics	Should this be HWB, Food Technology?	Primary phase		
61	Pollution				Not fundamental at primary				This is included in card 19 - Human impact on the environment				Covered by card 19 - Human impact on the environment		
62	Technology		No rationale provided	Removed from primary phase - Group did not have time to assign a rationale for why it should be removed							Too broad a title - included under topics	Should this be Technologies?	This is included in Technologies		Concept? Context?
63	Robotics		No rationale provided	Removed from primary phase - Group did not have time to assign a rationale for why it should be removed		This is included in Technologies		Not for science. It is another curricular area		Included in technologies	In Computing	Is this Technologies?	This is included in Technologies		
64	Elements, mixtures & compounds	Abstract		Secondary phase	Not primary phase										
65	Planetary limits	Abstract	No rationale provided. Suggestion to rename card to Earth's limits		Not sure what this means						What does this mean?		No rationale provided		What is this?

66	Physical and chemical changes														
67	Energy transfer								This is a heading (concept)	Merge types???					
68	Radiation	Abstract	No rationale provided	Secondary phase	Not at primary							Senior phase - Nat 4/5	Limited practical in senior phase	Not stage appropriate	Not for ELC - more Level 2/3
69	Components of electrical circuits	Abstract	No rationale provided				Primary phase		This is included in card 69 - Types of electrical circuits					Not level appropriate	Not for ELC - Level 2. Resourcing issues
70	Energy efficiency	Abstract	No rationale provided	Removed from primary phase - Group did not have time to assign a rationale for why it should be removed	Not foundation knowledge for primary										
71	DNA	Abstract	No rationale provided	Secondary phase	Not at primary				This is covered by card 78 - Inheritance					Not relevant	Not at ELC
72	Reproduction	Covered in PSE							This is covered by card 9 - Life cycles						
73	Solar system	Not easily taught. In context of daily/night routine?				Primary phase	Primary phase	Primary phase			Primary science		No rationale provided		
74	Space exploration	Abstract													
75	Types of energy														This is a concept
76	Resistance	Abstract		Secondary phase	Not at primary	Realistically not being taught for difficulty			This is included in card 69 - Types of electrical circuits			Senior phase - Nat 4/5		Too abstract for this stage	In what context?
77	Non-renewable energy	Abstract							Included in card 75 - Types of energy				This is covered by new card 117 - Sources of energy		
78	Inheritance	Abstract	No rationale provided	Secondary phase											
79	Microorganisms		No rationale provided		Not at primary										Not for ELC - more Level 2/3
80	Conductivity										Included in energy transfer (conduction of heat)		This is covered by card 76 - Resistance		Not for ELC - Level 2. Resourcing issues
81	Knowing how to take action	Vague		Important but not knowledge	Not core knowledge							This is skills more than knowledge	No rationale provided		Skill not knowledge
82	Inequalities in Science	Too abstract		Important but are theses a Golden thread - Are these skills or values?											
83	Cells	Abstract	No rationale provided	Removed from primary phase - Group did not have time to assign a rationale for why it should be removed	Not at primary									Not level relevant	Not for ELC - more Level 2/3 Very important but understanding at this age and stage would be difficult

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Appendix F - Concept headers and number of knowledge cards per table

Concept header	Number of knowledge cards per concept header and table														Total number of knowledge cards
	ASN	Primary				Secondary								ELC	
	Table 1	Table 2	Table 3	Table 4	Table 5	Table 6	Table 7	Table 8	Table 9	Table 10	Table 11	Table 12	Table 13	Table 14	
Becoming a Scientist												5			5
Being a scientist						10									10
Being scientific									11						11
Beyond our Planet		5													5
Body										11					11
Building blocks of matter								6							6
Cause & Effect		9											9		18
Cells					5				8						13
Chemical & Physical Changes					4										4
Chemical changes									5						5
Chemical Reactions												4			4
Chemical World							10								10
Circuits					6										6
Climate										5					5
Climate and sustainability									13						13
Climate change and sustainability								6							6
Climate Literacy							10								10
Climate, environment and nature											18				18
Community										17					17
Conservation and environmental biology						6									6
Cross curricular									1						1
Cross over themes									2						2
Delivery & key elements	5														5
Earth and beyond						8									8
Earth in Space													5		5
Earth science and geology								4							4
Electricity							3								3
Electricity and forces						8									8
Electromagnetism								6							6
Energy				10		11	9		11			10			51
Energy & Vibrations					10										10
Energy and forces			11												11
Energy transfer								4							4
Environmental Chemistry					4										4
Environmental Science												6			6

Food & Drink												6		6
Forces	4			5	7		7		12					35
Forces & Motion											5			5
Future	2													2
Health			7											7
Health & Disease											5			5
Home										25				25
How Things Work													17	17
Human Health					6		9							15
Individual living things									6					6
Interactions between living things									7					7
Interconnections													9	9
Interdependence of biological systems								6						6
Life												4	20	24
Life & Living things				9										9
Life journeys								10						10
Life on Earth					7									7
Life science											24			24
Living and growing			15											15
Living independently	9													9
Living Things							11					11		22
Looking after our planet												19		19
Materials	9				4							6		19
Matter									4			3		7
Matter and materials						7								7
Motion and forces								4						4
My Body												10		10
Natural World							7							7
Nature of science											11			11
New Frontiers							2							2
Our living planet		15												15
Our Planet		18												18
Our scientific environment			20											20
Our universe			5											5
Our World													17	17
Our World/Planet				14										14
Physical & Chemical Changes		3												3
Plants	2													2
Properties of matter and chemical interactions											11			11
Reactions						4								4
Science & Society					13									13
Science Identity												10		10
Science in Society		5					12	13				6		36

Science of health and wellbeing						14									14
Science of Science				6											6
Senses +	6														6
Space and planets								5							5
Sustainability					13	18									31
Technology													4		4
The Living World												5			5
The physical world											21				21
Transferrable concepts		9													9
World and universe										13					13
Grand Total	37	64	58	44	79	86	80	64	80	71	85	53	80	63	944

Appendix G – Concept headers and knowledge card distribution showing retained cards

[illegible]

[illegible]

32	Properties and uses of materials				Materials	Transferrable concepts	Our scientific environment	Our world/planet	Materials	Matter and materials	Chemical world	Building blocks of matter	Matter	Community	Properties of matter and chemical interactions	Chemical reactions	Materials	How Things Work
33	Atoms								Materials	Matter and materials	Chemical world	Building blocks of matter	Matter	Body	Properties of matter and chemical interactions			
33b	Atoms and atomic structure		Yes													Matter		
34	Light				Senses +		Energy and forces	Energy	Energy & vibrations	Energy	Energy		Energy	World and universe	The physical world	Energy	Cause & Effect	How Things Work
35	Gravity					Cause & Effect	Our universe	Forces	Forces	Electricity and forces		Motion and forces	Forces	World and universe	The physical world	Forces & motion	Cause & Effect	How Things Work
35b	Gravity, mass and weight		Yes								Forces							
36	Buoyancy				Forces	Cause & Effect	Energy and forces	Forces		Electricity and forces		Motion and forces	Forces		The physical world		Cause & Effect	How Things Work
36b	Buoyancy and density		Yes											World and universe				
37	Mechanics & Engineering					Our Planet			Forces	Earth and beyond							Technology	How Things Work
37b	Mechanics & Engineering - Fine and gross motor development - "Building things"		Yes		Delivery & key elements													
38	Evolution	Yes					Living and growing		Life on earth	Conservation and environmental biology	Living things	Life journeys	Interactions between living things		Life science			
39	Space and planets					Beyond our Planet	Our universe				New frontiers		Forces		The physical world		Earth in Space	Our World
40	Waves								Energy & vibrations	Energy	Energy	Energy transfer	Energy	Home	The physical world	Energy		
41	Sound				Senses +	Cause & Effect	Energy and forces	Energy	Energy & vibrations	Energy	Energy		Energy	Home	The physical world	Energy	Cause & Effect	How Things Work
42	Balanced and unbalanced forces	Yes				Cause & Effect			Forces	Electricity and forces	Forces		Forces	Home	The physical world	Forces & motion		How Things Work
43	Friction				Forces	Cause & Effect	Energy and forces	Forces	Forces	Electricity and forces	Forces	Motion and forces	Forces	Home	The physical world	Forces & motion	Cause & Effect	How Things Work
44	Magnetism				Forces	Cause & Effect	Energy and forces	Forces	Forces	Electricity and forces	Forces	Electromagnetism	Forces		The physical world		Cause & Effect	How Things Work
45	Seasons					Beyond our Planet	Our scientific environment					Space and planets	Forces		The physical world		Earth in Space	Our World
46	Day/night					Beyond our Planet	Our universe	Our world/planet				Space and planets	Forces		The physical world		Earth in Space	Our World
46b	Routines (not day/night)		Yes		Living independently													
47	Types of electrical circuits	Yes							Circuits	Electricity and forces		Electromagnetism	Energy	Home		Energy		How Things Work
47b	Types of electrical circuits - applications		Yes												The physical world			
48	Vibrations					Cause & Effect	Energy and forces	Energy		Energy	Energy	Energy transfer		Home	The physical world		Cause & Effect	How Things Work
49	Ethics					Transferrable concepts		Science of science	Science & society	Being a scientist	Science in society	Science in society	Being scientific	Community	Nature of science	Science in society	Science Identity	

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	changes and reactions																	
67	Energy transfer	Yes			Senses +	Transferrable concepts	Living and growing	Energy	Energy & vibrations	Energy	Energy			Home	Climate, environment and nature	Energy	Looking after our planet	Our World
68	Radiation	Yes							Energy & vibrations	Earth and beyond	Energy	Energy transfer	Energy	World and universe				
69	Components of electrical circuits	Yes					Energy and forces	Energy	Circuits		Electricity	Electromagnetism	Energy	Home	The physical world	Energy		
70	Energy efficiency	Yes							Energy & vibrations	Energy	Climate literacy	Climate change and sustainability		Home	Climate, environment and nature	Forces & motion	Looking after our planet	Our World
70b	Conservation energy efficiency		Yes										Energy					
71	DNA								Cells	Science of health and wellbeing	Living things		Cells	Body	Life science	Life		
72	Reproduction					Our living planet	Health		Cells	Science of health and wellbeing	Human health		Individual living things	Body	Life science		My Body	Life
72b	Reproduction - reintroduce sex chromosomes & chromosomal variations		Yes													Life		
73	Solar system					Beyond our Planet	Our universe	Our world/planet				Space and planets	Forces		The physical world		Earth in Space	Our World
74	Space exploration	Yes				Beyond our Planet	Our universe	Our world/planet	Forces	Earth and beyond	New frontiers	Space and planets	Forces	World and universe	The physical world		Earth in Space	Our World
75	Types of energy	Yes				Transferrable concepts	Energy and forces	Energy		Energy	Energy	Climate change and sustainability		Community	Climate, environment and nature	Energy	Looking after our planet	
75b	Types of energy (stores and transforms)		Yes										Energy					
75c	Types of energy- heat, light and sound		Yes		Senses +													
76	Resistance	Yes							Energy & vibrations	Electricity and forces	Electricity	Electromagnetism	Energy	Home		Energy		
76b	Forces instead of resistance?		Yes			Transferrable concepts												
77	Non-renewable energy	Yes				Our Planet	Our scientific environment	Energy	Energy & vibrations	Energy	Climate literacy		Climate and sustainability	Community	Climate, environment and nature		Looking after our planet	Our World
78	Inheritance	Yes							Cells	Science of health and wellbeing	Living things	Life journeys	Cells	Body	Life science	Life	My Body	Life
79	Microorganisms	Yes					Living and growing		Cells	Science of health and wellbeing	Living things	Life journeys	Cells		Life science		My Body	
79b	Use of Microorganisms		Yes											Home				
79c	Use of microorganisms - include human microbiome (pre & probiotics and gut health)		Yes													Health & disease		
79d	Hygiene (not microorganisms)		Yes		Living independently													
80	Conductivity	Yes				Cause & Effect	Energy and forces	Energy	Circuits	Matter and materials	Electricity	Electromagnetism	Energy		Properties of matter and chemical interactions		Cause & Effect	

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Concept headers and knowledge card mapping

Additional Support Needs (ASN)

Table 1

Concept headers

Knowledge cards

01	Delivery and key elements	- Life process (card 2) - Emotional wellbeing, resilience and mental health (card 10) - Mechanics & Engineering – Fine and gross motor development – "Building things" (card 37b) - Potions and sensory play – Physical and chemical changes and reactions (card 66c) - Cause and effect, sensory and play (card 95d)
02	Forces	- Buoyancy (card 36) - Friction (card 43) - Magnetism (card 44) - Motion (card 90)
03	Future	- Using AI (card 55b) - Robotics (card 63)
04	Living independently	- People who can help me (card 23b) - Routines (not day/night) (card 46b) - Personalised health and medicine (card 51) - Foods (card 60b) - Technology (card 62) - Hygiene (not micoroorganisms) (card 79d) - Electrical safety (card 80b) - Risk assessment and safety (card 93) - Weather and seasons (card 127)
05	Materials	- Living things and non-living things (card 1) - Animals (card 4) - Food webs and food chains – basic level (card 6c) - Life cycles (card 9) - Habitats (card 11) - Different living things (not Biodiversity) (card 12b) - Properties and uses of materials (card 32) - Recycling only (not pollution) (card 61b) - Life (card 126)
06	Plants	- Plants (card 3) - Horticulture (card 21)
07	Senses +	- Heat and temperature (card 24) - Light (card 34) - Sound (card 41) - Senses (card 50) - Energy transfer (card 67) - Types of energy– heat, light and sound (card 75c)

Concept headers and knowledge card mapping

Early Learning and Childcare (ELC)

Table 13

Concept headers

Knowledge cards

01	Cause & Effect	- Light (card 34) - Gravity (card 35) - Buoyancy (card 36) - Sound (card 41) - Friction (card 43)	- Friction (card 43) - Magnetism (card 44) - Vibrations (card 48) - Conductivity (card 80) - Motion (card 90)
02	Earth in Space	- Space and planets (card 39) - Seasons (card 45) - Day/night (card 46)	- Solar system (card 73) - Space exploration (card 74)
03	Food & Drink	- Food webs and food chains (card 6) - Agriculture (card 7) - Food and drink (card 8)	- Horticulture (card 21) - Food security (card 91)
04	Living Things	- Living things and non-living things (card 1) - Life processes (card 2) - Plants (card 3) - Animals (card 4) - Ecosystems (card 5) - Life cycles (card 9)	- Habitats (card 11) - Biodiversity (card 12) - Interdependence (card 13) - Adaptations (card 14) - Water cycle (card 16)
05	Looking after our planet	- Sustainability of natural resources (card 15) - Energy security (card 18) - Human impact on the environment (card 19) - Carbon footprint (card 20) - Response to climate change (card 22) - Heat and temperature (card 24) - Renewable energy (card 25) - Climate change (card 26) - Circular economy (card 28) - Fuels (card 30)	- Pollution (card 61) - Planetary limits (card 65) - Energy transfer (card 67) - Energy efficiency (card 70) - Types of energy (card 75) - Non-renewable energy (card 77) - Weather and climate (card 84) - Extraction of Earth's resources (card 86) - Charge (card 96)
06	Materials	(Chemical) reactions (card 29) - Models of matter (card 31) - Properties and uses of materials (card 32)	- Elements, mixtures & compounds (card 64) - Physical and chemical changes (card 66) - Earth science and geology (card 85)
07	My Body	- Healthy living (card 23) - Senses (card 50) - Personalised health and medicine (card 51) - Disease (card 52) - Organ systems (various) (card 57)	- Genetics (card 58) - Vaccines (card 59) - Reproduction (card 72) - Inheritance (card 78) - Microorganisms (card 79)
08	Science Identity	- Emotional wellbeing, resilience and mental health (card 10) - Ethics (card 49) - Future pathways (card 53) - Science Innovation (card 54) - Science in Society (card 56)	- Knowing how to take action (card 81) - Inequalities in Science (card 82) - Science Identity (card 87) - Risk assessment and safety (card 93) - Knowledge of the scientific process (card 94)
09	Technology	- Mechanics & Engineering (card 37) - Knowledge of AI (card 55) - Technology (card 62) - Robotics (card 63)	

Concept headers and knowldge card mapping

Early Learning and Childcare (ELC)

Table 14

Concept headers

Knowledge cards

01	How Things Work	• (Chemical) reactions (card 29) • Properties and uses of materials (card 32) • Light (card 34) • Gravity (card 35) • Buoyancy (card 36) • Mechanics & Engineering (card 37) • Sound (card 41) • Balanced and unbalanced forces (card 42) • Friction (card 43) • Magnetism (card 44) • Types of electrical circuits (card 47) • Vibrations (card 48) • Robotics (card 63) • Elements, mixtures & compounds (card 64) • Motion (card 90) • Cause and effect (card 95) • Water (card 113)
02	Interconnections	• Circular economy (card 28) • Future pathways (card 63) • Science Innovation (card 54) • Knowledge of AI (card 55) • Science in Society (card 56) • Physical and chemical changes (card 66) • Inequalities in Science (card 82) • Science Identity (card 87) • Food security (card 91)
03	Life	• Living things and non-living things (card 1) • Plants (card 3) • Animals (card 4) • Ecosystems (card 5) • Food webs and food chains (card 6) • Agriculture (card 7) • Food and drink (card 8) • Life cycles (card 9) • Habitats (card 11) • Biodiversity (card 12) • Interdependence (card 13) • Horticulture (card 21) • Healthy living (card 23) • Senses (card 50) • Disease (card 52) • Organ systems (various) (card 57) • Vaccines (card 59) • Nutrition (card 60) • Reproduction (card 72) • Inheritance (card 78)
04	Our World	• Sustainability of natural resources (card 15) • Water cycle (card 16) • Human impact on the environment (card 19) • Response to climate change (card 22) • Renewable energy (card 25) • Climate change (card 26) • Space and planets (card 39) • Seasons (card 45) • Day/night (card 46) • Pollution (card 61) • Energy transfer (card 67) • Energy efficiency (card 70) • Solar system (card 73) • Space exploration (card 74) • Non-renewable energy (card 77) • Weather and climate (card 84) • Global contributions to scientific thinking (card 88)

Concept headers and knowledge card mapping

Primary

Table 2

Concept headers

Knowledge cards

01	Beyond our Planet	• Space and planets (card 39) • Seasons (card 45) • Day/night (card 46) • Solar system (card 73) • Space exploration (card 74)
02	Cause & Effect	• Gravity (card 35) • Buoyancy (card 36) • Sound (card 41) • Balanced and unbalanced forces (card 42) • Friction (card 43) • Magnetism (card 44) • Vibrations (card 48) • Conductivity (card 80) • Cause and effect (card 95)
03	Our living planet	• Living things and non-living things (card 1) • Life processes (card 2) • Plants (card 3) • Animals (card 4) • Ecosystems (card 5) • Food webs and food chains (card 6) • Life cycles (card 9) • Habitats (card 11) • Biodiversity (card 12) • Interdependence (card 13) • Adaptations (card 14) • Senses (card 50) • Disease (card 52) • Organ systems (various) (card 57) • Reproduction (card 72)
04	Our Planet	• Agriculture (card 7) • Water cycle (card 16) • Rock cycle/erosion (card 17) • Human impact on the environment (card 19) • Carbon footprint (card 20) • Horticulture (card 21) • Response to climate change (card 22) • Renewable energy (card 25) • Climate change (card 26) • Mechanics & Engineering (card 37) • Pollution (card 61) • Non-renewable energy (card 77) • Knowing how to take action (card 81) • Weather and climate (card 84) • Earth science and geology (card 85) • Global warming (card 92) • Electricity (circuits) (card 124) • The Ocean (card 125)
05	Physical & Chemical Changes	• (Chemical) reactions (card 29) • Elements, mixtures & compounds (card 64) • Physical and chemical changes (card 66)
06	Science in Society	• Future pathways (card 53) • Science Innovation (card 54) • Science in Society (card 56) • Science Identity (card 87) • Global contributions to scientific thinking (card 88)
07	Transferrable concepts	• Heat and temperature (card 24) • States of mater (card 31b) • Properties and uses of materials (card 32) • Ethics (card 49) • Energy transfer (card 67) • Types of energy (card 75) • Forces instead of resistance? (card 76b) • Risk assessment and safety (card 93) • Knowledge of the scientific process (card 94)

Concept headers and knowlledge card mapping

Concept headers

Knowledge cards

Primary

Table 3

01	Energy and forces	- Heat and temperature (card 24) - Light (card 34) - Buoyancy (card 36) - Sound (card 41) - Friction (card 43) - Magnetism (card 44)	- Vibrations (card 48) - Components of electrical circuits (card 69) - Types of energy (card 75) - Conductivity (card 80) - Motion (card 90)
02	Health	- Food and drink (card 8) - Healthy living (card 23) - Senses (card 50) - Disease (card 52) - Organ systems (various) (card 57)	- Nutrition (card 60) - Reproduction (card 72)
03	Living and growing	- Living things and non-living things (card 1) - Life processes (card 2) - Plants (card 3) - Animals(card 4) - Ecosystems (card 5) - Food webs and food chains (card 6) - Life cycles (card 9) - Habitats (card 11)	- Biodiversity (card 12) - Interdependence (card 13) - Adaptations (card 14) - Horticulture (card 21) - Evolution (card 38) - Energy transfer (card 67) - Microorganisms (card 79)
04	Our scientific environment	- Agriculture (card 7) - Sustainability of natural resources (card 15) - Water cycle (card 16) - Human impact on the environment (card 19) - Carbon footprint (card 20) - Response to climate change (card 22) - Renewable energy (card 25) - Climate change (card 26) - Circular economy (card 28) (Chemical) reactions (card 29) - Fuels (card 30)	- Properties and uses of materials (card 32) - Seasons (card 45) - Pollution (card 61) - Physical and chemical changes (card 66) - Non-renewable energy (card 77) - Weather and climate (card 84) - Earth science and geology (card 85) - Food security (card 81) - Global warming (card 92)
05	Our universe	- Gravity (card 35) - Space and planets (card 39) - Day/night (card 46) - Solar system (card 73) - Space exploration (card 74)	

Concept headers and knowldge card mapping

Concept headers

Knowledge cards

Primary

Table 4



Concept headers and knowledge card mapping

Secondary

Table 5

Concept headers

Knowledge cards

01	Cells	- DNA (card 71) - Reproduction (card 72) - Inheritance (card 78)	- Microorganisms (card 79) - Cells (card 83)
02	Chemical & Physical Changes	(Chemical) reactions (card 29) - Physical and chemical changes (card 66)	- Acids and bases (card 89) - Solutions (card 122)
03	Circuits	- Types of electrical circuits (card 47) - Components of electrical circuits(card 69) - Conductivity (card 80)	- Charge (card 86) - Potential difference (not voltage) (card 120) - Current – conventional not electron (card 121)
04	Energy & Vibrations	- Heat and temperature (card 24) - Renewable energy (card 25) - Light (card 34) - Waves (card 40) - Sound (card 41)	- Energy transfer (card 67) - Radiation (card 68) - Energy efficiency (card 70) - Resistance (card 70) - Non-renewable energy (card 77)
05	Environmental Chemistry	- Sustainability of natural resources (card 15) - Carbon cycle (card 27)	- Fuels (card 30) - Extraction of Earth's resources (card 86)
06	Forces	- Gravity (card 35) - Mechanics & Engineering (card 37) - Balanced and unbalanced forces (card 42) - Friction (card 37)	- Magnetism (card 44) - Space exploration (card 74) - Motion (card 90)
07	Human health	- Healthy living (card 23) - Personalised health and medicine (card 51) - Disease (card 52)	- Organ systems (various) (card 57) - Vaccines (card 59) - Nutrition (card 60)
08	Life on Earth	- Plants (card 3) - Animals (card 4) - Ecosystems (card 5) - Biodiversity (card 12)	- Interdependence (card 13) - Adaptations (card 14) - Evolution (card 38)
09	Materials	- Models of matter (card 31) - Properties and uses of materials (card 32)	- Atoms (card 33) - Elements, mixtures & compounds (card 64)
10	Science & Society	- Emotional wellbeing, resilience and mental health (card 10) - Ethics (card 49) - Future pathways (card 53) - Science Innovation (card 54) - Knowledge of AI (card 55) - Technology (card 62) - Knowing how to take action (card 81)	- Inequalities in Science (card 82) - Science Identity (card 87) - Global contributions to scientific thinking (card 88) - Risk assessment and safety (card 93) - Knowledge of the scientific process (card 94) - Cause and effect (card 95)
11	Sustainability	- Life processes (card 2) - Agriculture (card 7) - Energy security (card 18) - Human impact on the environment (card 19) - Carbon footprint (card 20) - Response to climate change (card 22) - Climate change (card 26)	- Circular economy (card 28) - Pollution (card 61) - Planetary limits (card 65) - Weather and climate (card 84) - Food security (card 91) - Global warming (card 92)

Concept headers and knowledge card mapping

Secondary

Table 6

Concept headers

Knowledge cards

01	Being a scientist	- Ethics (card 49) - Future pathways (card 53) - Science Innovation *card 54) - Knowledge of AI (card 55) - Science in Society (card 56) - Inequalities in Science (card 83)	- Science Identity (card 87) - Global contributions to scientific thinking (card 88) - Risk assessment and safety (card 93) - Knowledge of the scientific process (card 94)
02	Conservation and environmental biology	- Life processes (card 2) - Ecosystems (card 5) - Habitats (card 11)	- Biodiversity (card 12) - Adaptations (card 14) - Evolution (card 38)
03	Earth and beyond	- Circular economy (card 28) - Mechanics & Engineering (card 37) - Technology (card 62) - Robotics (card 63)	- Planetary limits (card 65) - Radiation (card 68) - Space exploration (card 74) - Weather and climate (card 84)
04	Electricity and forces	- Gravity (card 35) - Buoyancy (card 36) - Balanced and unbalanced forces (card 42) - Friction (card 43)	- Magnetism (card 44) - Types of electrical circuits (card 47) - Resistance (card 76) - Motion (card 90)
05	Energy	- Energy security (card 18) - Heat and temperature (card 24) - Renewable energy (card 25) - Light (card 34) - Waves (card 40) - Sound (card 41)	- Vibrations (card 48) - Energy transfer (card 67) - Energy efficiency (card 70) - Types of energy (card 75) - Non-renewable energy (card 77)
06	Matter and materials	- Properties and uses of materials (card 32) - Atoms (card 33) - Elements, mixtures & compounds (card 64) - Physical and chemical changes (card 66)	- Conductivity (card 80) - Charge (card 96) - Movement between states of matter (card 98)
07	Reactions	(Chemical) reactions (card 29) - Fuels (card 30)	- Extraction of Earth's resources (card 86) - Acids and bases (card 89)
08	Science of health and wellbeing	- Living things and non-living things (card 1) - Emotional wellbeing, resilience and mental health (card 10) - Healthy living (card 23) - Personalised health and medicine (card 51) - Disease (card 52) - Organ systems (various) (card 57) - Genetics (card 58)	- Vaccines (card 59) - Nutrition (card 60) - DNA (card 71) - Reproduction (card 72) - Inheritance (card 78) - Microorganisms (card 79) - Cells (card 83)
09	Sustainability	- Plants (card 3) - Food webs and food chains (card 6) - Agriculture (card 7) - Food and drink (card 8) - Interdependence (card 13) - Sustainability of natural resources (card 15) - Water cycle (card 16) - Human impact on the environment (card 19) - Carbon footprint (card 20)	- Horticulture (card 21) - Response to climate change (card 22) - Climate change (card 26) - Carbon cycle (card 27) - Pollution (card 61) - Knowing how to take action (card 81) - Food security (card 91) - Global warming (card 92) - Cause and effect (card 95)

Concept headers and knowledge card mapping

Secondary

Table 7

Concept headers

Knowledge cards

01	Chemical World	- Human impact on the environment (card 19) (Chemical) reactions (card 29) - Models of matter (card 31) - Properties and uses of materials (card 32) - Atoms (card 33) - Elements, mixtures & compounds (card 64)	- Physical and chemical changes (card 66) - Extraction of Earth's resources (card 86) - Acids and bases (card 89) - Charge (card 96)
02	Climate Literacy	- Carbon footprint (card 20) - Response to climate change (card 22) - Renewable energy (card 25) - Climate change (card 26) - Pollution (card 61)	- Planetary limits (card 65) - Energy efficiency (card 70) - Non-renewable energy (card 77) - Weather and climate (card 84) - Global warming (card 92)
03	Electricity	- Components of electrical circuits(card 69) - Resistance (card 76) - Conductivity (card 80)	
04	Energy	- Heat and temperature (card 24) - Light (card 34) - Waves (card 40) - Sound (card 41) - Vibrations (card 48)	- Energy transfer (card 67) - Radiation (card 68) - Types of energy (card 75) - Chemical energy (card 118)
05	Forces	- Gravity, mass and weight (card 35b) - Balanced and unbalanced forces (card 42) - Friction (card 43) - Magnetism (card 44)	- Motion (card 90) - Cause and effect (card 96) - Speed, distance and time (card 119)
06	Human Health	- Food and drink (card 8) - Healthy living (card 23) - Senses (card 50) - Health and medicine (card 51b) - Disease (card 52)	- Organ systems (various) (card 57) - Vaccines (card 59) - Nutrition (card 60) - Reproduction (card 72)
07	Living Things	- Living things and non-living things (card 1) - Life processes (card 2) - Animals (card 4) - Life cycles (card 9) - Adaptations (card 14) - Evolution (card 38)	- Genetics (card 58) - DNA (card 71) - Inheritance (card 78) - Microorganisms (card 79) - Cells (card 83)
08	Natural World	- Plants (card 3) - Ecosystems (card 5) - Food webs and food chains (card 6) - Habitats (card 11)	- Biodiversity (card 12) - Interdependence (card 13) - Carbon cycle (card 27)
09	New Frontiers	- Space and planets (card 39) - Space exploration (card 74)	
10	Science in Society	- Ethics (card 49) - Future pathways (card 53) - Science Innovation (card 54) - Science in Society (card 56) - Technology (card 62) - Knowing how to take action (card 81) - Inequalities in Science (card 82)	- Science Identity (card 87) - Global contributions to scientific thinking (card 88) - Risk assessment and safety (card 93) - Knowledge of the scientific process (card 94) - Cause and effect (card 95c)

Concept headers and knowledge card mapping

Secondary

Table 8

Concept headers

Knowledge cards

01	Building blocks of matter	- Models of matter (card 31) - Properties and uses of materials (card 32) - Atoms (card 33) - Elements, mixtures & compounds (card 64)	- Elements, mixtures & compounds (card 64) - Physical and chemical changes (card 66) - Acids and bases (card 89)
02	Climate change and sustainability	- Sustainability of natural resources (card 15) - Energy security (card 18) - Human impact on the environment (card 19)	- Circular economy (card 28) - Energy efficiency (card 70) - Types of energy (card 75)
03	Earth science and geology	- Water cycle (card 16) - Carbon cycle (card 27)	- Weather and climate (card 84) - Extraction of Earth's resources (card 86)
04	Electromagnetism	- Magnetism (card 44) - Types of electrical circuits (card 47) - Components of electrical circuits (card 69)	- Resistance (card 76) - Conductivity (card 80) - Charge (card 96)
05	Energy transfer	- Heat and temperature (card 24) - Waves (card 40)	- Vibrations (card 48) - Radiation (card 68)
06	Interdependence of biological systems	- Living things and non-living things (card 1) - Ecosystems (card 5) - Food webs and food chains (card 6)	- Agriculture (card 7) - Biodiversity (card 12) - Food security (card 91)
07	Life journeys	- Life processes (card 2) - Food and drink (card 8) - Life cycles (card 9) - Healthy living (card 23) - Evolution (card 38)	- Disease (card 52) - Organ systems (various) (card 57) - Inheritance (card 78) - Microorganisms (card 79) - Cells (card 83)
08	Motion and forces	- Gravity (card 35) - Buoyancy (card 36)	- Friction (card 43) - Motion (card 90)
09	Science in society	- Ethics (card 49) - Future pathways (card 53) - Science Innovation (card 54) - Knowledge of AI (card 55) - Technology (card 62) - Robotics (card 63) - Knowing how to take action (card 81)	- Inequalities in Science (card 82) - Science Identity (card 87) - Global contributions to scientific thinking (card 88) - Risk assessment and safety (card 93) - Knowledge of the scientific process (card 94) - Cause and effect (card 95)
10	Space and planets	- Seasons (card 45) - Day/night (card 46) - Planetary limits (card 65)	- Solar system (card 73) - Space exploration (card 74)

Concept headers and knowledge card mapping

Secondary

Table 9

Concept headers

Knowledge cards

01	Being scientific	- Ethics (card 49) - Future pathways (card 53) - Science in Society (card 56) - Use of technology in science (card 62b) - Inequalities in Science (card 82) - Science Identity (card 87)	- Global contributions to scientific thinking (card 88) - Risk assessment and safety (card 93) - Knowledge of the scientific process (card 94) - Cause and effect (card 95) - Workplace applications (card 97)
02	Cells	- Personalised health and medicine (card 51) - Disease (card 52) - Genetics (card 58) - Vaccines (card 59)	- DNA (card 71) - Inheritance (card 78) - Microorganisms (card 79) - Cells (card 83)
03	Chemical changes	- Water cycle (card 16) - Heat and temperature (card 24) (Chemical) reactions (card 29)	- Physical and chemical changes (card 66) - Acids and bases (card 89)
04	Climate and sustainability	- Sustainability of natural resources (card 15) - Future energy security (card 18b) - Human impact on the environment (card 19) - Carbon footprint (card 20) - Response to climate change (card 22) - Renewable energy (card 25) - Climate change (card 26)	- Fuels (card 30) - Pollution (card 61) - Non-renewable energy (card 77) - Extraction of Earth's resources (card 86) - Food security (card 91) - Global warming (card 92)
05	Cross curricular	Circular economy (card 28)	
06	Cross over themes	- Emotional wellbeing, resilience and mental health (card 10) - Knowing how to take action (card 81)	
07	Energy	- Light (card 34) - Waves (card 40) - Sound (card 41) - Types of electrical circuits (card 47) - Radiation (card 68) - Components of electrical circuits (card 69) - Conservation energy efficient (card 70b)	- Conservation energy efficient (card 70b) - Types of energy (stores and transforms) (card 75b) - Resistance (card 76) - Conductivity (card 80) - Charge (card 96)
08	Forces	- Gravity (card 35) - Buoyancy (card 36) - Space and planets (card 39) - Balanced and unbalanced forces (card 42) - Friction (card 43) - Magnetism (card 44)	- Seasons (card 45) - Day/night (card 46) - Planetary limits (card 65) - Solar system (card 73) - Space exploration (card 74) - Motion (card 90)
09	Individual living things	- Living things and non-living things (card 1) - Life processes (card 2) - Senses (card 50)	- Organ systems (various) (card 57) - Nutrition (card 60) - Reproduction (card 72)
10	Interactions between living things	- Ecosystems (card 5) - Food webs and food chains (card 6) - Habitats (card 11) - Biodiversity (card 12)	- Interdependence (card 13) - Adaptations (card 14) - Evolution (card 38)
11	Matter	- Models of matter (card 31) - Properties and uses of materials (card 32)	- Atoms (card 33) - Elements, mixtures & compounds (card 64)

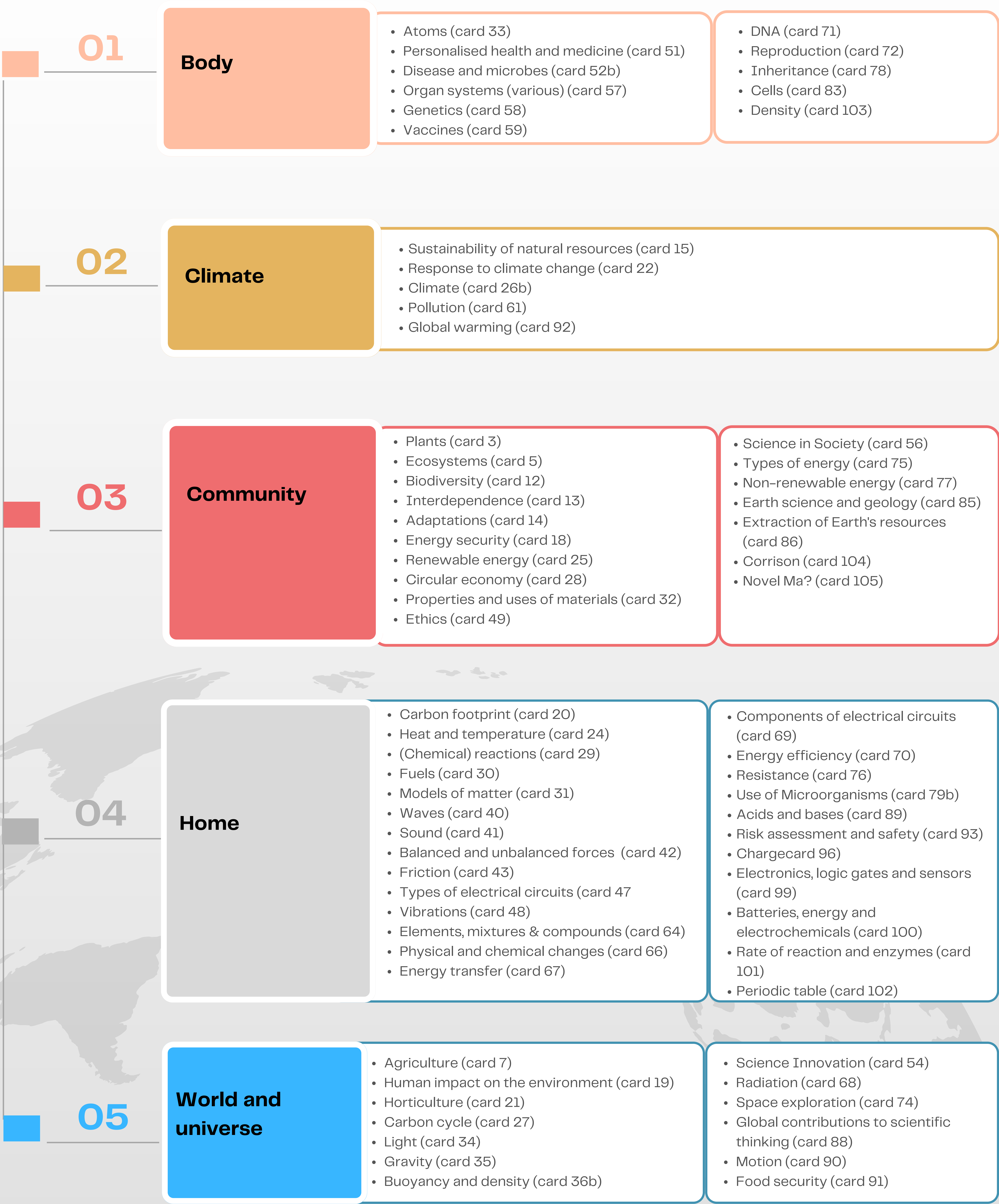
Concept headers and knowldge card mapping

Concept headers

Knowledge cards

Secondary

Table 10



Concept headers and knowledge card mapping

Secondary

Table 11

Concept headers

Knowledge cards

01	Climate, environment and nature - Sustainability of natural resources (card 15) - Energy security (card 18) - Human impact on the environment (card 19) - Carbon footprint (card 20) - Response to climate change (card 22) - Renewable energy (card 25) - Climate change (card 26) - Carbon cycle (card 27) - Circular economy (card 28) - Fuels (card 30) - Pollution (card 61) - Energy transfer (card 67) - Energy efficiency (card 70) - Types of energy (card 75) - Non-renewable energy (card 77) - Global warming (card 92) - Water as a resource (card 108) - Green chemistry (carbon capture batteries) (card 109)
02	Life science - Living things and non-living things (card 1) - Life processes (card 2) - Plants and photosynthesis (card 3b) - Animals (card 4) - Ecosystems(card 5) - Food webs and food chains (card 6) - Life cycles (card 9) - Habitats (card 11) - Biodiversity (card 12) - Interdependence (card 13) - Adaptations (card 14) - Evolution (card 38) - Personalised health and medicine (card 51) - Disease (card 52) - Organ systems (various) (card 57) - Genetics (card 58) - Vaccines (card 59) - DNA (card 71) - Reproduction (card 72) - Inheritance (card 78) - Microorganisms (card 79) - Animal cells(card 83b) - Plant cells (card 106) - Plant biology (card 107)
03	Nature of science - Ethics (card 49) - Future pathways (card 53) - Knowledge of AI (card 55) - Science in Society (card 56) - Inequalities in Science (card 82) - Science Identity (card 87) - Global contributions to scientific thinking (card 88) - Risk assessment and safety (card 93) - Knowledge of the scientific processes (card 94b) - Cause and effect (card 95) - Models – modelling (card 112)
04	Properties of matter and chemical interactions - Heat and temperature (card 24) (Chemical) reactions (card 29) - Models of matter (card 31) - Properties and uses of materials (card 32) - Atoms (card 33) - Elements, mixtures & compounds(card 64) - Physical and chemical changes (card 66) - Conductivity (card 80) - Extraction of Earth's resources(card 86) - Acids and bases (card 89) - Factoes effecting a chemical reaction (card 111)
05	The physical world - Light (card 34) - Gravity (card 35) - Buoyancy (card 36) - Space and planets (card 39) - Waves (card 40) - Sound (card 41) - Balanced and unbalanced forces (card 42) - Friction (card 43) - Magnetism (card 44) - Seasons (card 45) - Day/night (card 46) - Types of electrical circuits – applications (card 47b) - Vibrations (card 48) - Senses (card 50) - Planetary limits (card 65) - Components of electrical circuits(card 69) - Solar system (card 73) - Space exploration (card 74) - Motion (card 90) - Charge (card 96) - Astrobiology (card 110)

Concept headers and knowledge card mapping

Secondary

Table 12

Concept headers

Knowledge cards

01	Becoming a Scientist	- Energy security (card 18) - Science Identity (card 87) - Global contributions to scientific thinking (card 88)	- Risk assessment and safety (card 93) - Knowledge of the scientific process (card 94)
02	Chemical & Physical Changes	(Chemical) reactions (card 29) - Properties and uses of materials (card 32)	- Acids and bases (card 89) - Gas tests (card 114)
03	Energy	- Heat and temperature (card 24) - Light (card 34) - Waves (card 40) - Sound (card 41) - Types of electrical circuits (card 47) - Energy transfer (card 67)	- Components of electrical circuits (card 69) - Types of energy (card 75) - Resistance (card 76) - Charge (card 96)
04	Environmental Science	- Human impact on the environment – Incorporate pollution, carbon footprint and carbon cycle (card 19b) - Response to climate change (card 22) - Circular economy – future proofing (card 28b)	- Earth science and geology (card 85) - Cause and effect – include climate change, global warning, extraction of Earth's resources and sustainability of natural resources (card 95b) - Sources of energy – includes renewable and non-renewable (nuclear) (card 117)
05	Forces & Motion	- Gravity (card 35) - Balanced and unbalanced forces (card 42) - Friction (card 43)	- Energy efficiency (card 70) - Motion (card 90)
06	Health & Disease	- Disease (card 52) - Organ systems (various) (card 57) - Vaccines (card 59)	- Use of microorganisms – include human microbione (pre & probotics and gut health)card 79c) - Cells (card 83)
07	Life	- Genetics (card 58) - DNA (card 71)	- Reproduction – reintroduce sex chromosones & chromosomal variations (card 72b) - Inheritance (card 78)
08	Matter	- Atoms and atomic structure (card 33b) - Elements, mixtures & compounds (card 64) - Physical and chemical changes – States of matter and models (card 66b)	
09	Science in Society	- Ethics (card 49) - Future pathways (card 53) - Science Innovation (card 54)	- Science in Society (card 56) - Social justice and taking action (card 115) - Science in the media (card 116)
10	The Living World	- Plants and photosynthesis (card 3b) - Ecosystems (card 5) - Food webs (card 6b)	- Agriculture (card 7) - Food security (card 91)

Appendix I – Overview of session 2 to 4

The following table has been created to provide an overview of the output from sessions 2, 3 and 4 and how these led from the generation of concepts by individual groups to emerging big ideas.

The emerging big ideas listed in the right-hand column have been suggested by the Education Scotland Team based on the collated output from these sessions. These are just post-event suggestions at this stage and will be taken to the Core Group workshops taking place in August 2025 for further discussion, testing and refinement.

Suggested concept headers (Session 2 – individual sector groups)	Merged concept headers (Session 3 – collective sector groupings)	Big idea suggestions (Session 4 – cross-sector groups)	Emerging big ideas
Home (secondary) Our world (ELC) Our world/planet (primary) Sustainability and climate (secondary) World and universe (secondary) Beyond our planet (primary) Our living planet (primary) Our planet (primary) Our universe (primary) Life on Earth (secondary) Natural world (secondary) Materials (secondary) New frontiers (secondary) Earth and beyond (secondary)	ELC - Our world Primary - The Universe - Planet Earth - Beyond Planet Earth - Life - Ecosystems Secondary - The environment/ecosystems - Community - Home - World and Universe	All natural processes are cyclical (Table 4) Our world and beyond (Table 13) Our place in the universe (Table 11) Our planet (Tables 7 and 14) Our unique world (Table 12) Our world or World and universe (Table 3) Planet Earth and beyond (Table 1) The future world (Table 10) The Universe and the physical world (Table 8)	Our world and beyond

Earth science and geology (secondary) Interdependence of biological systems (secondary) Space and planets (secondary) Interactions between living things (secondary) Climate (secondary) Community (secondary) Climate, environment and nature (secondary) The living world (secondary) Looking after our planet (ELC) Earth in space (ELC)			
Body (secondary) Life (elc and secondary) Life science (secondary) Living and growing (primary) Living things (ELC and secondary) Health (primary) Life and living things (primary) Cells (secondary) Human health (secondary) Science of health and wellbeing (secondary)	ELC • Living things Primary • Life • Living things • Interdependence Secondary • Living and growing/living organisms • Life science • Body	Life (Table 6) Living and growing (Table 7) Living things (Tables 1, 3, 13 and 14) The living world (Table 10) The science of life (Table 2) The wonder of life – Living things (Table 12) Science of life (Table 9)	Living things

Life journeys (secondary) Individual living things (secondary) Health and disease (secondary) Food and drink (ELC) My body (ELC) Living independently (ASN) Plants (ASN) Senses + (ASN)			
Being a scientist (secondary) Being scientific (secondary) Cause and effect (ELC and primary) Science identity (ELC) Science in society (primary and secondary) Science of science (primary) Science and society (secondary) Nature of science (secondary) Becoming a scientist (secondary) Delivery and key elements (ASN)	ELC • Science identity Primary • Becoming a scientist • Skills • Society • Equity and equality Secondary • Role of Science in society/Being scientific • Being a scientist	Being scientific – I am a scientist (Table 13) Being a scientist (Tables 1, 2, 4, 5, 7 and 11) How do we know? (Table 14) How science impacts society (Table 8) Science identity (Tables 3 and 6) Scientists use evidence to understand the Universe (Table 4) The scientific world (Table 10) Being a scientist – science identity (Table 12) Being scientific (Table 9) Science and society (Table 9)	Being scientific
Cause and effect (ELC and primary) Chemical changes (secondary)	ELC • How things work	Big things are made of smaller things (Table 4) Energy (Table 14)	How things work

Energy (primary and secondary) Energy and forces (primary) Forces (ASN, primary and secondary) How things work (ELC) Interconnections (ELC) Matter (secondary) Materials (ASN) Physical and chemical changes (primary and secondary) Circuits (secondary) Energy and vibrations (secondary) Electricity and forces (secondary) Electricity (secondary) Matter and materials (secondary) Reactions (secondary) Motion and forces (secondary) Chemical world (secondary) Building blocks of matter (secondary) Electromagnetism (secondary) Energy transfer (secondary) Properties of matter and chemical interactions (secondary) The physical world (secondary)	Primary • Energy and forces • Cause and effect • Movement Secondary • Matter and its interactions/chemical changes • Energy • Forces • Material science • Physical science	How things work (Tables 3, 11, 12 and 13) How things work and interact (Table 1) Materials (Table 14) Matter of materials (Table 6) Rules of our world – Scientific principles (Table 7) The physical world (Table 10) The science of how things work (Table 2) The science of materials (Table 2) What the world is made of (Table 7) What things are made of (Table 1) How matter explains the world (Table 8) How stuff behaves (Table 9) What stuff is made of (Table 9)	
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Chemical reactions (secondary) Materials (ELC) Technology (ELC)			
Environmental science (secondary) Our world/planet (primary) Sustainability (secondary) Our scientific environment (primary) Environmental chemistry (secondary) Conservation and environment (secondary) Climate literacy (secondary) Climate change and sustainability (secondary) Looking after our planet (ELC) Future (ASN)	ELC Primary • The Universe • Science for climate change and sustainability Secondary • Sustainability/climate • Science of sustainability	Humans as transformers (Table 6) Human impact on our planet and our world (Table 6) Humans have an impact on the planet and beyond (Table 4) Science for sustainability (Table 11) Sustainable futures (Table 5) Sustaining life on Earth (Table 8) The science of sustainability (Table 2) Climate and sustainability (Table 9)	Sustainable futures

Appendix J: Aligning mathematics and science

1. Graphing and data handling

ELC & primary sectors

- Learners need early visual modelling of graphs, using concrete tools like post-it notes and classroom displays to represent data.
- “Model graphs visually from Early level... from first level to give more time for children to experience bigger, smaller, longer, less than, more than...”
- Lack of hands-on data collection and analysis in primary science, limiting numeracy integration.
- “More experiences for learners in Primary science where data is collected from an investigation and analysis and data handling skills are used to draw conclusions.”

Secondary sector

Learners entering S1/S2 often lack confidence in:

- Drawing graphs
- Choosing appropriate scales
- Using correct graphing vocabulary

“Lack of confidence in line graph drawing / scatter graph... graphing terms and consistent/differences in terminology.”

There is debate over whether digital or hand-drawn graphs should dominate.

“A question going forward might be should hand drawing graphs be the standard... feeling is that SQA still require hand drawn graph skills.”

Bike Park feedback from Collaboration Group

Computer graphs are fine but need major and minor gridlines or would be the same as doing a graph on blank paper.

Also biology its connect the points but chemistry and physics its line of best fit.

Equation of straight line (graphs)

Graphs – huge problem for S1/2...disconnect with Primary.

Aligning mathematics and science

2. Measurement and scale

ELC & primary sectors

- Young learners need physical exploration to grasp size, space, and comparison.
- “Developing spatial reasoning skills... needs to start with movement—children experiencing being at height, navigating different spaces.”
- Challenges include underemphasis on perimeter, area, and volume.
- “Practical elements like measure can be avoided in schools—perimeter/area.”

Secondary sector

Learners face difficulties with:

- Unit conversions
- Scientific notation
- Scales in physics and chemistry

“Big challenges around measure and scale... some of basics have not been mastered.”

Inconsistent notation use across subjects (e.g., mps vs m/s).

“In Physics – different use of symbols (s for speed in Maths instead of v)... different ways of writing units.”

Bike park feedback from Collaboration Group

Important to gain experience estimating and handling volumes.

Eg 0.01, 0.02 etc

ml/cm³

Primary and secondary dept's should use consistent tools eg protractors.

Aligning mathematics and science

3. Number Sense, Sequencing, and Magnitude

ELC & primary sectors

- Emphasis needed on estimating, rounding, comparing big and small values.
- “Understanding of big numbers and orders of magnitude – the difference between a million and a billion.”
Early number sequencing is essential for graph axes understanding.
- “Wide range of ability in sequencing number line for graph axes.”

Secondary sector

Frequent issues with:

- Scientific notation
 - Orders of magnitude
 - Negative numbers
-
- “Rounding, estimating and orders of magnitude (without calling it that).”
 - Review of key numeracy/mathematical skills required to ensure science progression.
 - “Focus on number/life skills rather than higher order maths mastery for STEM.”

Bike park feedback from Collaboration Group

Consider use of manipulations in BGE and Senior phase (not just Primary)

Apps of maths useful for problem solving in Biology eg proportion

Use new tech to visualise virtual/augmented reality eg to walk distances.

Aligning mathematics and science

4. Algebraic reasoning and equation handling

Primary sector

Needs foundation through pattern recognition and formula use in context.

“Application of maths in primary is challenging and not enough across curriculum.”

Secondary sector

Some learners, especially in physics, find the following challenging:

- Rearranging equations
- Understanding and applying variables

“Lack of confidence rearranging equations... we have to spend much more time teaching these skills now.”

Bike park feedback from Collaboration Group

Physics always has to teach this and SOH CAH TOA (rearranging equations)

Share common practice with maths and science re teaching this. Science may use change the side, change the sign however this is not done in Maths.

With reference to “Lack of confidence rearranging equations... we have to spend much more time teaching these skills now.” - Shared practice of how this is delivered/taught to share steps/language/process.

Currently N5 Applications of Maths does not develop algebraic reasoning sufficiently for H Physics.

Aligning mathematics and science

Curriculum misalignment and inconsistency

ELC & primary sectors

- Practitioners feel pace is too fast and content overloaded. Overload of second Level Es & Os prevents deep learning.
- “Need to slow down to allow depth of learning and understanding... so much to do and so little time to do it.”
- Science could be used more effectively to frame numeracy learning.
- “Should we be looking at the science experience... and then frame the numeracy and mathematics knowledge and skills required?”
- “Second level mathematics too many Es & Os to teach and not enough time.”

Secondary sector

- Inconsistent models of BGE and expectations between departments.
- “Schools have flexibility in S3/S4 and using different curriculum models... used to be better defined.”
- Calls for clearer progression frameworks.
- “The 5-14 framework had nicely outlined progression... we’ve lost a bit of this with BGE.”

Bike park feedback from Collaboration Group

With reference to “Should we be looking at the science experience... and then frame the numeracy and mathematics knowledge and skills required?” – make more work based, practical applications of maths in science, eg why count cells?, why is it important to know when cells are in exponential growth (eg for protein synthesis).

Why learn to rearrange formulas? Eg to do molarity calculations.

Why learn about orders of magnitude? Eg to use a multimeter.

Aligning mathematics and science

Cross-sector recommendations / current solutions

1. Align planning across subjects

- Use shared benchmark review sessions to synchronise numeracy and science objectives.
- “Would be helpful for sciences teachers to have more detail about what and how things are taught in mathematics... staff currently having to spend time to go digging themselves.”

2. Embed maths skills in science periods (Secondary)

As practiced in some schools, a dedicated science period in S1 focuses on:

- Interpreting and drawing graphs
- Unit conversions
- Rearranging formulae

3. Reinforce core numeracy through science (ELC & Primary)

- Encourage outdoor and context-rich learning using real measurements and data.
- “Science provides the context for numeracy and mathematics in outdoor learning environments.”

4. Retain & prioritise hand-drawn graphing

Reinforce manual graph drawing before transitioning to digital tools – “SQA still require hand drawn graph skills.”

5. Build a shared vocabulary

Develop cross-disciplinary numeracy glossaries to ensure consistency in unit representation, formula symbols, and graphing terms.

“We need a common mathematical vocabulary.”

Bike park feedback from Collaboration Group

Sign post the maths skills in science and use common language across both areas.

Have maths areas like graphing in the science curriculum explicitly.

Having a separate period with ‘this is maths’ takes away the idea that it is embedded.

Relating to 4 – each science and tech do graphs differently – question as to whether SQA should still require hand drawn graphs?

Relating to 5 – $s = d/t$ versus $v = d/t$. Consistency in unit representation – YES! This would help especially in ASN. Also needs to be aligned with science eg mean versus average and in biology different graph expectations

Appendix K: Sector summaries

Sector summaries

Overview summary – ASN Sector

Participants

Participant numbers below do not include Education Scotland or Scottish Government staff who also attended the event and helped facilitate the sessions.

Sector	Number of participants 	Number of distinct settings 	Number of tables of ASN participants at the event 	Number of distinct local authorities 
ASN	5 Practitioners: 4 Partners: 1	5 Practitioners: 4 Partners: 1	1	3
Participant breakdown	93 5.4%	83 6.0%	14 7.1%	26 11.5%

Session 1 (Sciences Curriculum rationale) and Session 4 (Big ideas)

These sessions were in mixed sessions so there is no sector related data from these sessions.

Session 2 – Knowledge cards and concept headers

Across 14 tables, 96 knowledge cards were reviewed, comprising 62 core group cards (these cards were the output from Core Group workshop 1 in March 2025) and 34 “refined and added knowledge cards (knowledge card content refined and added by Education Scotland).

Number of knowledge cards retained 	Number of knowledge cards modified 	Number of added cards 	Number of knowledge cards removed 	Total number of knowledge cards 	Total number of concept headers 
37	13	2	61	37	7

	Knowledge card distribution for ASN • Displayed the most careful and adaptive use of content. Many cards were removed due to abstractness or complexity. Highest removal ratios—nearly 60% of wild cards removed due to complexity. • Cards that were retained tended to support cause-effect reasoning, emotional wellbeing, and sensory play. • Several modified or added cards were suggested to better support communication, accessibility, and differentiated learning needs. • ASN & ELC: More likely to request modifications or propose new content (e.g., play-based or routine-related science concepts). • ASN removed 59 cards (61.5%), with a strong focus on developmental relevance. • ASN and ELC often diverged from Secondary in content focus but showed alignment with each other in foundational topics (e.g., food, senses).
	Concept headers for ASN • Concept headers reflected real-world functionality and lived experience, such as “Living independently” and “Cause and effect.” • Cards were clustered under accessible, sensory, and social themes. For example, “Emotional wellbeing,” “Weather and seasons,” and “People who can help me” were grouped under headers like “Delivery & key elements” and “Living things.” • The ASN mapping strategy emphasised broad, generalisable headers to support flexible curriculum design.

Session 3 – Concept header alignment per sector

Across 14 tables, sectors agreed individually per sector an alignment of concept headers.

	Concept headers alignment for ASN • Concept headers are ➤ Delivery and key elements ➤ Forces ➤ Future ➤ Living independently ➤ Materials ➤ Plants ➤ Sense+ • Insights: ASN themes emphasise life skills, practical knowledge, and experiential learning. The inclusion of topics like <i>Senses+</i> and <i>Living independently</i> highlights differentiated pedagogy and curriculum design, ensuring scientific ideas support autonomy and sensory engagement for learners with diverse needs.
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Overview summary – ELC Sector

Participants

Participant numbers below do not include Education Scotland or Scottish Government staff who also attended the event and helped facilitate the sessions.

Sector	Number of participants 	Number of distinct settings 	Number of tables of ELC participants at the event 	Number of distinct local authorities 
ELC	12 Practitioners: 8 Partners: 4	12 Practitioners: 8 Partners: 4	2	5
Participant breakdown	93 12.9%	83 14.5%	14 14.3%	26 19.2%

Session 1 (Sciences Curriculum rationale) and Session 4 (Big ideas)

These sessions were in mixed sessions so there is no sector related data from these sessions.

Session 2 – Knowledge cards and concept headers

Across 14 tables, 96 knowledge cards were reviewed, comprising 62 core group cards (these cards were the output from Core Group workshop 1 in March 2025) and 34 “refined and added knowledge cards (knowledge card content refined and added by Education Scotland).

Number of knowledge cards retained 	Number of knowledge cards modified 	Number of added cards 	Number of knowledge cards removed 	Total number of knowledge cards 	Total number of concept headers 
58 common cards for ELC sector Table 13: 80 cards Table 14: 63 cards	0	1 Table 14: 1 card added	11 common cards for ELC sector Table 13: 16 cards Table 14: 33 cards	85 Common cards: 58 Table 13: 22 more cards Table 14: 5 more cards	9 – Table 13 4 – Table 14

	Knowledge card distribution for ELC • Prioritised foundational concepts, removing higher-order content perceived as developmentally inappropriate. • Retained and added cards focused on weather, senses, basic biology, and routines. • New cards like “Hygiene (not microorganisms)” or “Potions and sensory play” demonstrate play-based contextualisation of scientific concepts. • ASN & ELC: More likely to request modifications or propose new content (e.g., play-based or routine-related science concepts). • ELC tables removed over 50% of cards due to abstractness or age inappropriateness. • ASN and ELC often diverged from Secondary in content focus but showed alignment with each other in foundational topics (e.g., food, senses).																				
	Concept headers for ELC • Focused on sensory learning, natural phenomena, and relationships with the environment. • Common headers included “Nature,” “Senses,” and “Living things,” with cards like “Hygiene (not microorganisms),” “Potions and sensory play,” and “Food chains” falling under them. • This sector avoided abstract or domain-heavy terms, instead aligning concept headers with early years developmental frameworks. <table border="1" data-bbox="397 994 1273 1359"> <thead> <tr> <th>Table 13</th><th>Table 14</th></tr> </thead> <tbody> <tr> <td>Cause and effect</td><td>How things work</td></tr> <tr> <td>Earth in space</td><td>Interconnections</td></tr> <tr> <td>Food and Drink</td><td>Life</td></tr> <tr> <td>Living Things</td><td>Our World</td></tr> <tr> <td>Looking after our planet</td><td></td></tr> <tr> <td>Materials</td><td></td></tr> <tr> <td>My body</td><td></td></tr> <tr> <td>Science identity</td><td></td></tr> <tr> <td>Technology</td><td></td></tr> </tbody> </table>	Table 13	Table 14	Cause and effect	How things work	Earth in space	Interconnections	Food and Drink	Life	Living Things	Our World	Looking after our planet		Materials		My body		Science identity		Technology	
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Session 3 – Concept header alignment per sector

Across 14 tables, sectors agreed individually per sector an alignment of concept headers.

	Concept headers alignment for ELC • Concept headers are ➤ How things work ➤ Science identity ➤ Living things ➤ Our world • Insights: The ELC concepts centre around early curiosity, observational learning, and social-emotional connections to the environment and community. There is a strong foundation for fostering <i>science identity</i> early, emphasising exploration, inclusivity, and sensory experiences
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Overview summary – Primary Sector

Participants

Participant numbers below do not include Education Scotland or Scottish Government staff who also attended the event and helped facilitate the sessions.

Sector	Number of participants 	Number of distinct settings 	Number of tables of Primary participants at the event 	Number of distinct local authorities 
Primary	22 Practitioners: 18 Partners: 4	22 Practitioners: 7 Partners: 1	3	14
Participant breakdown	93 23.7%	83 26.5%	14 21.4%	26 53.8%

Session 1 (Sciences Curriculum rationale) and Session 4 (Big ideas)

These sessions were in mixed sessions so there is no sector related data from these sessions.

Session 2 – Knowledge cards and concept headers

Across 14 tables, 96 knowledge cards were reviewed, comprising 62 core group cards (these cards were the output from Core Group workshop 1 in March 2025) and 34 “refined and added knowledge cards (knowledge card content refined and added by Education Scotland).

Number of knowledge cards retained 	Number of knowledge cards modified 	Number of added cards 	Number of knowledge cards removed 	Total number of knowledge cards 	Total number of concept headers 
32 common cards for Primary sector Table 2: 64 cards Table 3: 58 cards Table 4: 44 cards	2 Table 2: 2 cards added	2 Table 2: 2 cards added	11 common cards for Primary sector Table 2: 31 cards Table 3: 38 cards Table 4: 36 cards	85 Common cards: 32 Table 2: 32 more cards Table 3: 26 more cards Table 4: 12 more cards	7 – Table 2 5 – Table 3 5 – Table 4



Knowledge card distribution for Primary

- Retained a **broad, balanced set of cards** spanning life sciences, physical processes, sustainability, and human biology.
- Added cards focused on emerging priorities like **energy systems, climate change**, and **circular economy**.
- Showed moderate card removal, mostly due to perceived overlap or thematic duplication.



Concept headers for Primary

- Demonstrated the **most structured disciplinary mapping**, using headers like “Ecosystems,” “Forces and Energy,” “Materials,” and “Our planet.”
- Cards such as “Sound,” “Reproduction,” “Plants,” and “Ecosystems” were mapped accordingly, showing high thematic clarity.
- Some headers, such as “Our world” and “Living and growing,” were used as **cross-cutting anchors**, reflecting integrated teaching strategies related to sustainability.

Table 2	Table 3	Table 4
Beyond our planet	Energy and forces	Energy
Cause and effect	Health	Forces
Our living Planet	Living and growing	Life and Living Things
Our planet	Our Scientific environment	Our World/planet
Physical and Chemical changes	Our universe	Science of science
Science in society		
Transferable concepts		

Session 3 – Concept header alignment per sector

Across 14 tables, sectors agreed individually per sector an alignment of concept headers.

	Concept headers alignment for Primary - Concept headers are ➤ The Universe ➤ Life ➤ Energy and forces ➤ Becoming a scientist Insights: Primary education builds on curiosity by introducing conceptual frameworks—how things work, where we are in the universe, and basic causal reasoning. Notably, climate change and sustainability appear early, suggesting an effort to normalise complex issues from a young age.
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Overview summary – Secondary Sector

Participants

Participant numbers below do not include Education Scotland or Scottish Government staff who also attended the event and helped facilitate the sessions.

Sector	Number of participants 	Number of distinct settings 	Number of tables of Secondary participants at the event 	Number of local authorities 
Secondary	51 Practitioners: 41 Partners: 13	51 Practitioners: 41 Partners: 13	8	23
Participant breakdown	93 54.8%	83 9.6%	14 57.1%	26 88.5%

Session 1 (Sciences Curriculum rationale) and Session 4 (Big ideas)

These sessions were in mixed sessions so there is no sector related data from these sessions.

Session 2 – Knowledge cards and concept headers

Across 14 tables, 96 knowledge cards were reviewed, comprising 62 core group cards (these cards were the output from Core Group workshop 1 in March 2025) and 34 “refined and added knowledge cards (knowledge card content refined and added by Education Scotland).

Number of knowledge cards retained 	Number of knowledge cards modified 	Number of added cards 	Number of knowledge cards removed 	Total number of knowledge cards 	Total number of concept headers 
14 common cards across 8 secondary tables 142 knowledge cards for secondary	23	25	68 cards removed	142	16 merged concept headers

	Knowledge card distribution for Secondary • Had the highest level of card retention overall and showed a greater appetite for complex and abstract content. • Retained nearly all Core Group cards, and many refined cards dealing with ethics, AI, systems thinking, scientific identity, and planetary science. • Removal was minimal and focused on outdated terminology or cards overlapping with current qualifications content.
	Concept headers for Secondary • Emphasised thematic depth and disciplinary abstraction, with headers like “Chemical reactions,” “Scientific ethics,” “Human impact,” and “Science Identity.” • Cards were tightly clustered to support progression and specialisation. For instance, “Green chemistry,” “Chemical energy,” and “Global systems” were grouped under advanced concept headers. • The mapping shows sectoral maturity and readiness to handle interconnected systems and conceptual overlap.

Session 3 – Concept header alignment per sector

Across 14 tables, sectors agreed individually per sector an alignment of concept headers.

	Concept headers alignment for Secondary • Concept headers are ➤ Role of science in society / Being scientific ➤ Living and growing / Living organisms ➤ Sustainability / Climate ➤ The environment / ecosystems ➤ Matter and its interactions / Chemical changes ➤ Energy ➤ Forces ➤ Being a scientist ➤ Material science ➤ Physical science ➤ Life science ➤ Science of sustainability ➤ Community ➤ Body ➤ Home ➤ World & universe Insights: Secondary education reflects a more formalised structure, aligning closely with disciplinary strands. The inclusion of <i>Being a scientist</i> alongside rigorous content headers suggests a dual focus on knowledge acquisition and epistemic understanding (how science works).
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