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## Developing the Diploma in Science Line of Learning Statement – February 2009

A report on the findings from the Consultation Events and Online Survey

March 2009

*A Report produced by Pye Tait Consulting for the Diploma in Science Diploma Development Partnership (SDDP)*

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## Executive Summary

### Introduction

The Executive Summary and the main report attempt to present a clear picture of the findings for the Science Diploma Development Partnership (SDDP) from a very complex set of responses from many different levels. The four regional consultation events and an online survey available on the Science Diploma website during a 3 week period in February 2009 prompted a range of high level strategic responses, responses on structural issues as well as responses on content and matters of detail.

### Focus for the consultation

The focus for the consultation was the Line of Learning Statement (LoLS) February 2009 version (draft 2 version 3). The LoLS has undergone a series of iterations and now contains:

- Purpose and aims of the Diploma
- Rationale for the Diploma in Science (e.g. vision, evidence, market view, progression, diversity and inclusion)
- Principal Learning content – topics at Foundation, Higher and Advanced levels
- Appendices: identifying challenges and questions; university entry requirements; various consultation processes and subject communities involved; flexibility, personalised learning programmes and progression

### Consultation events and online survey

#### Consultation events

The purpose of the four events was to review a selected set of topics, one per level, with specific questions that checked clarity of topic summary, content, topic purpose and opportunities for the application of learning through work related activities and context.

Attendees at the events were also prompted for feedback on the distinctiveness of the Diploma content to current provision, whether the content matched the vision outlined for the Diploma, and the likelihood of engagement with learners.

Separate sessions in the afternoons provided an opportunity to look specifically at progression from one level to the next, the pitch or demand of content, continuity from Key stage 3 and how well the Advanced level provides a sound basis for progression into Higher Education.

The four events for Science attracted around 95 attendees (this figure has taken into account the few that stayed for both the morning and afternoon sessions), with a fairly strong bias towards Schools and Colleges (41). Aside from training providers, the lowest set of representatives came from Higher Education (5).

#### Online survey

The online survey was an opportunity to provide feedback on a series of questions about

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all three levels of the Diploma in Science, covering all lines of questioning listed above. It was available to all types of stakeholder, regardless of their attendance at an event. Networks, contacts established via previous consultations, and SSC contacts amongst others were alerted to the consultation. Respondents were asked to review the LoLS prior to responding to the online questions.

The survey attracted over 282 respondents (a number of organisations also submitted their own 'collective' responses not necessarily aligned to the specific questions within the survey). Secondary schools at 22% represented the largest stakeholder group, followed by Higher Education Institutions at just under 15%. Employers and Sector Skills Councils representing sectoral employer interests accounted for 8.5% of the respondents.

## Context

It is important to remember the context of these findings. The Diploma is a composite qualification (consisting of Principal Learning, generic learning and the additional and specialist learning – ASL). Consultees were provided with proposals on the Principal Learning only; i.e. without any detail on Additional and Specialist Learning, Assessment, Toolkits or Curriculum guidance. Such items are currently being planned or are in the early stages of development. This incomplete picture understandably prompted a number of queries – many of which were answered at the events or have been separately captured for future note/action by the SDDP.

The summary of findings below presents the feedback from both research applications (events and survey), and with reference to the main stakeholder types (schools/colleges, HE and employers).

## Reaction to the Vision and approach

The vision and themes have been reviewed since the last consultation in September 2008, and there can be no doubt that the 'major challenges and big questions', with an emphasis on a multi-disciplinary approach, has attracted positive and enthusiastic reactions.

Overall survey respondents broadly agreed that the vision reflects employer needs, is engaging for learners, is different to existing 14-19 science provision and is described clearly through the topics.

The survey questions also asked whether the 'vision reflects HE needs' and this is the only question about the vision that attracted clear dissatisfaction - 44.9% at Foundation, 42.5% at Higher and 44.8% at Advanced level disagreed or strongly disagreed.

Around a quarter of responses on the survey noted that the major challenges and big questions could perhaps be even more exciting and visionary than the examples given in the LoLS.

### Main considerations

The bigger issues that have emerged from the consultation vary, depending on stakeholder type, but fall very broadly into these groupings:

1. a perception that the exciting nature of the **vision is not fully translated** into the topics/content (*all stakeholder types*) and this will dampen positive reactions by learners and similarly among those delivering it;
2. lack of clarity in the **relationships of the topics** to the world of work, work related learning and the feasibility and arrangement of work placement element (*schools/colleges*);
3. perceived '**traditional**' nature and **similarity of content** to that currently being taught/delivered (*schools/colleges*);
4. **lack of clarity on progression**; these concerns centred around:
  - the rationale for recommending the Diploma in Science as a viable option given existing curriculum/qualifications particularly at Foundation and Higher level (*schools/colleges*)
  - the Advanced level and acceptance of it by HEIs, and their differing admission requirements (*schools/colleges*)
  - and, **insufficient core scientific principles and maths** to cater for progression into HE - (*HE/schools/colleges*)
5. critical writing and thinking skills are seen as insufficiently catered for (*HE*);
6. there needs to be a balance between practical skills and theoretical knowledge, employers tend to request more of the former with HE requesting more of the latter;
7. there is also some debate about the 'interdisciplinary' nature of the content; although the emphasis is on a multidisciplinary approach, a mix set of respondents are concerned that this implies a deeper specialism within specific scientific disciplines than may have been intended.

### Advanced Level

Besides potential assessment methods and coverage of diversity and inclusions issues, at Advanced Level further survey questions attempted to discover to what extent respondents were content with:

1. opportunities for progression into education and employment
2. Principal Learning content (e.g. balance, amount etc.)
3. proposed approaches to Additional and Specialist Learning

## 1 – Opportunities for progression from the Advanced Diploma in Science

- **Common core**

Just under half of respondents (43.4%) were positive that a common core of Principal Learning at Advanced level would enable progression into both employment and Higher Education – HE representatives were particularly concerned with the suitability of this approach. There were two main points made: that the breadth of content might not allow learners to develop adequate depth of knowledge and understanding to meet HE requirements; or, that the mathematics content was inadequate for learners wanting to progress into HE. Most commonly, respondents suggested the need for Principal Learning to provide a more ‘thorough grounding’ in fundamental scientific principles and mathematics. There were some dissenting voices on this point and the report contains fuller detail.

- **Progression to single sciences/directly related courses**

Whilst 41.3% said that progression to single science courses at HE might be possible, 40.9% said that progression to directly related science disciplines such as medicine and pharmacy would be problematic for Advanced level learners. For both types of courses, there were three main issues: that students will require a deeper knowledge and understanding of scientific concepts than the Diploma will provide; that HE institutions will continue to consider A levels as the ‘gold standard’ of preparation for HE science; that the mathematics coverage is currently not adequate to support science study at HE.

## 2 – Principal Learning

### **Approach**

- Nearly two thirds (64.9%) of survey respondents agreed that the approach to Principal Learning, covering the three major science disciplines and elements of maths, is appropriate. However, some caveats were added – most commonly that mathematics needs to become a ‘central component’ or theme to the Diploma content, rather than just covering ‘elements’ of the subject.
- The multi-disciplinary approach at Advanced level was thought to be appropriate by 64.5% of respondents. Where it was perceived to be inappropriate, this was mainly attributed to the content not being presented in a way that clearly reflected this approach.

### **Content**

- 48.0% felt the amount of content at Advanced level was appropriate – where they did not think so, the content was perceived as being too broad in scope to enable learners to develop a detailed understanding of core disciplines and principles.
- Over two thirds (67.2%) said the content would be engaging to learners, with more than half also agreeing that it looked new and different to existing provision. However, there were caveats added, suggesting that ‘different’ did not necessarily equate to ‘better’.

### 3 – Additional and Specialist Learning

- Although the majority 56.5% agreed in principle with ASL enabling learners to cover the equivalent depth and breadth as a single subject A level, many felt that this would be difficult in practice. It was also queried why learners would choose the Advanced level Diploma if they knew they would need to take A level units anyway, e.g. in order to meet entry requirements for HE courses.

### 4 – Assessment methods

A range of potential assessment methods at Advanced level were suggested by survey respondents – most commonly:

- Closed-book examination: structured questions (84.6%)
- Closed-book examination: essay based responses (81.9%)
- Demonstration of a practical task (80.1%)
- Development and production of case studies (66.6%)

### 5 – Diversity and inclusion

The most commonly identified problems with the potential delivery of the Advanced level Diploma in Science were:

- Lack of availability/suitability of work placements
- Lack of ability to provide appropriate equipment for practical work
- The need for teacher training/CPD
- Lack of sufficient 'hands on' ability of students for complex practical work
- Lack of employer engagement/inability to maintain employer interest
- Lack of specialist support, placements or equipment for learners with individual needs

## Mathematics in the Diploma in Science

It was evident from the consultation that stakeholders consider the development of in-depth mathematical skills, knowledge and understanding to be pivotal to enabling learners to succeed in their scientific study, and subsequently progress both into education and employment from the Diploma in Science. This was a particularly important point for stakeholders considering the Advanced level Diploma and the ability for learners to progress onto Higher Education courses (both in single sciences and science-related disciplines).

It was strongly recommended by many respondents at the face-to-face events, as well as throughout the online survey, that the coverage of Maths at **all** levels of the Diploma is revisited – and, at least at Advanced level, the need for a separate Maths unit very carefully considered.

**Note on this report:**

This report produced for the Science DDP is a presentation of the findings from the online survey and a summary of the consultation events held in February 2009 - for current usage and for future record.

It does not attempt to provide detailed conclusions or recommendations – as it is for the SDDP to discuss and decide upon changes to be incorporated into the Line of Learning Statement and thus into the Line of Learning Criteria.

Pye Tait Consulting was commissioned by the QCA in July 2008 to provide research support to the SDDP which included two detailed research reports. These were:

the Secondary Research Report for the Diploma (January 2009) examined an extensive body of existing research by learned societies, employer representative bodies and academics, with resulting findings helping form the basis for the design of the content for the Diploma.

the Market View for the Diploma in Science (November 2008) comprised a detailed review of the current science qualifications 'market,' establishing how and where the Diploma would best fit within the existing offer.

## 1. Introduction and background

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The SDDP, consisting of eight Sector Skills Councils (SSCs) and facilitated by Semta, represents key UK industrial sectors with a strong interest in science and technology. The eight SSCs represented on the Science Diploma Development Partnership (SDDP) are:

- Cogent
- ConstructionSkills
- EU Skills
- Improve
- Proskills
- Semta
- Skills for Health
- Skills for Justice

As part of the development process, the SDDP has conducted a range of research activities informing the Line of Learning Statement of Content. The Statement is a detailed document that outlines the rationale and vision for the Diploma and the content that should be included within the Principal Learning component at Levels 1 (Foundation), 2 (Higher) and 3 (Advanced).

With documents such as the Secondary Research report (January 2009) and other work helping to inform its development, the SDDP produced a **consultation version** of the Diploma in Science Line of Learning Statement of Content in February 2009.

This formed the main focus for the consultation in February 2009 – to seek feedback on its vision and content before moving towards the stage of creating the regulatory document – the Line of Learning Criteria.

This report brings together key messages from the consultation, and highlights areas for consideration for when the SDDP revise the Line of Learning Statement for each level of the Diploma and produces the Line of Learning Criteria going forward from March 2009.

It is important to remember when reviewing this feedback that the Line of Learning Statement only contains proposed content for the Principal Learning element of the composite qualification. Work on detailing Additional and Specialist learning (ASL), possible progression routes and assessment criteria is yet to be finalised. The consultation feedback therefore only relates, in the main, to questions surrounding Principal Learning.

## 2. Line of Learning Statement Consultation Methodology

### 2.1 Regional Consultation Events

Four regional consultation events took place at the following locations to discuss particular aspects of the Line of Learning Statement for the Diploma in Science:

- London 9<sup>th</sup> February
- Leeds 11<sup>th</sup> February
- Newcastle 13<sup>th</sup> February
- Birmingham 23<sup>rd</sup> February

Events were attended by a wide range of stakeholders, including representatives from school, Further and Higher Education and Local Authorities, Training Providers, Employers and Representative Bodies. The total attendee numbers are presented in the table below.

**Table 1 Total attendees by stakeholder type across all 4 events**

	Percentage	Count
Higher Education	5.3%	5
Employer/ Representative Body	14.7%	14
Schools/Colleges	43.2%	41
Training Provider	3.2%	3
Local Authority	22.1%	21
Other (e.g. Awarding Organisation, Government Department etc)	11.6%	11
<b>Total (not including observers)</b>		<b>95</b>

The aim of the events was to seek constructive feedback from stakeholders on the Line of Learning Statement<sup>1</sup> by examining specific questions in workshop groups. Due to the limited timescales and detailed nature of the Statement, questions covered areas of the Line of Learning the SDDP considered critical to the overall success of the Diploma. Broadly speaking these were: the effectiveness of the topics, and opportunities for progression.

The events were split into two sessions, discussing the effectiveness of the topics in the morning, and progression in the afternoon. In most cases delegates attended either the morning or afternoon session but a small minority attended both.

Each discussion was tape recorded, with feedback sheets distributed to enable delegates to note individual points and opinions.

The workshops were independently facilitated<sup>2</sup>, and observed by representatives from QCA and members of the SDDP. Pye Tait Consulting representatives attended to help inform the key messages post-consultation analysis.

<sup>1</sup> Consultation Draft – February 2009

<sup>2</sup> By Tribal Group Ltd

### Morning Sessions

Three topics were provided for the focus of the morning sessions – one each from Foundation, Higher and Advanced level. These topics were:

***Topic 1.3 Obtaining and analysing materials (30 glh)***

***Topic 2.7 Using scientific techniques to solve problems (60 glh)***

***Topic 3.6 Diagnosing and combating human disease (60 glh)***

Delegates were asked to consider:

- Whether the topic summaries were clear, succinct and understandable and consistent with the knowledge, skills and understanding (KUS) listed, and if not how each could be improved
- Whether, in each topic, the content seemed appropriate for the Diploma and if the volume of content would present difficulties for delivery
- How clear the purpose of the topic was in each topic summary, and if unclear, how each could be improved
- Whether topics provided sufficient opportunity for students to apply their learning in purposeful work-related activities and contexts, and if not how they could be improved (with examples of activities)
- Whether topics were sufficiently distinct from current provision and if not, what changes were required
- Whether the topics supported a curriculum that will be engaging for learners
- Whether the topics overall reflected the vision outlined for the Diploma by the SDDP

### Afternoon Sessions

The afternoon session focussed on how topics supported progression into, within and from the Diploma. The example topics highlighted progression through the Diploma levels in a single area of content, from Foundation through to Advanced.

The topics chosen were;

***Topic 1.5 Generating and using electricity to do work (30 glh)***

***Topic 2.5 Harnessing, storing and using energy efficiently (60 glh)***

***Topic 3.5 Using energy in transport, communication and detection (90 glh)***

Delegates were asked to consider;

- Whether topics showed clear progression in terms of the KUS and if not, what changes were required at each level
  - Whether the topics were at the right 'level' for students, and if not, what changes were required
  - Whether there was clear progression from Key Stage 3 to Foundation/Higher levels
  - Whether opportunities existed for co-teaching of Foundation and Higher level topics
-

- Whether Advanced level topics provided a sound basis for progression into Higher Education, either in the same discipline or more broadly, and,
- Whether additional A levels would be required alongside the Diploma to support progression to HE?

A series of optional questions were also asked in either the morning or afternoon sessions where time permitted, and where there was clear experience and familiarity with the Statement of Content amongst delegates. These questions covered the overarching aims of the Diploma, and coverage of Personal, Learning and Thinking Skills (PLTS) and Functional Skills.

## 2.2 On-Line Survey

The questions for the online survey were developed from a series of suggestions by Pye Tait Consulting, the SDDP Project Team with contributions by the DCSF, QCA and UKCES.

It was hosted on the Diploma in Science website<sup>3</sup> between February 9<sup>th</sup> and February 27<sup>th</sup> 2009.

Respondents were asked to consider a range of different issues for each of the Foundation, Higher and Advanced levels. These included:

- Attracting learners to the Diploma
- Translating the vision of the Diploma
- Progression
- Principal Learning content
- Assessment
- Diversity and inclusion

The survey ensured stakeholders who could not attend the events, or did not wish to attend, could still have their say on the Statement of Content. Those who did attend the events were also encouraged to take part. The survey was open to a wide range of stakeholders and the respondents are listed by type below. The vast majority of those who responded to the survey did not attend any of the four events.

In total 282 responses were received. The breakdown is provided below.

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<sup>3</sup> [www.sciencediploma.co.uk/consultation](http://www.sciencediploma.co.uk/consultation)

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**Table 2 Online survey respondents by stakeholder type**

	Percentage	Count
<b>Awarding Body</b>	3.2%	9
<b>Employer</b>	5.7%	16
<b>Secondary school (11-16)</b>	8.2%	23
<b>Secondary school (11-18)</b>	13.8%	39
<b>Specialist science school/college</b>	3.2%	9
<b>Further Education/6<sup>th</sup> form college</b>	10.3%	29
<b>Higher Education Institution</b>	14.9%	42
<b>Learning and Skills Council</b>	0.7%	2
<b>Local Authority</b>	7.4%	21
<b>Professional body/association</b>	7.1%	20
<b>Science professional</b>	11.7%	33
<b>Sector Skills Council</b>	2.8%	8
<b>Other</b>	11.0%	31
<b>TOTAL</b>		<b>282</b>

Those classifying themselves as 'other' included:

- Charitable organisations (x4)/Consultants (x6)/Connexions advisers (x2)
- Examiner/moderator/Curriculum developer (x2)
- HE admissions tutor/Provider offering HE and FE provision

In addition to the 282 responses to the survey questionnaire, there were 11 'freeform' responses to the consultation (e.g. from associations such as SCORE, ACME and STEMNET), their main points have been included within the analysis of the survey responses.

### 3. Key messages from the consultation events

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Each event was independently facilitated; there was little scope for debate or opportunity to probe into responses made by attendees from others present (including the DDP member or the SDDP researcher).

The responses below have been drawn from the main rapporteur for each separate group at the events.

In addition, attendees were asked to use Post It notes to note down any individual comments or points they wished to make, exclusive of the group discussion.

#### 3.1 Coherence and clarity of topics

This was the first area covered in the morning group discussions.

Across all four events there was a consistent belief that the topic summaries seem clear and succinct, and on the whole consistent with the Knowledge, Understanding and Skills (KUS).

However there was a strong message from schools at the Birmingham, Leeds and Newcastle events, stating that there is not enough emphasis on the 'skills.' It was unclear if this comment was prompted by the fact that the Statement requires the Knowledge statements to be set out before the Skills and that the list of knowledge statements is longer than that for Skills.

#### 3.2 Topic content

In the morning discussion in Birmingham, all mixed groups voiced concerns that a topic driven approach would lead to 'content-based' teaching. They said this was certainly something that should be avoided.

Another point made by one mixed group in Birmingham and one in Leeds, and several schools in Birmingham and Newcastle, was that some of the topics are content heavy and may pose a problem for delivery.

Specifically, teachers requested space within the content to develop tasks that will engage learners, and enable consideration of emerging disciplines and scientific breakthroughs, as hinted at in the vision.

#### 3.3 Applied purpose

Mixed groups at all four events cited a number of points regarding the applied/work-related aspects of the Diploma content. These included:

- A need for more examples from industry to 'bring the content alive' and make it real and relevant
- A need for more on how the topics relate to the world of work
- The applied flavour is not described sufficiently
- Exemplification through 'local' contexts would be helpful for both teaching and learning

### 3.4 Distinctiveness of the Diploma

There was general consensus across all events, particularly from schools, that the Diploma (in its current form) does not look markedly different from existing qualifications.

Specific examples used by attendees to describe qualifications the Diploma appeared similar to included OCR Nationals (Science), BTEC Science and current GCSE Science courses.

### 3.5 Engaging for learners

There were many comments on this point. All groups in Leeds and one group in Birmingham said there is no 'wow factor' in the topics. As a result they said the topics would not be inspiring for learners or teachers.

Similarly all groups in Newcastle and a mixed group in Leeds said the content is not scenario based enough and therefore not engaging for learners.

These groups also asked whether the Diploma could be linked to the Assessing Pupils Progress programme which they claimed could be motivational for the learner.

### 3.6 Content reflects the vision

One mixed group in each of the Birmingham, Leeds and London events said the vision is not translated into the content, partly because of the low emphasis on 'skills' within the topics.

They said the vision suggests there will be less content and more application than is actually apparent in the topics provided.

### 3.7 Progression in the KUS through the Diploma

There was general consensus across all four events that progression is visible and clear throughout the topics but there are some inconsistencies. Those noted have been presented in various places throughout the report, including the Appendices.

### 3.8 Demand appropriate for level

The groups at all events struggled to answer this question coherently, as in many instances they were unsure of the target audience for the Diploma.

Examples of common points made included, 'why would an A Level student do the Diploma' and 'it must be aimed at vocational students' and 'it's not for the brightest students'.

Those that did comment said that on the whole demand appears to be at the right level for learners.

### 3.9 Continuity with Key Stage 3

There was some evidence across all groups at all events of differences in understanding in terms of where the Diploma will be placed in relation to Key Stage 3 and 4.

Most groups concurred that Foundation level is equivalent to current Key Stage 3 provision and decided that most learners would go straight to the Higher Diploma from Key Stage 3. From this the question was raised as to why learners would do the Foundation level if they had already covered much of the content at Key Stage 3.

### 3.10 Co-Teaching at Level 1 and 2

There were mixed reactions from the groups to whether co-teaching would be possible. These ranged from it being very easily possible to not possible at all.

Another point made included co-teaching posing a problem for those progressing to Higher level. There was concern over elements of duplication in the work from that which had been studied before.

The concerns regarding co-teaching tended to centre around a number of issues most notably practical issues such as timetabling and other logistical considerations.

### 3.11 Support for progression to Higher Education – Including suggestions for Additional and Specialist Learning (ASL)

A number of groups from all four events focussed on how the Diploma will be accepted by Universities.

Commonly occurring points made included:

- 'many (universities) still do not accept BTEC courses, so in reality some universities will accept it (Diploma) and some won't'
- (there is a) 'limited amount of physics to support progression to HE'
- 'A levels are not the be all and end all so it's good for learners to have another option', and,
- 'the Advanced level topics will provide a sound basis for progression to HE and it is not something to worry about, because the first year of HE is used to ensure all students are at the same level anyway!'.

It is useful to note that other points were raised at the events that are in many ways common to the other Diplomas. It may be useful to have those noted here for future record by the SDDP.

These are (*in no particular order*) :

- The type of learner that would choose a Diploma, given for example issues such as the existence of other 'similar' subject qualifications or performance targets required of schools from the core curriculum
- The assessment profile for the Diploma in Science at different levels is regarded as a fundamentally critical element but it is not yet known
- Work placements – how will these be managed, and how much are the employers prepared to be involved
- Timetabling – this seems to be of concern to schools and colleges alike in terms of the logistics and what can be included within a school 'week'
- CPD is a must for teachers in science – a point made by teachers and HE alike – not just in the subject area but relating to how science is used by scientists and by those who use science in their work across a range of industries
- Work related learning – a very simple point on its integration and practicality. There is evidence of confusion over the difference between this and the required work placement element.

## 4. Online survey findings - Foundation level

A summary of the main findings for the Foundation level is presented here with fuller detail following.

### SUMMARY - FOUNDATION

**These are the headline results from the online survey.**

Most (51.6%) thought Foundation level would attract learners wishing to undertake a science-based apprenticeship, but still some uncertainty (8.1%) who it would attract.

### TOPICS

- 78.8% said topic summaries reflect the content; the remainder reported that the vision of a 'challenging, dynamic approach' came through in the vision but did not necessarily translate well into the content.

The majority said topics reflect:

- **opportunities to develop relevant practical skills** (76.3%)
- **science-based work requirements and real-world problems** and issues (68.0%) – but, 26.2% thought the topics were unsuccessful in this respect – three stated that there was currently a lack of detail about how this would be delivered in practice
- **flexible, less prescriptive content** (65.5%)
- **enquiry-based learning approaches** (61.2%)
- **application of maths** (54.9%) – however, **30.3% disagreed, with calls for more detail on the level/depth of mathematical content envisaged for this level of the Diploma**
- **critical writing and thinking skills** (51.6%) – however, **30.2% disagreed; it did not appear to be clear to these respondents how these skills could be developed among Foundation level learners**
- The majority thought topics contain the right amount of content (54.0%) and are satisfied with the balance between theoretical knowledge and practical skills (58.7%). However, 23.4% felt there was not enough or too much content – both groups suggesting a need to concentrate more on developing thinking skills at this level. Among those not satisfied with the balance of content (29.4%) – HE representatives reported a lack of theoretical knowledge, employers requested greater emphasis on practical skills.

***A range of specific changes to individual topics were suggested. These have been provided in detail in the Appendix.***

### VISION

- Nearly half (44.9%) disagreed that the vision reflects HE needs at this level; a further 16.7% said that they were not sure. This was mainly attributed to a perceived lack of ability for learners to develop a sound basis of core scientific knowledge and

understanding.

- 30.7% disagreed that the range of challenges and questions was exciting and visionary; 29.6% disagreed that the challenges and questions followed through clearly into topics.

### **PROGRESSION**

- The majority felt that progression routes into education/employment were clear (66.9%), as well as across the different Diploma levels (65.3%). Where they thought routes were unclear, respondents felt that routes into employment appeared limited, and queried the practicality of 'sideways' progression.

### **KUS STATEMENTS**

- Although 36.8% did not think any KUS needed to be moved, 37.9% said that they did not know. Of the few points raised, these related to removing duplication of Key Stage 2 and 3 material (see appendix for detail).

### **ENGAGING LEARNERS**

- Over one third did not think topics would be engaging for learners, or did not know. This was put down to a perceived lack of difference with existing KS3 and KS4 Programmes of Study, or lack of relevant applications of science to everyday life. It was also pointed out that delivery style, not content, will decide whether the Diploma is engaging.

### **EXISTING PROVISION**

- Nearly half (48.8%) disagreed or did not know whether Foundation level looks different to existing provision. Even where they agreed – five added the caveat that 'new and different' did not translate into 'desirably different' or 'better'. Fourteen identified overlaps with BTEC, GCSE, Key Stage 2 and 3 content. Two conceded that similarities were inevitable, for example because of the need to reflect the Key Stage 4 curriculum.
- 30.1% disagreed that the vision outlined how the Diploma would be different to existing provision at this level; again identifying overlaps with current courses as listed above.

## 4.1 Attracting learners – Foundation level

In terms of attracting learners to the Diploma in Science at Foundation level, the science-based apprenticeship is the most commonly selected option:

**Table 3 Attracting learners – Foundation Level**

	Percentage of respondents
Learners looking to progress onto a science-based apprenticeship	51.6%
Learners who enjoy a mix of theoretical and applied learning	50.0%
Learners looking to progress into entry-level employment	44.1%
Learners not yet decided about their destination post-Level 1 learning	43.6%
Learners looking to develop a solid basis of science knowledge and skills	37.8%
Other (please state)	17.6%

Base - 185

A further 15 respondents (7.9%) said that the Foundation level Diploma in Science was unlikely to attract many (or any) learners, for the following reasons:

- Lack of opportunity to gain grades higher than an equivalent to D at GCSE
- Similarity to existing, established courses such as BTEC or Applied Science GCSE
- Learners not wanting to commit so heavily to science at a young age, when they may not have made decisions about future career or education aspirations

Three suggested that learners would take the Foundation Diploma if 'advised to do so by their teachers'.

Eight said that they found the rationale for the Diploma, or the Line of Learning Statement itself, to be unclear as to the type of learner the qualification is intended to attract – for example: one could not get a 'flavour' from the document of who Foundation level would attract, and another said that the document is 'strong on aspiration and weak on how the aspirations were to be delivered'.

**Table 4: Translating the vision – Foundation Level****4.2 Translating the vision – Foundation level**

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>	<b>Don't Know</b>
The vision for the Diploma in Science reflects employer needs (Base – 154)	6.5% (10)	14.3% (22)	<b>53.9% (83)</b>	7.8% (12)	17.5% (27)
The vision for the Diploma in Science reflects HE needs (Base – 156)	15.4% (24)	29.5% (46)	<b>33.3% (52)</b>	5.1% (8)	16.7% (26)
The vision outlines how the Diploma in Science will be engaging for learners (Base – 156)	5.1% (8)	17.9% (28)	<b>57.1% (89)</b>	12.8% (20)	7.1% (11)
The vision outlines how the Diploma in Science will be different to existing 14-19 science provision (Base – 153)	11.1% (17)	19.0% (29)	<b>52.9% (81)</b>	13.7% (21)	3.3% (5)
The vision of major challenges and big questions described in Section 1 clearly follows through into the topics (section 2) (Base – 152)	9.9% (15)	19.7% (30)	<b>58.6% (89)</b>	7.2% (11)	4.6% (7)
The examples given in the diagram (see section 1.2.2 in the LOLS) indicate a good range of challenges and questions that are exciting and visionary (Base – 150)	6.0% (9)	24.7% (37)	<b>52.0% (78)</b>	9.3% (14)	8.0% (12)

Although overall, most stakeholders agree with the statements regarding the vision and how it is translated at Foundation level, there are some areas where a significant minority of survey respondents cited their disagreement.

**The vision reflects HE needs (44.9% say they disagree or strongly disagree at Foundation level)**

Of those disagreeing with this statement at Foundation level, just less than one quarter (24.6%) were secondary schools, and 23.1% were HE representatives. Where they provided additional comments, seven respondents perceived a lack of opportunity for learners at this level to develop a 'sound knowledge and understanding of each of the core scientific disciplines' (HE representative). Even though they acknowledged the interdisciplinary approach of the Diploma, another HE provider suggested that this had been 'misunderstood' in the vision and required individuals to develop 'focussed skills in a particular discipline'.

Two respondents suggested that the specific learning and support needs of Foundation level learners needed to be considered, and two also queried whether there was adequate coverage of maths within the current content.

**Diagram in 1.2.2 indicates a range of challenges and questions that are exciting and visionary (30.7% say they disagree or strongly disagree at Foundation level)**

The types of stakeholder most disagreeing with the above statement at Foundation level were secondary schools (26.0%). There were very few further comments made in relation to this point, but three respondents said that although there was a good range of questions and challenges, they could not agree that they were 'exciting and visionary'.

**The vision outlines how the Diploma will be different to existing provision (30.1% say they disagree or strongly disagree at Foundation level)**

Secondary schools were again the largest group of stakeholders disagreeing with this statement (24.4%). Where they made further comment, seven respondents identified overlaps with current GCSE science, GCSE Applied Science and BTEC qualifications, as well as Key Stage 3 curriculum content and were unable to see how the Diploma would be different to these. Three others felt that the vision had not been clearly translated into the topic content to show how the Diploma would be different, and there was a '*need to state clearly in one paragraph how this is different and what the target audience is*' (charitable organisation).

**The major challenges and big questions clearly follow through into the topics (29.6% say they disagree or strongly disagree at Foundation level)**

Secondary schools most predominantly disagreed with this statement (20.4%) at Foundation level – a further 11.3% were HE representatives and 11.3% also local authorities. Little additional comment was made in reference to this, except to reiterate points made above that the vision of addressing big questions does not appear to translate clearly into the topic content, or show how the Diploma will be different to existing provision.

### 4.3 Progression – Foundation level

**Table 5 Progression routes into education/employment- Foundation level**

	Very Unclear	Unclear	Clear	Very Clear	Not Sure
Foundation level	7.4% (11)	20.9% (31)	<b>60.8% (90)</b>	6.1% (9)	4.7% (7)

Base = 148

Just less than 22% of those stating progression routes at Foundation level are unclear or very unclear responded from HE Institutions. Nearly 30% more were either employers or science professionals (14.6% each).

Eight respondents went on to specify that they thought routes into employment were particularly unclear from the diagram in section 1.6.1 – *'employment examples may appear to be limiting the opportunities from the Diploma'* (employer).

Two queried that a route into apprenticeships from Foundation level does not appear possible from the diagram provided in the line of learning statement.

**Table 6 Progression routes across different levels of the Diploma- Foundation level**

	Very Unclear	Unclear	Clear	Very Clear	Not Sure
Foundation Level	6.9% (10)	21.5% (31)	<b>61.1% (88)</b>	4.2% (6)	6.3% (9)

Base = 144

Of those thinking progression routes across different levels were unclear or very unclear at this level, 22.5% were HE representatives; 17.5% were science professionals and 12.5% secondary schools taking learners aged 11-18.

Nine respondents specifically queried whether 'sideways' or 'horizontal' progression was explained clearly enough and, in practice, possible. Other queries were also raised regarding the opportunity for progression between Foundation and Higher levels of the Diploma. For example, one asked whether this would mean four years of study, and another stated that for schools or colleges offering the Diploma, 'flexibility is essential' – i.e. not making students opt for a specific level at this stage in their learning, particularly those 'performing at the critical C/D borderline'. Such requirements, it was pointed out, are not necessary with existing tiered GCSE specifications in science.

#### 4.4 Principal Learning content – Foundation level

This section covers a number of items:

- How well do the topic summaries reflect topic content
- Balance between theoretical knowledge and practical skills
- success in identifying issues addressed through the secondary research
- Should any of the Knowledge, Understanding and Skills be moved
- Engaging for learners and difference with existing provision

**Table 7 How well topic summaries reflect the topic content- Foundation level**

	Not well at all	Not very well	Quite well	Very well	Not Sure
Foundation Level	2.1% (3)	10.6% (15)	<b>66.0% (93)</b>	12.8% (18)	8.5% (12)

Base = 141

Of the 21 stakeholders adding further responses relating to the topic summaries, 28.5% have suggested that although the summaries may infer a 'dynamic, challenging approach' or elements of the vision and big questions, this does not translate as well into the content of the topics themselves which can appear 'traditional' or similar to the existing curriculum. Two suggested that at Foundation level there needs to be further reference to how science is applied to 'everyday lives' – for example, in topic 1.3 it was put forward that there needs to be content adding relating to the environmental impact of mining.

**Table 8 Balance between theoretical knowledge and practical skills-- Foundation level**

	Not satisfied at all	Not too satisfied	Quite satisfied	Very satisfied	Not sure
Foundation Level	11.9% (15)	17.5% (22)	<b>52.4% (66)</b>	6.3% (8)	11.9% (15)

Base = 126

Although 58.1% of respondents stated being quite or very satisfied with the balance between theoretical knowledge and practical skills at Foundation level, a further 29.8% are not satisfied with this balance. The additional comments made by those unsatisfied with the current balance are generally split as to whether there appears to be too much theoretical or too much practical content.

Perhaps not surprisingly, this conflict lies between two distinct perspectives – over three-quarters of respondents citing a lack of theoretical content are HE representatives; whereas at least half of those looking for a greater emphasis on practical skills are employers.

As one professional body affirmed, the challenge is being able to reconcile these two perspectives within the one qualification – *'We welcome the inclusion of both theoretical knowledge and practical skills in the Diploma. However, this must not be at the expense of developing a fundamental understanding of science in general and its mathematical basis in particular'*

**Table 9 Success in addressing the following issues identified through the secondary research**

	Very Unsuccessful	Unsuccessful	Successful	Very Successful	Don't Know
Content centred on science-based work requirements and on "real-world" problems and issues (Base - 122)	5.7% (7)	20.5% (25)	<b>63.9% (78)</b>	4.1% (5)	5.7% (7)
Integrated progression route for knowledge, understanding and skills in the sciences (Base – 120)	5.8% (7)	15.0% (18)	<b>65.8% (79)</b>	3.3% (4)	10.0% (12)
Application of mathematical skills and knowledge in a scientific context (Base - 122)	9.0% (11)	21.3% (26)	<b>50.8% (62)</b>	4.1% (5)	14.8% (18)
Flexible, less prescriptive content (Base – 122)	1.6% (2)	23.0% (28)	<b>55.7% (68)</b>	9.8% (12)	9.8% (12)
Emphasis on developing enquiry-based learning approaches among students (Base – 121)	8.3% (10)	19.0% (23)	<b>52.1% (63)</b>	9.1% (11)	11.6% (14)
Opportunities to develop relevant practical skills (Base – 118)	2.5% (3)	11.0% (13)	<b>67.8% (80)</b>	8.5% (10)	10.2% (12)
Critical writing and thinking skills (Base – 122)	7.4% (9)	23.8% (29)	<b>50.0% (61)</b>	1.6% (2)	17.2% (21)

Although overall, stakeholders agree that the Foundation level Diploma in Science is successful in reflecting the areas listed above, however, more than one quarter think that it is unsuccessful in the three areas of:

1. Critical writing and thinking skills (30.2% said unsuccessful or very unsuccessful)
2. Application of mathematical skills and knowledge (30.3% said unsuccessful or very unsuccessful)

3. Content centred on science-based work requirements (26.2% said unsuccessful or very unsuccessful)

### **Critical writing and thinking skills**

Over one quarter (27.5%) of survey respondents stating that this area at Foundation level was 'unsuccessful' were representatives from secondary schools.

It was suggested by one science professional that most content will be covered in a 'fairly didactic way' using 'mundane practical work' to 'tick the right boxes' rather than providing opportunities for critical thinking. Two respondents suggested that it was unclear from the Line of Learning Statement how these skills could be developed at Foundation level, with one secondary school stating that they were sceptical because 'independence is likely to be an issue with learners at this level'.

### **Application of mathematics**

Of those that rated this aspect as being 'unsuccessful', 19.2% were representatives from HE and a further 15.4% were science professionals. Additional comments on the application of mathematics at this level were minimal, with three calls for further detail on the level/depth of mathematical skills and knowledge learners at Foundation level are going to be expected to apply in a scientific context.

### **Content centred on science-based work requirements and 'real world' problems and issues**

Of those stating that this aspect of the Foundation level is currently 'unsuccessful', the greatest proportion of responses came from secondary schools (24.0%) and employers (16.0%). Three respondents said that although it was outlined in the vision, there was currently a lack of detail on how the Foundation Diploma in practice would be led by practical, work-related applications.

**Table 10 Amount of content- Foundation level**

	<b>Not enough content</b>	<b>Just the right amount</b>	<b>Too much content</b>	<b>Not sure</b>
Foundation Level	10.5% (13)	<b>54.0% (67)</b>	12.9% (16)	22.6% (28)

Base = 124

There is some perception among stakeholders that the topics may be aiming to do too much, 'to be seen to cover everything' and as a result, as one secondary school representative suggests, 'learners will only pick up a fraction of what they are exposed to'.

Of the 13 respondents that suggested there is not enough content at Foundation level, 5 (38.4%) were from HE institutions and 3 (23.0%) were science professionals. The five HE representatives reported insufficient coverage of core scientific and mathematical principles to provide students at this level with a 'scientific context for skills development' or help develop their conceptual thinking and ability in working with and presenting data.

The 16 believing that that there is too much content at Foundation level were spread much more across different stakeholder types, and included 3 secondary schools (11-18), 2 Awarding Bodies, 2 SSCs and 2 local authorities. Although they gave the initial response that there is 'too much content', additional comments indicate a similarity in opinion to those who feel that there is too *little* content – i.e. that either way, the result will be students unable to

develop a solid foundation of knowledge and skills in the time available.

The key to both arguments seems to be to reflect the development of thinking skills at this level. One respondent from an FE college suggested further development of thinking skills in order to *increase* the content; another suggests that the topics at Foundation level should *'drop some content'* to 'concentrate on developing thinking' (again from an FE college).

*The ambition to develop seriously good practical skills as well as communication and mathematical skills and to learn by investigation and enquiry means that the content has to be much more severely constrained* (curriculum developer)

**Table 11 Should any of the KUS be moved -Foundation level**

	Remove	Move higher	Move lower	Integrate with another topic at same level	Appropriate	Don't know
Foundation Level	3.4% (4)	6.0% (7)	6.0% (7)	10.3% (12)	36.2% (42)	<b>37.9% (44)</b>

Base = 116

There were some concerns raised among respondents that the Foundation level Diploma repeats content from the Key Stage 2 and 3 curricula. Specific comments relating to topics at Foundation level were as follows:

- **Topics 1.1 and 1.2** repeat Key Stage 2 and 3 material that should be removed (two stakeholders)
- The Foundation Diploma overall contains too much Key Stage 3 material.
- **Topic 1.3** (section 5) seems quite hard for the intended ability range (two stakeholders). Reversible reactions repeats KS2 and KS3 material.
- **Topic 1.4** chemical vs. nuclear reactions too demanding for Foundation level (suggested by three respondents) – move higher
- **Topics 1.6 and 1.7** - histograms are too demanding for this level of qualification.

**Table 12 Engaging for learners - Foundation level**

	Not engaging at all	Not very engaging	Quite engaging	Very engaging	Not sure
Foundation Level	4.1% (5)	16.3% (20)	<b>59.3% (73)</b>	6.5% (8)	13.8% (17)

Base = 121

Of the 25 who do not think that the Foundation level Diploma in Science will be engaging to learners, 28.0% are secondary schools, 16.0% local authorities and 12.0% Sector Skills Councils.

Where 10 of these respondents have made further comment, they give three main reasons for their lack of enthusiasm:

- Three report a lack of difference between proposals for the Diploma content and existing Programmes of Study at Key Stage 3 and 4
- Three suggest that the content lacks relevant, practical applications of science in everyday life ('they need to see science in action')
- Two point out that it is not content but delivery style that will make the Foundation Diploma engaging

**Table 13 New and different to existing provision - Foundation level**

	Strongly disagree	Disagree	Agree	Strongly agree	Don't know
Foundation Level	11.6% (14)	22.3% (27)	45.5% (55)	5.9% (7)	14.9% (18)

Base = 121

Although most stakeholders said that Foundation level does look new and different to existing provision for 14-19 year olds, five (of which 4 were HE representatives) added the caveat that new and different should not be taken to mean 'desirably different' or 'better'.

Where they disagreed or 'don't know' if the Foundation Diploma looks different, 14 stakeholders went on to add that this is a result of apparent overlaps and similarities between the proposed topics and the content of existing courses such as BTEC Science, GCSE sciences (including Applied) and Key Stage 2 and 3 Programmes of Study.

One HE institution did suggest, however, that any proposal that looked 'wildly different' to existing qualifications would cause greater concern to them. A curriculum developer and a secondary school acknowledged that with elements of Key Stage 4 having to be included within the Diploma, overlap with existing provision was inevitable: '*There is such a range of existing 14 - 19 provision that across the board pretty well everything in these topics can be found in other courses* (curriculum developer)'

#### 4.5 Changes to topics

So that the SDDP and Criteria Writer are aware of all suggested changes to topics, comments made during the online survey about topic changes for all levels have been included within an Appendix.

#### 4.6 Suggestions for Assessment – Foundation level

No detail on assessment was provided in the Line of Learning Statement, however, in recognition that this is of interest and concern for those considering delivering the Diploma suggestions for assessment at each level were requested via the survey.

**Table 14 Possible assessment methods appropriate to Foundation level**

	<b>Foundation Level</b>
Closed-book examination: multiple-choice responses	<b>81.3% (87)</b>
Closed-book examination: essay-based responses	18.6% (20)
Closed-book examination: structured questions	54.2% (58)
Development and production of coursework portfolios	<b>77.5% (83)</b>
Development and production of an artefact	39.2% (42)
Development and production of case studies	43.9% (47)
Self-evaluation	36.4% (39)
Demonstration of practical task	<b>81.3% (87)</b>
Viva voce (oral examination)	43.9% (47)

Base - 107

Other suggestions for assessment methods at Foundation level include:

- Giving a presentation to peers/evaluating presentations given by others (x4)
- E-assessments (x4)
- Employer-based assessment (x3)
- Open book examination (x3) – reflects the necessary skill of looking up data
- Production of a portfolio of work (x2) - e.g. researching and testing a product or theory
- Periodic discussions and evaluations with teachers as learners progress (APP) (x2)
- Pre-release paper/research booklet for study before an exam
- Creating multi-media artefacts such as DVD, video diary, podcast, blogs
- Project involving team-based work
- Design and demonstration of a practical experiment

#### **4.7 Diversity and inclusion – at foundation level**

##### **Potential problems with delivery**

A total of 46 respondents identified potential problems with delivery at Foundation level due to diversity and inclusion issues. The main problems cited were:

- Lack of availability of suitable or sufficient work experience placements (9 respondents – 19.5%)
- The potential need for teacher training/lack of subject specialists or teachers with industrial experience to deliver the qualification (7 respondents – 15.2%)
- Learners with individual needs (e.g. disabilities, learning difficulties) requiring

additional support/specialist equipment – creating difficulties in identifying suitable work placements, learners (e.g. those with autism) feeling comfortable with delivery by a range of teachers/locations, or finding the time to provide further learning support that may be required in literacy, numeracy etc. (7 respondents – 15.2%)

- Inability for consortia to engage with employers/create links with industry (6 respondents – 13.0%)
- Health and Safety issues when students are in the workplace or working in a laboratory (5 respondents – 10.8%)

## 5. Online survey findings - Higher level

### 5.1 Attracting Learners

The main type of learner that will be attracted to the Higher level. Respondents were able to tick as many as they thought applicable.

**Table 15 Attracting Learners – Higher Level**

	Percentage of respondents
Learners looking to progress onto a science-based apprenticeship	55.4%
Learners who enjoy a mix of theoretical and applied learning	55.4%
Learners looking to progress into employment at Level 2	54.8%
Learners looking to progress into science-based Further Education (e.g. A levels)	54.3%
Learners looking to develop a solid basis of science knowledge and skills	44.6%
Learners not yet decided about their destination post-Level 2 learning	34.9%
Other (please state)	15.1%

Base = 186

Twenty-eight survey respondents went on to make additional comments about the types of learner likely to be attracted to the Higher level Diploma in Science. Exactly half suggested that it was currently unclear who it would attract. This was attributed to:

- Similarities between existing provision and the proposed content of the Diploma
- The range of science qualifications already available at this level meaning learners may not be attracted to the Diploma, at least until it 'becomes established and progression routes are regarded as secure'
- A lack of understanding or 'insufficient detail' relating to the rationale for a Diploma in Science

## 5.2 Translating the Vision

The table below lists those responses to the question about the vision and respondents views on how well it meets different needs as listed below.

**Table 16- Translating the vision – Higher Level**

	Strongly Disagree	Disagree	Agree	Strongly Agree	Don't know
The vision for the Diploma in Science reflects employer needs (Base - 152)	7.2% (11)	13.8% (21)	<b>54.6% (83)</b>	6.6% (10)	17.8% (27)
The vision for the Diploma in Science reflects HE needs (Base – 153)	13.7% (21)	28.8% (44)	<b>39.2% (60)</b>	2.6% (4)	15.7% (24)
The vision outlines how the Diploma in Science will be engaging for learners (Base – 152)	4.6% (7)	19.7% (30)	<b>56.6% (86)</b>	13.2% (20)	5.9% (9)
The vision outlines how the Diploma in Science will be different to existing 14-19 science provision (Base- 151)	9.9% (15)	20.5% (31)	<b>55.0% (83)</b>	11.3% (17)	3.3% (5)
The vision of major challenges and big questions described in Section 1 clearly follows through into the topics (section 2) (Base – 149)	8.7% (13)	19.5% (29)	<b>60.4% (90)</b>	6.0% (9)	5.4% (8)
The examples given in the diagram (section 1.2.2) indicate a good range of challenges and questions that are exciting and visionary (Base – 148)	7.4% (11)	23.0% (34)	<b>52.7% (78)</b>	10.8% (16)	6.1% (9)

Although that overall most stakeholders “agree” with the above statements, there are three areas where at least thirty percent of survey respondents disagreed.

**The vision for the Diploma in Science reflects HE needs (42.5% of survey respondents either disagree or strongly disagree with this statement for Higher level)**

Taking into account those respondents who answered this question with ‘don’t know’ – the proportion of respondents disagreeing that the vision reflects HE needs is actually greater than those agreeing. Over one quarter of respondents disagreeing were HE representatives

(26.5%) and exactly one quarter were from secondary schools. The main issue raised by these stakeholders was the perception that due to the breadth of the qualification, students undertaking the Higher level Diploma in Science will not develop a 'sound knowledge and understanding of core scientific disciplines' (HE) and instead obtain a 'superficial knowledge of many things' (HE). Three did not think there was sufficient coverage of mathematics to meet HE needs.

**The vision outlines how the Diploma will be different to existing provision (30.4% of survey respondents either disagree or strongly disagree with this statement for Higher level)**

The stakeholder group most disagreeing with this statement at Higher level were representatives from secondary schools (20.0%). Where they added further comments, they identified overlaps with the 'wide range' of existing science provision available at this level, and particularly GCSE Applied Science and BTEC Science courses.

**The examples in the diagram indicate a good range of challenges and questions that are exciting and visionary (30.4% of survey respondents either disagree or strongly disagree with this statement for Higher level)**

Few additional comments were made relating specifically to the major challenges and big questions. Two respondents suggested that although the challenges were appropriate, the big questions might need further work and, as one put it, 'widening' – a range of examples was provided:

### 5.3 Progression – Higher Level

The majority of survey respondents thought that progression routes into education/employment at Higher level were either clear or very clear.

**Table 17 Progression routes into education/employment – Higher Level**

	Very Unclear	Unclear	Clear	Very Clear	Not Sure
Higher Level	9.5% (14)	20.3% (29)	<b>58.1% (86)</b>	6.8% (10)	5.4% (8)

Base - 148

However, just less than 30.0% disagreed (with the largest number of these being HE representatives).

Additional comments relating to progression from Higher level were split equally between two points:

1. It is not apparent from the diagram in section 1.6.1 of the Line of Learning Statement that there is a direct progression route for learners to follow from the Higher level Diploma onto A level courses (5 respondents)
2. Progression through qualifications is thought to be made much clearer in the Line of Learning Statement than the possible employment opportunities open to learners undertaking the Diploma in Science (5 respondents)

**Table 18 Progression routes between different levels of the Diploma – Higher Level**

	Very Unclear	Unclear	Clear	Very Clear	Not Sure
Higher Level	8.3% (12)	18.1% (26)	<b>63.9% (92)</b>	4.2% (6)	5.6% (8)

Base - 144

Where additional comments related to progression between levels, seven respondents queried the practicality – not of progression between different levels – but of ‘sideways’ progression as implied by the diagram in section 1.6.1 of the Line of Learning Statement (e.g. Higher level to GCSEs). One respondent suggested that the diagram actually highlights ‘equivalents’ to the Diploma at each level and if so, progression routes need to be made clearer ‘for the untrained eye’.

#### 5.4 Principal Learning content – Higher Level

This section covers a number of items relating to Higher Level:

- How well do the topic summaries reflect topic content
- Balance between theoretical knowledge and practical skills
- success in identifying issues addressed through the secondary research
- Should any of the Knowledge, Understanding and Skills be moved
- Engaging for learners and difference with existing provision

**Table 19 How well topic summaries reflect the topic content – Higher Level**

	Not well at all	Not very well	Quite well	Very well	Not Sure
Higher Level	2.9% (4)	10.1% (14)	<b>66.2% (92)</b>	12.2% (17)	8.6% (12)

Base – 139

Additional comments were similar across all levels of the Diploma in Science – i.e. the topic summaries either reflected ‘weaknesses’ in the content, or the vision was not then translated into the knowledge and understanding outlined in each topic (11 respondents). Where further explanation was given, two Awarding Bodies suggested that the vision and big questions reflected in the summaries need to be further emphasised within the topic content:

*‘In many places the content seems rather traditional - it needs to be made more applied in order to reflect the summary’*

*‘The topic summaries do have elements of the vision, big questions etc. but the topic content looks like a very traditional general qualification... The content needs to be led by the vision, so that the work-related/applied/ problem solving approach and the big questions etc. are up-front.’*

**Table 20 Success in addressing the following issues identified through the secondary research...– Higher Level**

	Very Unsuccessful	Unsuccessful	Successful	Very Successful	Don't Know
Content centred on science-based work requirements and on "real-world" problems and issues (Base – 121)	8.3% (10)	15.7% (19)	<b>66.9% (81)</b>	3.3% (4)	5.8% (7)
Integrated progression route for knowledge, understanding and skills in the sciences (Base – 123)	8.1% (10)	14.6% (18)	<b>67.5% (83)</b>	2.4% (3)	7.3% (9)
Application of mathematical skills and knowledge in a scientific context (Base - 121)	9.1% (11)	20.7% (25)	<b>52.9% (64)</b>	4.1% (5)	13.4% (16)
Flexible, less prescriptive content (Base -120)	2.5% (3)	19.2% (23)	<b>59.2% (71)</b>	9.2% (11)	10.0% (12)
Emphasis on developing enquiry-based learning approaches among students (Base – 121)	6.6% (8)	17.4% (21)	<b>57.9% (70)</b>	8.3% (10)	9.9% (12)
Opportunities to develop relevant practical skills (Base – 118)	2.5% (3)	11.9% (14)	<b>69.5% (82)</b>	5.1% (6)	11.0% (13)
Critical writing and thinking skills (Base – 121)	8.3% (10)	17.4% (21)	<b>54.5% (66)</b>	4.1% (5)	15.7% (19)

**1. 29.8% of survey respondents think that the application of mathematical skills and knowledge in a scientific context is either unsuccessful or very unsuccessful at Higher level**

Those not thinking that the application of mathematical skills at Higher level is currently successful were mainly representatives from Higher Education institutions (23.5%),

secondary schools (20.5%) and Further Education or 6<sup>th</sup> form colleges (20.5%).

Four made additional comments regarding maths at this point in the survey – stating that it was ‘unclear’ or even ‘incoherent’ as to the sorts of mathematical methods that would be applied, and the level to which a learner’s mathematical ability would be stretched.

*‘Mathematical skills and knowledge are only included in 2.7 and while most of these are of appropriate demand it is not clear whether they apply to all the other topics, in which there are examples of equations etc. It might be better to have an appendix showing the mathematical and ICT requirements for each level of the diploma, which could then be applied where appropriate in each topic. Statistical analyses and levels of confidence are beyond GCSE maths and it is suggested that these are removed.’ (Awarding Body)*

**2. 25.7% of survey respondents think that reflection of critical writing and thinking skills is either unsuccessful or very unsuccessful at Higher level**

This point of view was mainly expressed by Higher Education representatives (25.8%), secondary schools (22.5%) and science professionals (12.9%). Where additional feedback related to the development of critical writing and thinking skills, all five suggested that the opportunities for this at Higher level were currently unclear within the Line of Learning Statement – four suggested that such skills could only be developed once learners had developed a strong basis of scientific and mathematical knowledge and understanding.

**Table 21 Amount of content – Higher Level**

	Not enough content	Just the right amount	Too much content	Not sure
Higher Level	12.1% (15)	<b>52.4% (65)</b>	12.9% (16)	22.06 (28)

Base – 124

Although the majority of stakeholders felt the amount of content at Higher level is appropriate, others were evenly split as to whether there may be not enough or too much content at this level.

However, the limited additional feedback given suggests that in essence, the two groups of respondents were actually making the same point but from slightly different perspectives – i.e. respondents have either interpreted “content” to mean the **amount** of knowledge and skills learners might develop, or the **depth** to which they will be developed.

The content was thought “too much” by those who suggested the Diploma was trying to include a large amount of material for the time available; there was “not enough” for those who think the content is so broad that core scientific and mathematic knowledge and skills are only covered at a superficial level.

Ultimately, the two groups both suggested that the Diploma might be too broad in scope to enable a learners’ detailed understanding of core disciplines and principles (8 respondents – 5 Higher Education representatives and 3 secondary schools).

**Table 22 Balance between theoretical knowledge and practical skills – Higher Level**

	Not satisfied at all	Not too satisfied	Quite satisfied	Very satisfied	Not sure
Higher Level	12.7% (16)	19.8% (25)	<b>51.6% (65)</b>	5.6% (7)	10.3% (13)

Base – 126

Although the majority were satisfied with the balance of theoretical knowledge and practical skills, one third of survey respondents reported being unsatisfied with this at Higher level.

The additional comments made by those unsatisfied with the current balance were split between too much theoretical or too much practical content (9 stated the theoretical content is lacking, 6 stated a wish to see more emphasis on practical work).

Perhaps not surprisingly, this conflict lies between two distinct perspectives – just less than three-quarters of respondents citing a lack of theoretical content were HE representatives; whereas at least half of those looking for a greater emphasis on practical skills were employers or science professionals.

**Table 23 Should any of the KUS be moved– Higher Level**

	Remove	Move higher	Move lower	Integrate with another topic at same level	Appropriate	Don't know
Higher Level	2.6% (3)	3.4% (4)	5.2% (6)	10.3% (12)	<b>40.5% (47)</b>	37.9% (44)

Base - 116

There were limited comments about the knowledge, understanding and skills statements at Higher level:

- 2.1 Microbiology and aseptic technique should be moved to Advanced level
- 2.3 Remove reference to atom economy
- 2.4 Reference to quarks should be moved to Advanced level
- 2.6 Parts could be moved lower as this would be accessible and interesting to Foundation students
- 2.6 Reference to radiation therapy should be removed
- 2.7 Should be integrated with other topics (two respondents)

**Table 24 Engaging for learners– Higher Level**

	Not engaging at all	Not very engaging	Quite engaging	Very engaging	Not sure
Higher Level	0.0% (0)	18.7% (23)	<b>60.2% (74)</b>	8.1% (10)	13.0% (16)

Base – 123

In terms of engaging learners, the Higher level Diploma was generally well received by survey respondents – over two-thirds stated that it appeared quite or very engaging (with a quarter of these being from secondary schools and FE colleges). However, four positive respondents did add the caveat that how engaging the topics proved to be would be dependent on teaching and delivery methods.

**Table 25 New and different to existing provision– Higher Level**

	Strongly disagree	Disagree	Agree	Strongly agree	Don't know
Higher Level	9.8% (12)	24.6% (30)	<b>45.9% (56)</b>	6.6% (8)	13.1% (16)

Base - 120

Although most stakeholders said that Higher level does look new and different to existing provision for 14-19 year olds, five (of which 4 were HE representatives) added the caveat that new and different should *not* be taken to mean 'desirably different' or 'better'.

Where they disagreed or 'don't know' if the Higher Diploma looks different, 14 stakeholders went on to add that this was due to apparent overlaps and similarities between the proposed topics and the content of existing courses such as BTEC and GCSE sciences (including Applied).

One HE institution did suggest that any proposal that looked 'wildly different' to existing qualifications would cause greater concern to them. A curriculum developer and a secondary school acknowledged that with elements of Key Stage 4 having to be included within the Diploma, overlap with existing provision was inevitable: '*There is such a range of existing 14 - 19 provision that across the board pretty well everything in these topics can be found in other courses*' (curriculum developer).

### 5.5 Suggestions for Assessment at Higher Level

No detail on assessment was provided in the Line of Learning Statement, however, in recognition that this is of interest and concern for those considering delivering the Diploma suggestions for assessment at each level were requested via the survey.

**Table 26 Possible assessment methods appropriate to Higher level**

	Higher Level
Closed-book examination: multiple-choice responses	57.4% (62)
Closed-book examination: essay-based responses	49.0% (53)
Closed-book examination: structured questions	<b>89.8% (97)</b>
Development and production of coursework portfolios	<b>79.6% (86)</b>

Development and production of an artefact	35.1% (38)
Development and production of case studies	71.2% (77)
Self-evaluation	46.2% (50)
Demonstration of practical task	<b>85.1% (92)</b>
Viva voce (oral examination)	37.0% (40)

Base - 108

Other assessment methods suggested by stakeholders for the Higher level Diploma in Science were:

- E-assessment (x4)
- Open book examination (x3) – e.g. to reflect the need to be able to look up/identify relevant data
- Employer-led assessment process (x3) – e.g. based on work placement tasks
- Production of a portfolio of work (x2)
- Periodic discussion and assessment by teachers to continually assess learner's progress (x2)
- Giving presentations/evaluating presentations of others (x2)
- Design and demonstration of a practical
- Pre-release paper/research booklet for exam
- Production of multi-media reports (DVD, video diary, blog, podcast)
- Projects involving team-based work
- Production of a written report with a specific focus

## 5.6 Diversity and inclusion at Higher Level

### Potential problems with delivery

A total of 39 survey respondents highlighted potential problems with delivery of the Diploma at Higher level. The main problems identified were as follows:

- The need for teacher training (6 respondents – 15.3%)
- The need to supply specialist equipment to enable learners to carry out practical work effectively/access to sufficient resources (6 respondents – 15.3%)
- The need to engage with employers/sustain their interest (4 respondents – 10.2%)
- Needing to provide specialist support and provision for learners with individual needs, especially for practical work/work placements (3 respondents – 7.6%)
- Health and Safety issues, particularly in relation to work placements (3 respondents – 7.6%)
- Lack of suitable or sufficient work placements (3 respondents – 7.6%)

## 6. Online Survey Findings - Advanced Level

### SUMMARY - ADVANCED

**This short summary provides the headline results from the online survey.**

Most (65.4%) thought Advanced level would attract learners wishing to progress into science-based HE, although caveats were added to suggest that this did not mean that HE would necessarily accept Diploma learners.

### TOPICS

- 75.5% said topic summaries reflect the content; the remainder reported that the vision of major challenges and big questions came through in the summaries but did not necessarily translate well into the topic content.

Most said topics reflect:

- **opportunities to develop relevant practical skills** (68.3%)
- **science-based work requirements and real-world problems** and issues (66.4%)
- **flexible, less prescriptive content** (64.5%)
- **enquiry-based learning approaches** (63.2%)
- **application of maths** (49.2%)
- **critical writing and thinking skills** (60.2%)

In all areas apart from the development of practical skills, over one quarter of respondents felt that the topics did *not* reflect these concepts. This was attributed to inadequate mathematics content for Advanced level science study, a perceived lack of in-depth treatment of scientific principles, and a large amount of content necessitating inflexible or prescriptive delivery.

- Most thought topics contain the right amount of content (48.0%) and were satisfied with the balance between theoretical knowledge and practical skills (50.0%). However, 27.6% felt there was not enough or too much content – suggesting a need to cover more in-depth science and maths knowledge at this level. Among those not satisfied with the balance of content (37.7%) – HE representatives reported a lack of theoretical knowledge, employers requested greater emphasis on practical skills.

***A range of specific changes to individual topics were suggested. These have been provided in detail in the Appendix.***

### VISION

- Nearly half (44.8%) disagreed that the vision reflects HE needs at this level; a further 13.0% said that they were not sure. This was mainly attributed to a perceived lack of adequate mathematical coverage, or a lack of ability for learners to develop a sound basis of core scientific knowledge and understanding.

### PROGRESSION

- The majority felt that progression routes into education/employment were clear (60.2%), as well as across the different Diploma levels (67.4%). Where they thought routes were unclear, respondents felt that opportunities for employment appeared limited, and queried the practicality of 'sideways' progression.
- More than 4 out of 10 respondents (41.3%) felt progression to single subject science at HE might be possible.
- In responding to the same question about progression to 'directly related science disciplines' (exemplified as being medicine or pharmacy) 40.9% said *no, ie this was not possible*. For both areas, it was felt that a lack of adequate maths coverage or in-depth coverage of scientific principles would make progression to HE difficult – plus a perception that HE institutions would continue to favour students who have opted to complete three or four relevant A levels.

### COMMON CORE OF PRINCIPAL LEARNING

- 43.4% agreed with the approach of providing a common core of Principal Learning to meet the needs of employers and HE providers. However, 33.1% did not feel this was appropriate, mostly stating that the Advanced level did not appear to provide sufficient depth of either science or maths to enable progression to HE. Six respondents suggested revisiting the content to provide a 'more thorough grounding' in these areas, and three felt that it would not be possible to meet the needs of employers and HE with one single qualification.

### ADDITIONAL AND SPECIALIST LEARNING

- The majority felt ASL enabling the equivalent of a single subject A level was a suitable approach, although many had reservations that this would be difficult to manage in practice. Twelve queried why learners having to take A level units as ASL would not therefore opt to take full A levels instead.
- Over two-thirds of survey respondents felt that topics at Advanced level would be engaging for learners, although some added the caveat that this would be dependent on delivery style of teachers.

### EXISTING PROVISION

- 43.2% disagreed or did not know whether Advanced level looks different to existing provision. Even where they agreed – five added the caveat that 'new and different' did not translate into 'desirably different' or 'better'. Others identified overlaps with existing Level 3 provision.

## 6.1 Attracting Learners

As before the respondents were asked to choose which type of learner would likely be attracted to the Diploma in Science at Advanced Level. Multiple answers could be selected.

**Table 27 Attracting learners\_– Advanced Level**

	<b>Percentage of respondents</b>
Learners looking to progress into science-based Higher Education	<b>65.4%</b>
Learners looking to progress into science-based employment at Level 3	63.3%
Learners who enjoy a mix of theoretical and applied learning	47.3%
Learners looking to progress onto a science-based apprenticeship	44.7%
Learners looking to develop a solid basis of science knowledge and skills	43.6%
Learners not yet decided about their destination post-Level 3 learning	32.4%
Other (please state)	17.6%

Base - 188

Although nearly two-thirds of respondents suggested that the Advanced level Diploma will attract learners to progress into science-based Higher Education, a number of caveats or queries were raised within the additional comments:

- Learners wishing to progress to science-based HE may be attracted to the Advanced Diploma, but 'find they have been badly served' by the qualification when entering university
- Learners wishing to progress to Higher Education would sooner study 'traditional' A levels in the science subjects as these qualifications are established and recognised by universities
- Learners who have not decided on their main area of study at Higher Education should 'steer clear' of the Advanced Diploma

## 6.2 Translating the Vision – Advanced Level

**Table 28 Translating the vision – Advanced Level**

	Strongly Disagree	Disagree	Agree	Strongly Agree	Don't Know
The vision for the Diploma in Science reflects employer needs (Base – 151)	9.3% (14)	14.6% (22)	<b>49.7% (75)</b>	10.6% (16)	15.9% (24)
The vision for the Diploma in Science reflects HE needs (Base – 154)	18.8% (29)	26.0% (40)	<b>35.7% (55)</b>	6.5% (10)	13.0% (20)
The vision outlines how the Diploma in Science will be engaging for learners (Base – 152)	5.9% (9)	19.1% (29)	<b>55.9% (85)</b>	11.2% (17)	7.9% (12)
The vision outlines how the Diploma in Science will be different to existing 14-19 science provision (Base – 151)	8.6% (13)	19.2% (29)	<b>54.3% (82)</b>	12.6% (19)	5.3% (8)
The vision of major challenges and big questions described in Section 1 clearly follows through into the topics (section 2) (Base – 150)	11.3% (17)	15.3% (23)	<b>62.0% (93)</b>	5.3% (8)	6.0% (9)
The examples given in the venn diagram indicate a good range of challenges and questions that are exciting and visionary (Base – 147)	8.2% (12)	21.8% (32)	<b>51.7% (76)</b>	10.2% (15)	8.2% (12)

### **44.8% of survey respondents disagree or strongly disagree that the vision at Advanced level reflects HE needs**

More than half of those *strongly* disagreeing with the suggestion that Advanced level reflects HE needs were representatives from HE institutions, with three main reasons given for this response:

- Six HE respondents reported that the content, depth and coverage of mathematics at Advanced level was currently 'inadequate' to meet the demands of Higher Education – 'there is no systematic teaching of advanced mathematics in any form, only ad hoc applications, a student who has got this far will be (to his or her surprise, disappointment and annoyance) completely unprepared for a degree course in any mathematically-based discipline' (HE)
- Five HE respondents perceived a lack of opportunity for learners to develop a strong knowledge and understanding of core scientific principles: '*I do not see how this links to fundamental understanding*'. Two specifically raised queries regarding the interdisciplinary nature of Advanced level, commenting that this required individuals to have developed deep interest and specialism within specific scientific disciplines.
- Four HE respondents commented that universities 'look for A levels' and will continue to do so – one said HE institutions would ask, '*if they are bright, why didn't they do A levels?*'

### **30.0% of survey respondents disagree or strongly disagree that the examples given indicate a range of challenges and questions that are exciting and visionary**

Very limited additional comments were made regarding the range of challenges and questions, except to confirm that respondents did not feel the range could be described as 'exciting and visionary'.

### **27.8% of survey respondents disagree or strongly disagree that the visions outlines how the Diploma in Science at Advanced level will be different to existing provision**

Again, additional comments about this statement were limited, but several respondents did identify overlaps with the variety of existing provision for science and applied science, making it 'difficult' to see where the Diploma at this level would offer something different to learners.

## **6.3 Progression at Advanced Level**

A number of different questions about progression were included in the survey and responses to each have been presented below.

### **6.3.1 Progression routes into education/employment**

**Table 29 Progression routes – Advanced Level**

	Very Unclear	Unclear	Clear	Very Clear	Not Sure
Advanced Level	14.4% (21)	19.2% (28)	<b>53.4% (78)</b>	6.8% (10)	6.2% (9)

Base – 146

HE representatives were the largest group of respondents disagreeing that progression routes into education/employment were clear – although it is worth noting that well over a third of all employers responding to the survey also thought that progression routes were unclear (6 out of 16 – compared to just over one quarter of all HE institutions respondents).

Five respondents said that although progression routes into education were clear, employment opportunities from Advanced level were not so well explained. There were additional queries from three that it was not possible to meet the needs of Higher Education institutions, and those of employers, with a single qualification.

Four respondents (all HE institutions) highlighted the need to differentiate between Foundation and Honours Degrees in the diagram in section 1.6.1 of the Line of Learning Statement – it was felt that showing the two types of degree at the same level was misleading.

### 6.3.2 Progression routes across different levels of the Diploma

**Table 30 Progression levels across different levels – Advanced Level**

	Very Unclear	Unclear	Clear	Very Clear	Not Sure
Advanced Level	7.6% (11)	19.4% (28)	<b>62.5% (90)</b>	4.9% (7)	5.6% (8)

Base - 144

Where stakeholders felt that the progression routes across the different levels were unclear at Advanced level, their reasons were the same as those given at Foundation and Higher levels. Respondents queried the practicality – not of progression between different levels – but of ‘sideways’ progression as implied by the diagram in section 1.6.1 of the Line of Learning Statement (e.g. Advanced level to A levels). As suggested before, one felt that the diagram actually highlights ‘equivalents’ to the Diploma at each level and if so, progression routes need to be made clearer ‘for the untrained eye’.

### 6.3.3 Common core of Principal Learning to allow progression into both employment and Higher Education

**Table 31 Suitability of the common core approach at Advanced Level for both HE and Employment**

	Percentage of respondents
Yes	<b>43.4% (63)</b>
No	33.1% (48)
Don't know	23.4% (34)

Base - 145

Where they were positive about content of Principal Learning at Advanced level being suitable for progression into both employment and Higher Education, respondents were varied across most types of stakeholder, with the largest group being secondary schools at 17.4%. Three stakeholders added the caveat that this would also depend on choices made for Additional and Specialist Learning.

However, where they thought that Principal Learning content was **not** suitable for allowing progression into both employment and Higher Education, most (29.1%) were HE representatives.

Where they opted to provide additional comment, two main reasons were given by stakeholders:

1. Nine (18.7%) felt that due to the breadth of Advanced level, learners would not be provided the opportunity to develop the required depth of knowledge and understanding in their chosen scientific discipline to enable them to study a specific science at HE.
2. The maths content at Advanced level was perceived by 7 respondents as being inadequate for learners wishing to progress into Higher Education, with two suggesting that the current Statement implies Advanced level students will attain not much higher than GCSE level mathematics.

In addition, two respondents also commented that the emphasis on biology, chemistry and physics as 'core' sciences was 'demeaning' to other scientific disciplines, particularly within a qualification intended as interdisciplinary in design.

Where they disagreed with the approach, some survey respondents went on to suggest alternatives. The most common are presented here:

- Six thought that the core of Principal Learning Diploma needed to provide a more 'thorough grounding' in scientific principles, plus greater inclusion of mathematical content to enable progression for study at research-led institutions. One suggested that this could be achieved by enabling learners an element of choice within the Principal Learning – i.e. so they could opt to focus on two out of three areas of biology, chemistry and physics, with one more strongly weighted than the other (i.e. covering the equivalent of A level in one, AS level in the other and then ASL would allow 'further depth' in one or 'greater breadth' overall, depending on the interests of the learner).
- Three were not convinced that the Diploma should aim to meet the needs of both employers and Higher Education. One suggested the development of two distinct Diplomas in Science – one to meet employer needs, and one to meet the needs of HE. Another suggested just focussing on the creation of a 'vocational' science qualification.
- Three suggested that the alternative already existed in the form of A levels, and that Higher Education institutions would still look to take students with A levels, rather than an Advanced Diploma.

#### 6.3.4 Appropriateness of the approach to Principal Learning – covering the three major science disciplines with elements of Maths

**Table 32 The approach to Principal Learning at Advanced Level**

Is this the right approach?	Percentage of respondents
Yes	<b>64.9% (96)</b>
No	29.1%(43)
Don't know	6.1%(9)

Base - 148

Where respondents thought that this approach to Principal Learning was not appropriate, the additional comments made were:

- They should be taught as distinct disciplines (8 respondents)
- The mathematics content needs to become a 'central component' so that the Diploma covers more than just 'elements' of the subject (10 respondents)
- Mathematics content will need to ensure different principles are covered for each of the science disciplines – e.g. data analysis for biology adopts a much more statistical approach than the physical sciences (2 respondents)
- This approach could mean that knowledge covered in each discipline is too broad/lacks depth (4 respondents)
- The Principal Learning should offer a modular system, where students are able to choose options to study

### 6.3.5 Progression into HE from Advanced level Principal Learning plus ASL

**Table 33 Advanced level progression with specialist ASL into HE**

To study	Yes	No	Don't know
Single sciences (Base – 143)	<b>41.3% (59)</b>	37.8% (54)	21.0% (30)
Directly related science disciplines e.g. medicine, pharmacy (Base – 132)	37.1% (49)	<b>40.9% (54)</b>	22.0% (29)

A number of respondents did state that whether or not progression will be possible to single sciences or directly-related science disciplines will be dependent on the choice of ASL a learner makes at Advanced level.

Where they have said that progression to study **single sciences** would **not** be appropriate, the main reasons were:

- Students will require deeper knowledge and understanding in the single science disciplines than the Advanced level Diploma would provide (17 respondents)
- Learners and/or HE institutions will continue favouring A level single science as the 'gold standard' for preparation for single science study at HE (12 respondents)
- Mathematics coverage is not adequate at Advanced level to support single science study at HE (e.g. physics) (10 respondents)

Where they have said that progression to study **directly related science disciplines** would **not** be appropriate, the main reasons given for this were the same as above:

- Students will require deeper knowledge and understanding of scientific concepts than the Advanced level Diploma would provide (18 respondents)
- HE institutions will continue favouring A levels as the 'gold standard' of preparation for directly related HE courses, where entry can be highly competitive – e.g. medicine, dentistry, veterinary science (9 respondents)

- Mathematics coverage is not adequate at Advanced level to support science study at HE (e.g. medicine) (9 respondents)

### 6.3.6 Additional and Specialist Learning– allowing equivalent depth and breadth as a single subject A level

**Table 34 Taking relevant content from existing A Level to supplement Principal Learning at Advanced level**

Do you agree with this approach?	Percentage of respondents
Yes	<b>56.5% (83)</b>
No	25.2% (37)
Don't know	18.4% (27)

Base - 147

Although the majority of respondents agreed in principle with this approach, there were reservations among stakeholders that in practice, it would be very difficult for deliverers and assessors to manage in terms of both delivery and assessment processes. It was also felt that the choice of units would be difficult to manipulate and learners would require very careful guidance as to which ASL units would be required for progression to specific HE courses.

As a result, 12 respondents queried why, if they were to take A level units as part of ASL, a learner would not 'simply go for the A level in the first place', particularly as it was thought HE institutions would continue to request full A levels as part of their entry requirements onto science courses.

Five respondents also felt that this approach did not provide ample opportunity for learners to develop sufficient knowledge and understanding in single subject sciences and mathematics, as required by many HE institutions offering science-based courses.

## 6.4 Principal Learning Content

This section covers a number of items relating to Higher Level:

- How well do the topic summaries reflect topic content/ amount of content
- Balance between theoretical knowledge and practical skills
- Success in identifying issues addressed through the secondary research
- Should any of the Knowledge, Understanding and Skills be moved
- Engaging for learners and difference with existing provision
- Success of the multidisciplinary approach

**Table 35 How well topic summaries reflect the topic content at Advanced Level**

	Not well at all	Not very well	Quite well	Very well	Not Sure
Advanced Level	3.6% (5)	13.7% (19)	<b>63.3% (88)</b>	12.2% (17)	7.2% (10)

Base - 139

The additional comments regarding the topic summaries were similar across all levels of the Diploma in Science – i.e. that the topic summaries either reflected ‘weaknesses’ in the content, or that the vision as described in each summary was not then translated into the knowledge and understanding outlined in each topic (11 respondents). Where further explanation was given, two Awarding Bodies suggested that the vision and big questions reflected in the summaries need to be further emphasised within the topic content:

*‘In many places the content seems rather traditional - it needs to be made more applied in order to reflect the summary’*

*‘The topic summaries do have elements of the vision, big questions etc. but the topic content looks like a very traditional general qualification... The content needs to be led by the vision, so that the work-related/applied/ problem solving approach and the big questions etc. are up-front.’*

**Table 36 Amount of content at – Advanced Level**

	Not enough content	Just the right amount	Too much content	Not sure
Advanced Level	12.6% (16)	48.0% (61)	15.0% (19)	24.4% (31)

Base – 127

As with Higher level, the number of stakeholders thinking there was either too much or too little content at Advanced level were fairly equally split.

The limited additional feedback given suggests that in essence, the two groups of respondents were actually making the same point but from slightly different perspectives – i.e. respondents have either interpreted “content” to mean the **amount** of knowledge and skills learners might develop, or the **depth** to which they will be developed.

The content was thought “too much” by those who suggested the Diploma was trying to include a large amount of material for the time available; there was “not enough” for those who think the content is so broad that core scientific and mathematic knowledge and skills are only covered at a superficial level.

Ultimately, the two groups both suggested that the Diploma might be too broad in scope to enable a learners’ detailed understanding of core disciplines and principles (8 respondents – 5 Higher Education representatives and 3 secondary schools).

**Table 37 Success in addressing the following issues identified through the secondary research...**

	Very Unsuccessful	Unsuccessful	Successful	Very Successful	Don't Know
Content centred on science-based work requirements and on "real-world" problems and issues (Base – 125)	8.0% (10)	18.4% (23)	<b>60.0% (75)</b>	6.4% (8)	7.2% (9)
Integrated progression route for knowledge, understanding and skills in the sciences (Base -124)	8.1% (10)	17.7% (22)	<b>61.3% (76)</b>	4.8% (6)	8.1% (10)
Application of mathematical skills and knowledge in a scientific context (Base - 126)	13.5% (17)	20.6% (26)	<b>49.2% (62)</b>	4.0% (5)	12.7% (16)
Flexible, less prescriptive content (Base – 124)	6.5% (8)	21.0% (26)	<b>55.6% (69)</b>	8.9% (11)	8.1% (10)
Emphasis on developing enquiry-based learning approaches among students (Base – 125)	10.4% (13)	16.0% (20)	<b>56.0% (70)</b>	7.2% (9)	10.4% (13)
Opportunities to develop relevant practical skills (Base – 120)	5.8% (7)	15.0% (18)	<b>63.3% (76)</b>	5.0% (6)	10.8% (13)
Critical writing and thinking skills (Base - 123)	8.9% (11)	17.9% (22)	<b>55.3% (68)</b>	4.9% (6)	13.0% (16)

Although overall, survey respondents thought that the Advanced level was 'successful' in the above areas, across most of them there was still some scepticism among stakeholders:

- 34.5% of survey respondents think that the application of mathematical skills and knowledge in a scientific context at Advanced level is either unsuccessful or very unsuccessful

- 27.5% of survey respondents think that the Advanced level is unsuccessful or very unsuccessful in reflecting flexible, less prescriptive content
- 26.8% of survey respondents think that the Advanced level is unsuccessful or very unsuccessful in reflecting opportunities for developing critical writing and thinking skills
- 26.4% of survey respondents think that the Advanced level is unsuccessful or very unsuccessful in reflecting content centred on science-based work requirements and 'real world' problems and issues
- 26.4% of survey respondents think that the Advanced level is unsuccessful or very unsuccessful in reflecting content emphasising enquiry-based learning approaches
- 25.8% of survey respondents think that the Advanced level is unsuccessful or very unsuccessful in providing an integrated progression route for KUS

Where they had provided additional commentary relating directly to these issues at Advanced level, survey respondents made 3 key points:

1. The mathematics content appears inadequate for Advanced level learners, or does not give indication of the 'mathematical sophistication required in some areas' (8 respondents)
2. Advanced level learners might not be able to develop in-depth knowledge in a specific science discipline plus mathematics to be able to demonstrate critical thinking skills (4 respondents)
3. The amount of content to be covered means creates an impression that in practice, the Diploma will be inflexible and prescriptive in delivery (2 respondents)

**Table 38 Balance between theoretical knowledge and practical skills – Advanced Level**

	Not satisfied at all	Not too satisfied	Quite satisfied	Very satisfied	Not sure
Advanced Level	14.6% (19)	23.1% (30)	<b>46.2% (60)</b>	3.8% (5)	12.3% (16)

Base - 130

Although the majority were satisfied with the balance of theoretical knowledge and practical skills, just more than one third of survey respondents reported being unsatisfied with this at Advanced level.

As with Foundation and Higher levels, the additional comments made by those unsatisfied with the current balance were split between too much theoretical or too much practical content (the former case reported by employers, the latter by HE representatives).

**Table 39 Should any of the KUS be moved – Advanced Level**

	Remove	Move higher	Move lower	Integrate with another topic at same level	Appropriate	Don't know
Advanced Level	1.7% (2)	3.4% (4)	3.4% (4)	11.8% (14)	<b>40.3% (48)</b>	39.5% (47)

Base – 119

Very few respondents suggested that any of the KUS should be moved at Advanced level. Only two specific suggestions were made:

- **3.7** should be integrated with other topics (2 respondents)
- There should be a parallel activity at Advanced level for topic 2.2 at Higher level

**Table 40 Engaging for learners – Advanced Level**

	Not engaging at all	Not very engaging	Quite engaging	Very engaging	Not sure
Advanced Level	1.6% (2)	19.2% (24)	<b>60.0% (75)</b>	7.2% (9)	12.0% (15)

Base - 125

In terms of engaging learners, the Advanced level Diploma (like the Higher level) was generally well received by survey respondents – over two-thirds stated that it appeared quite or very engaging. However, four positive respondents did add the caveat that how engaging the topics proved to be would be dependent on teaching and delivery methods.

**Table 41 New and different to existing provision – Advanced Level**

	Strongly disagree	Disagree	Agree	Strongly agree	Don't know
Advanced Level	7.2% (9)	21.6% (27)	<b>48.8% (61)</b>	8.0% (10)	14.4% (18)

Base – 125

Over one quarter of those disagreeing that the Advanced level looked new and different to existing provision were secondary schools and Awarding Bodies (13.8% each).

As with the previous two levels, positive respondents added the caveat that new and different should not be taken to mean 'desirably different' or 'better'. Where they disagreed or 'don't know' stakeholders stated this was due to apparent overlaps between the proposed topics and the content of existing courses at Level 3.

**Table 42 Multi-disciplinary approach at Advanced level**

	Percentage of respondents
Appropriate	<b>64.5% (80)</b>
Inappropriate	20.2% (25)
Not sure	15.3% (19)

Base - 124

Just less than one third (32.0%) of respondents finding the multi-disciplinary approach at Advanced level were HE representatives. A further 24.0% were from secondary schools, and 12.0% each from employers, FE institutions and science professionals.

Where they felt the approach was inappropriate, reasons given (by one respondent each unless otherwise stated) were:

- The content of the topics has not been presented in a multidisciplinary way
- The segregation of content into discrete topics creates an impression that the multidisciplinary approach has been lost
- Opportunities for integration of science disciplines have been missed within the content
- The multidisciplinary approach goes against feedback from HE and employers as reported on page 21 of the Line of Learning Statement

Three respondents went on to make the suggestion that the topics needed to be revisited in order to 'broaden [the content] out' or 'replicate with is shown in the Venn diagram' – i.e. demonstrating more clearly the overlaps between the different science disciplines.

## 6.5 Suggestions for Assessment at Advanced Level

**Table 43 Possible assessment methods appropriate to Advanced level**

	Percentage of respondents
Closed-book examination: multiple-choice responses	42.3% (47)
Closed-book examination: essay-based responses	81.9% (91)
Closed-book examination: structured questions	84.6% (94)
Development and production of coursework portfolios	67.5% (75)
Development and production of an artefact	31.5% (35)
Development and production of case studies	66.6% (74)
Self-evaluation	54.9% (61)
Demonstration of practical task	80.1% (89)
Viva voce (oral examination)	57.6% (64)

Base - 111

A range of other possible assessment methods for Advanced level were also suggested by survey respondents. These were:

- Open book exam/pre-release research paper for examination (x5)
- Oral presentation of work and/or evaluation of other presentations given by peers (x4)
- E-assessment (x4)
- Employer-based assessment (e.g. based on work placement activities) (x3)
- Continuous assessment of progress by tutors (x3)
- Use of multi-media reporting (DVD, video, blogs, podcasts)
- Team-based project work
- Major practical investigation for extended project
- Practical examination
- Report writing
- Development of practical 'portfolios'

## 6.6 Diversity and inclusion – Advanced level

### Potential problems with delivery

The potential problems with delivery identified by survey respondents for the Advanced level Diploma in Science were:

- Lack of availability/suitability of work placements (x10)
- Lack of ability to provide appropriate equipment for practical work (x8)
- The need for teacher training/CPD (x6)
- Lack of sufficient 'hands on' ability of students for complex practical work (x4)
- Lack of employer engagement/inability to maintain employer interest (x4)
- Lack of specialist support, placements or equipment for learners with special needs (x4)
- Health and Safety issues relating to work placements/practical work (x3)
- Lack of adequate mathematics coverage
- Lack of availability of 'high value' extended projects

## 7. Summary of pivotal points for consideration by the SDDP

Whilst it is clear that a few respondents/organisations question the need for the Diploma in Science, identifying overlaps with current provision for 14-19 year olds and pointing to the fact that recent changes in national curricula have yet to be fully evaluated, it is also evident that the Diploma in Science is welcomed and received positively - for example

*' we welcome the introduction of a science diploma and as an employer of scientists recognise the need to engage young people in science and encourage more to take a career in science.'*

*As an employer taking on mainly graduate scientists we have seen the lack of practical experience in graduates today and see the need for skills in a (number) of areas.'*

Having such a good turnout at events and a high response to an lengthy online survey highlights the level of interest as well as the areas of concern that respondents wish to see addressed in order to ensure a product that will be well regarded and followed as a natural route from 2011.

**The vision and its "major challenges, big questions" approach has been positively received: as one contributor said:**

*' this has great potential to encourage and engage a wide range of students – the use of the big questions and major challenges is likely to stimulate the interest of young people who hitherto may have found school Science rather dry...'*

Caveats supplemented this; those delivering the Diploma may need a wide range of support tools and resources to help underpin this approach. Additionally there is a sub-note that big questions are being used as contexts for learning and these must be used carefully. It has been suggested this approach will work as long as smaller questions are also considered to ensure some learners do not feel that science is still 'out of reach'. HE has indicated a lower level of contentment with the Vision than other stakeholder types.

The main issues that need consideration by the SDDP at this stage in the development of the Principal Learning have been documented throughout the report but two important and fairly complex points stand out as being pivotal to the way forward and are summarised here.

### **1. The current mathematical content of the Diploma appears inadequate – mathematics should be more explicitly evident within the content and, for some, needs to be a central 'theme' or 'component' of the Diploma content**

This is a reoccurring theme in the survey responses and across the events. In recognition that mathematical skills are fundamental to any form of science or scientific understanding, many respondents strongly recommend that the requirements for Maths, at all levels of the Diploma, need to be very carefully considered.

In particular respondents emphasise this for the Advanced level with several organisations explicitly recommending a separate unit within the Principal Learning. One organisation suggested learners need to undertake functional maths at level 3 (or equivalent qualification) in order to achieve an Advanced level Diploma in Science.

**2. Higher Education and some key science organisations/professionals have provided many of the responses to the online survey and have indicated dissatisfaction not just with the mathematical content as above but also a lack of ‘scientific content and rigour’ for those aspiring to study science within HE .**

This links, too, with questions raised by some respondents regarding the suitability of the Principal Learning content for progression into both HE and employment. One organisation questions whether it can realistically meet the needs of:

- *learners preparing for the most demanding university degree courses across the full spectrum of science based subjects from, for example, astrophysics to zoology, and*
- *learners preparing for employment or work-based learning across the full range of science-based industry and employers, from the pharmaceutical industry to the petrochemical sector and employers, from, and the National Health Service to local science-based SMEs.*

Responses to the ‘common core’ approach at Principal learning (as shown in the report) were mainly positive. Few suggested a more radical approach such as a split common core or even two level 3 Science Diplomas.

The suggestions for change in topic content (see Appendix) also indicates some levels of dissatisfaction with the apparent focus on the Principal Learning content on the three disciplines of Biology, Chemistry and Physics.

Consideration of these suggestions is recommended for the development of the Line of Learning Criteria and any further iterations of the Line of Learning Statement.

**It is also important to acknowledge the consultation event feedback which pointed to a concern that the practical/applied vision for the Diploma not coming through sufficiently strongly in the content of the topics**

This is not just an issue about the presentation of the Line of Learning Statement appearing knowledge-heavy, but about an apparent lack of effective translation of the statements made in the vision into the content.

However it is important to acknowledge that plans to feature an ‘applied purpose’ much more explicitly within the Topic Summaries and in the Line of Learning Criteria will give clarity to this issue. More industry-related examples and encouraging local adaptations will be useful.

**Finally much commentary has been received on the practicality of engaging with employers and identifying sufficient/meaningful work placements for all Diploma in Science students. Although this has been mentioned here it should be noted that there will be toolkits and curriculum guidance made available for deliverers in time. Therefore, with the help of education business partnerships and similar arrangements it is understood these latter issues will be fully addressed during the next stages of the Diploma development.**

## Appendix 1 - FOUNDATION LEVEL

### Topic change suggestions

The majority of comments are verbatim - direct from the survey completions. They have been grouped by topic for ease of reference. Unless otherwise stated, comments were made by one respondent each.

#### 1.1 Tending Plants and Animals:

- Two respondents suggested this does not appear engaging and even that 'pupils will find this very dull'.
- Two suggest the title of topic does not reflect the content and is 'not inspiring' – one suggested Suggest 'The World of Plants and Animals'

Other comments:

- Remove reference to plant mineral deficiencies
- Classification of animals - invertebrates and arthropods, for instance, could be confusing and is incorrect.
- No practical skills shown for rearing animals;

#### 1.2 Monitoring the environment

- Modify the notes for knowledge statement 5 to reflect that most geoscientists work as environmental geologists and particularly with waste disposal, and that this industry needs technical support. Suggest: *'Notes: monitoring: indicator species and chemical analysis; near waste disposal sites, the monitoring of surface water and groundwater through boreholes; recovery and re-use, recycling and safe disposal; using portable test kits or Tullgren funnels; using appropriate units for mass, volume and concentration and use  $c = m/V$  to determine concentration'*
- One of the key aspects of environmental monitoring is to know where you are and the direction you are working in. The first skill should be modified as below:  
'1. gather data about the environment, using simple identification guides and measuring instruments, and record observations and measurements  
*Note: data such as the distribution and abundance of organisms; environment: ecosystem, habitat; recording: words, diagrams, photographs, tables; measuring instruments such as thermometers, light meters and pH meters, magnetic compass and GPS (global positioning systems)'*
- It might also be helpful to modify Skill 2 as:  
'collect, prepare and analyse soil or water (surface and groundwater) samples from the environment'

#### 1.3 Obtaining and analysing materials

- Does not appear to be engaging/interesting for learners
- Gives a rather 'rose-tinted glasses' perspective on raw materials.
- Suggested text to add to skill 1:

*'1. that supplies of raw materials from the Earth's crust are finite and their sustainable use is vital; nevertheless their continued supply in bulk is necessary to support lifestyles in both the developed and developing world.'*

It would also be helpful to indicate where they come from, as:

*'Notes: raw materials: rocks, minerals, ores, fossil fuels, nuclear fuels, obtained by mining'*

and quarrying'

- It would also be helpful to give a perspective on how raw materials are naturally concentrated in the first place, as:

*'2. how raw materials are naturally concentrated, extracted and made into more useful materials*

*Notes: useful materials are obtained from natural concentrations in the Earth's crust before being extracted and further concentrated industrially: consumer products (eg medicines, paints and dyes, agrochemicals, plastics, healthcare products, cosmetics); materials: mixtures (random or formulated) or pure substances (elements and compounds - suitable compounds are acids, bases and salts)*

- Consideration of renewable raw materials should be included in this topic.
- It also seems bizarre to suggest that chemical reactions are not reversible.
- Much more could be made of formulations and the testing of their effectiveness.
- The skills section is not explicit enough about mathematical and enquiry skills.

#### **1.4 Exploring particles and the solar system**

- Whilst it is very pleasing to find that '6. how the conditions found on Earth that support life forms came about' is to be included, it is not clear how this very large statement is to be addressed - some notes are certainly necessary. For example, the conditions found on Earth that support life have among them that the temperature of the Earth has stayed between limits of about 12oC and 24oC over geological time whilst the Sun's energy output may have increased by something like 40%. The causes of this (including the role of 'life') are still being hotly debated. Teachers will need guidance on the scope of this statement.
- Add to the notes for the first knowledge statement: study of the phases of matter to understand how they interrelate. Freeze water with and without salt added, say.

#### **1.5 Generating and using electricity to do work**

- This topic dose not appear to be engaging/interesting for learners
- Why does this topic only include reference to electricity – looks more suitable to engineering
- The content looks similar to GCSE science and some repetition of areas covered at Key Stage 3.
- We use energy to provide power – could incorporate limitations of power production and that not all is efficient. Electrical circuits need to be handled with care as this may well turn off learners to the subject.
- The topic title on its own doesn't provide enough of a handle to hold the whole topic together.

#### **1.5 Promoting health, wellbeing and fitness**

- Include artificial joints, disabled aids, sports equipment - use of new materials.
- Link to chemistry re medicines.

#### **1.6 Gathering and using scientific evidence**

- This topic is 'unnecessary' and should be integrated with others (three respondents)
- Emphasise the importance of making and recording accurate and precise measurements
- Include ethical collection and use of evidence

**Other comments regarding Foundation level topics in general:**

- Page 41: The central Venn diagram is fine. The 'chemistry, biology, physics' Venn diagram is unnecessary – particularly as it implies that physics is not involved in 'monitoring the environment' when such things as temperature and aspect are key observations.
- All topics need to reflect more closely the summary in terms of the application and "vocationality" of science
- Generating and using electricity to do work & Exploring particles and the solar system seem to be the only physics topics covered. Motion and waves do not seem to be covered.
- The mathematics content needs to be expanded to underpin study in the core science disciplines.
- A minimum of functional mathematics at level 1 is required; for many students lower tier GCSE Mathematics will be appropriate

**Accurate reflection of key science-related industries, activities and people**

	Yes	No	Don't know
Foundation Level	51.6% (65)	26.2% (33)	22.2% (28)

Base = 126

**Accurate reflection of key science-based disciplines**

	Yes	No	Don't know
Foundation Level	60.0% (72)	23.3% (28)	16.7% (20)

Base = 120

## Appendix 2 – HIGHER Level

### Changes to topics

So that the SDDP and Criteria Writer are aware of all suggested changes to topics, comments made during the online survey have been included below. The majority have been added here as verbatim comments direct from survey completions. They have been grouped by topic for ease of reference. Unless otherwise stated, comments were made by one respondent each.

#### Topic 2.2 Studying and protecting the environment

- The addition of soil conservation is suggested. Although climate change is briefly mentioned, the profile of this could be raised within this topic, as it is of major public interest and offers a good opportunity for critical thinking and data evaluation skills.
- We would be dubious about including: '4. the potential of organisms for future sustainable sources of energy and chemical feedstocks, as alternatives to fossil fuels' without more guidance being provided. Whilst the use of waste organic products as biofuels is to be applauded, the growing of biofuels as alternatives to crop production for consumption is proving very controversial.
- Knowledge statement 7. there is not the faintest possibility that biomass could be a long term future alternative to fossil fuel. There is not enough space on Earth to grow the required biomass without devastating consumer crop production. While other alternatives are more likely to reduce our dependence on fossil fuels, this should be put into context. We are likely to be highly reliant on fossil fuels for many years to come and much important science focuses on how to use these most efficiently and with least polluting effects. The phrase 'biomass as a long-term future alternative to fossil fuels' should be deleted.
- The sequencing of knowledge and understanding topics is possibly inappropriate (but could be resolved by the awarding bodies' specifications). There is some linking of concepts, e.g. how to classify organisms and the use of environmental technology where the linking of these may not be readily apparent to some.
- Remove the four spheres of the earth - not relevant

#### Topic 2.3 Preparing, analysing and testing materials

- Should include biodegradable polymers, food tests
- The summary begins: 'A very important area of scientific activity is the conversion of raw materials obtained from the Earth's crust, waters and atmosphere into more useful substances and materials.' yet the source of the raw materials is nowhere mentioned in the knowledge and understanding list. Hopefully some of this would have been covered at Foundation Level in the Science Diploma, or in other science qualifications taken by candidates before starting on the Higher Level. Nevertheless, it would be helpful to put a reminder here as the first statement in the list: 1.Raw materials are extracted from the Earth's crust, waters and atmosphere by a range of techniques. Notes: mining; quarrying; brine pumping; evaporation of sea water; refrigeration and distillation of air

- It would be better to show why materials are so vital for development – we depend on materials in everyday life – understanding the physical and chemical properties of them is just part of this – can we make it more friendly by showing the applications of materials? The unit is very clearly chemistry based – but materials can be biological, or solid state – bringing in biology and physics applications would be a way forward
- There is a lot of content here. The outline does not seem to justify the inclusion of the concept 'atom economy' (two respondents)
- Item 2 under skills is an example of a statement that does not adequately prompt the sort of approach to enquiry-based learning that is really effective.

### **Topic 2.5 Harnessing, storing and using energy efficiently**

- Gives a rather 'rose-tinted glasses' view of energy supply. The first 'Knowledge and understanding' statement in the list should become the second statement, following a new 1st statement, such as: 1. The need to use current energy resources as efficiently as possible with the least polluting effects whilst the search for alternatives continues. Notes: improved engine efficiency; 'clean coal' technology; the possible sequestering of carbon. This is particularly important as the sustainable energy sources given in the existing first statement are unlikely ever to contribute a major percentage of our energy needs.
- Has lots of stuff in it that really isn't necessary - atomic structure, solar system, radiation. It doesn't link together and teaching it doesn't really teach any skills - it's just learning facts (interesting facts but still just facts)
- Knowledge statement 4 - add design a new system which improves efficiency based on the understanding gained from the above activity. Test the improved design and check objectives are achieved (or not and why)
- Too much about electricity

### **Topic 2.6 Maintaining the human body and mind**

- Currently not an engaging topic

### **Topic 2.7 Using scientific techniques to solve problems**

- Should be integrated with other topics (3 respondents)
- Should include ethical collection and use of evidence

### **Other general comments about Higher level topic content**

- The mathematics content needs to be expanded to underpin study in the core science disciplines (4 respondents)
- This should contain the structure of two new GCSEs in mathematics. The topics in the diagram are extremely vague and make no reference to detailed subject content. It is important at this level that students are taught basic scientific principles and develop a sound understanding of them. They cannot "use science to provide evidence" without a solid understanding and knowledge of science itself.

- The 'chemistry, biology, physics' Venn diagram is completely unnecessary – particularly as it implies that physics is not involved in 'studying and protecting the environment'.
- Subjects to be added to the Higher level Diploma: Light: properties - how lenses work - refraction - reflection - absorption - parallax - applications (opticians, optical instrument manufacture and applications) Sound: propagation and properties - ultrasound, sonar, waves, insulation effects on people and animals. Heat: sources, generation, efficiency, insulation, global warming.

#### Accurate reflection of key science-related industries, activities and people

	Yes	No	Don't know
Higher Level	51.6% (65)	26.2% (33)	22.2% (28)

Base – 126

#### Accurate reflection of key science-based disciplines

	Yes	No	Don't know
Higher Level	57.0% (69)	25.6% (31)	17.4% (21)

Base - 121

## Appendix 3 – ADVANCED Level

### Changes to topics

So that the SDDP and Criteria Writer are aware of all suggested changes to topics, comments made during the online survey have been included below. The majority have been added here as verbatim comments direct from the survey completions. They have been grouped by topic for ease of reference. Unless otherwise stated, comments were made by one respondent each.

#### 3.1 Sustaining biodiversity and a productive biosphere

- The addition of soil conservation is suggested. Although climate change is briefly mentioned, the profile of this could be raised within this topic, as it is of major public interest and offers a good opportunity for critical thinking and data evaluation skills.
- The content should reflect topic summary more closely.
- This should include how global secondary data will be acquired. A useful source would be the UN World Conservation Monitoring Centre at Cambridge UK.
- Rewording is necessary as the potential of the biosphere to provide any major contribution to future sustainable energy demands is very limited indeed.

#### 3.2 Understanding and modelling molecular behaviour

- Add theory/principles behind the scientific instruments featured.
- Skill 2 - cannot see how can access a large range of activity for this without more detail.

#### 3.3 Synthesising, analysis and characterising compounds

- Add theory/principles behind the scientific instruments featured.
- There should be clearer specification of the range and number of practical skills which students are expected to practice until they reach a level of mastery that would impress employers and HE.

#### 3.5 Using energy in transport, communication and detection

- Add theory/principles behind the scientific instruments featured

#### 3.6 Diagnosing and combating human disease

- Inclusion of infectious disease - building on microbiology in Higher level- and as an easy way in to drugs and therapy.
- Remove radiation stuff in this topic.
- Need anatomy added - also this is a very negative way to approach the science of the body.

### 3.7 Investigating problems using rigorous scientific methods

- Include ethical collection and use of evidence
- This topic needs to be integrated with others (3 respondents – see further detail in point below)
  - It would be preferable (at this level particularly, but in other levels also) to see these used in the context of the subject areas – show where these methods/techniques are used – leaving more “science-subject” relevant areas to be covered such as the earth sciences and psychology rather than having it as a set stand-alone unit.
- Knowledge statement 4: enquiry based learning would change this to identify improvements to a procedure to obtain better results. Better to get students to study areas where results are not necessarily already known.

### General feedback on Advanced topics overall

- Subjects such medicine and geology should not be represented as ‘emerging’ disciplines in the vision
- Physics - repetition of Higher level with very little difference - where's the electronics, programming and modelling?
- Needs more practical content.
- The mathematics content needs to be expanded to underpin study in the core science disciplines (7 respondents – see further comments below)
  - The mathematics: for example, it appears to exclude differential calculus and use discrete approximation instead, which seems inappropriate at this level. Some of it looks like revision of GCSE maths.
  - The diplomas must make it possible for students with a mathematical interest to study mathematics to the breadth and depth currently available to them, such as maths A-level and Further maths AS level. If this is not possible then the supply of students to mathematically rich disciplines will be severely threatened. This will significantly narrow the opportunities available to such students in HE and in employment.
  - I think the maths element needs to be explored a little more so as to make sure that students do not find doors closed on them if they want to progress onto maths related programmes in higher education.
  - Insufficient Maths content to continue to degree level.
- In order to study Medicine/BSc at a research-led institution, the content of all core science subjects need to be expanded.

- Add more links to creative industries.
- The 'chemistry, biology, physics' Venn diagram is completely unnecessary and is counterproductive.
- Nothing about cosmology or space at this level, which would lead directly on from the topics in Foundation and Higher level.
- Add content on: electronics; the IT world; the nature and calculation of forces; the effects of defects in materials; spreadsheets and customising programmes.
- Add units offering Biotechnology, Microbiology, Biomedicine, Genetics as per the National Diploma and the A/S units.

#### Accurate reflection of key science-related industries, activities and people

	Yes	No	Don't know
Advanced Level	50.8% (65)	32.0% (41)	17.2% (22)

Base – 128

#### Accurate reflection of key science-based disciplines

	Yes	No	Don't know
Advanced Level	54.1% (66)	27.9% (34)	18.0% (22)

Base – 122