DIPLOMA IN SCIENCE LINE OF LEARNING STATEMENT CONSULTATION – FEBRUARY 2009 QUESTIONNAIRE

N(6C)

Welcome to the latest consultation for the Diploma in Science.

The deadline for returning this questionnaire is 27TH February.

Please send your completed questionnaire to: l.oliver@pyetait.com

or by post to:

Lizzie Oliver, Pye Tait Ltd, Royal House, 110 Station Parade, Harrogate HG1 1EP

If you have any questions about this consultation please e-mail: l.oliver@pyetait.com

Before beginning the questionnaire, please tick one of the following that best describes the perspective from which you are responding to this consultation:

- Awarding Body ☐
- Employer ☐
- Primary school (ages 4-11) ☐
- Secondary school (ages 11-16) ☐
- Secondary school (ages 11-18) ☐
- Specialist science school/college ☐
- Further Education/6th Form College ☐
- Higher Education Institution ☐
- Learning and Skills Council ☐
- Local authority ☐
- Professional body/association ☒x
- Science professional ☐
- Sector Skills Council ☐
- Other (please state) ☐

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This response is made on behalf of the London Mathematical Society, which also supports the ACME position statement on mathematics and the Level 3 diplomas as well as the ACME response to the consultation.

Questionnaire Instructions

Before answering the following questions, please ensure that you have read in detail the DIPLOMA IN SCIENCE LINE OF LEARNING STATEMENT OF CONTENT containing the proposed vision, rationale and topic content for the Diploma in Science at Foundation, Higher and Advanced levels (this can be downloaded from the Diploma in Science website: http://sciencediploma.co.uk)

Before you complete the survey you will need to understand that **the Line of Learning Statement is not a specification**. It presents a vision of a new approach to teaching and learning science. However, it also acknowledges that there may be different ways to fulfil this vision. QCA then uses it to develop criteria. It is then the role of awarding bodies to imaginatively create specifications that meet the QCA criteria and remain true to the Science Diploma Development Partnership's vision.

The questionnaire will take approximately 20 minutes to complete, depending on how much feedback you want to provide.

Please complete as many questions as you can.

- Questions 1 and 2 cover the vision/translating the vision for the Diploma in Science
- Questions 3 – 8 cover Progression and Additional and Specialist Learning
- Questions 9 -21 cover Principal Learning topics and the content of the Diploma in Science
- Question 22 asks about possible assessment methods
- Questions 23 – 24 ask you to consider Equality of Opportunity within the Diploma in Science

Please be assured that **your response is completely confidential** to the Diploma Development Partnership and no individuals will be identified during the analysis and reporting.

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SECTION 1 AND THE VISION / TRANSLATING THE VISION

1. Looking at the sections for the vision, the rationale and Principal Learning what type of learner do you think will be attracted to each level of the Diploma in Science?

- **The Diploma in Science at FOUNDATION LEVEL will attract**… (tick as many as apply)

- Learners looking to develop a solid basis of science knowledge and skills ☐x
- Learners looking to progress onto a science-based apprenticeship ☐x
- Learners looking to progress into entry-level employment ☐
- Learners not yet decided about their destination post-Level 1 learning ☐x
- Learners who enjoy a mix of theoretical and applied learning ☐x
- Other (please state below)

It is likely that the science diploma will attract many students who may not only study science but may later change their minds to study mathematics and engineering.

- **The Diploma in Science at HIGHER LEVEL will attract**… (tick as many as apply)

- Learners looking to develop a solid basis of science knowledge and skills ☐x
- Learners looking to progress onto a science-based apprenticeship ☐x
- Learners looking to progress into science-based Further Education (e.g. A levels) ☐x
- Learners looking to progress into employment at Level 2 ☐x
- Learners not yet decided about their destination post-Level 2 learning ☐x

- Learners who enjoy a mix of theoretical and applied learning ☐x
- Other (please state below)

It is likely that the science diploma will attract many students who may not only study science but may later change their minds to study mathematics and engineering. This includes students who would otherwise be studying A level mathematics

- **The Diploma in Science at ADVANCED LEVEL will attract**… (tick as many as apply)

- Learners looking to develop a solid basis of science knowledge and skills ☐x
- Learners looking to progress onto a science-based apprenticeship ☐x
- Learners looking to progress into science-based Higher Education ☐x
- Learners looking to progress into employment at Level 3 ☐x
- Learners not yet decided about their destination post-Level 3 learning ☐x
- Learners who enjoy a mix of theoretical and applied learning ☐x
- Other (please state)

It is likely that the science diploma will attract many students who may not only study science but may later change their minds to study mathematics and engineering. This includes students who would otherwise be studying A level mathematics

2. To what extent do you agree with the following statements?

	Strongly disagree	**Disagree**	**Agree**	**Strongly agree**	**Don't know**
The vision for the Diploma in Science reflects employer needs	☐x	☐	☐	☐	☐
The vision for the Diploma in Science reflects HE needs	☐x	☐	☐	☐	☐
The vision outlines how the Diploma in Science will be engaging for learners	☐x	☐	☐	☐	☐
The vision outlines how the Diploma in Science will be different to existing 14-19 science provision	☐x	☐	☐	☐	☐
The vision of major challenges and big questions described in Section 1 clearly follows through into the topics (section 2)	☐x	☐	☐	☐	☐
The examples given in the diagram (section 1.2.2) indicate a good range of challenges and questions that are exciting and visionary	☐x	☐	☐	☐	☐

2a) if you have said that you 'strongly disagree' or 'strongly agree' with any of the above statements, please could you provide your reasons for doing so

As a key part of any study of science, mathematics and statistics must play a central role in the Science Diplomas at all levels. Mathematics is the language of science; and science by its very nature is quantitative rather than qualitative, with data at the heart of any scientific discovery. It is therefore essential that students at all levels learn sufficient mathematics for them to use quantitative and mathematical methods as appropriate for their level of study, and for progression to further study. Furthermore, in order to reach many of the aims of this Diploma, subject knowledge must be central in the design of the syllabus. One cannot have any "insight into the application of science to real life issues" without understanding the basic science itself. However, the mathematics content in the diploma is far to low. Mathematics underpins all of the sciences. This is strongly recognised by both employers and HE institutions. There are only 60 GLH in the mathematics unit in the PL. This is one AS unit. This is quite inadequate mathematical content for a Level 3 diploma and does not give students of science anything like the foundations that they need. It is wholly inadequate for any student that may be going on to study a degree with a high mathematical content in HE, such as physics, engineering or mathematics itself. It is most important that mathematics is taught as a separate unit within the PL, and that the mathematical ideas learnt in this unit are then revisited and placed in context in the science based areas of the PL.

PROGRESSION

3. Are the potential progression routes (as described throughout section 1 and in section 1.6) **into education/employment** clear at each of the three levels?

	Very unclear	Unclear	Clear	Very clear	Not sure
Foundation level	☐x	☐	☐	☐	☐
Higher level	☐x	☐	☐	☐	☐
Advanced level	☐x	☐	☐	☐	☐

3a) If you have rated one of the levels either 'very unclear' or 'very clear' please could you provide your reasons for doing so (noting the level to which you are referring)?

Mathematics must be a major component of the principal learning in the Diplomas at all levels. The Foundation Diploma should contain at least Level 1 Functional Mathematics; the Higher Diploma the two new GCSEs in mathematics. For the Advanced Diploma, the principal learning must contain, as an absolute minimum, the equivalent of AS-level mathematics, with the equivalent of A level mathematics for most students. In addition, students should be encouraged to take their study of mathematics further, with the equivalent of A level Further Mathematics available as part of the additional and specialized learning. At all levels, the principal learning must also contain sufficient scientific subject knowledge to enable the aims of the diploma to be met.

4. Are potential progression routes **across the different levels** of the Diploma clear at each of the three levels?

	Very unclear	**Unclear**	**Clear**	**Very clear**	**Not sure**
Foundation level	☐	☐	☐	☐	☐
Higher level	☐	☐	☐	☐	☐
Advanced level	☐	☐	☐	☐	☐

4a) If you have rated one of the levels either 'very unclear' or 'very clear' please could you provide your reasons for doing so (noting the level to which you are referring)?

5. For the Advanced Diploma, there is a common core of Principal Learning for progression into both employment and Higher Education. Additional and Specialist Learning, work experience and the extended project will enable a learner to tailor their programme to meet individual progression aspirations (either into employment or HE). Is the content within the Principal Learning suitable for this purpose?

- Yes ☐
- No ☐**x**
- Don't know ☐

5a) If you have answered 'no', please could you provide your reasons for doing so

The Diploma must be formulated so that all students have an adequate background in the ideas and methods needed to do science. The mathematical content of the current PL in the diploma is not sufficient for this to be possible.

5b) If you do not agree with this approach of a common core of Principal Learning at Advanced level, please can you suggest an alternative?

6. The intention is that the approach to Principal Learning will cover the three major science disciplines – Biology, Physics and Chemistry – with elements of Maths. Is this the right approach?

- Yes ☐
- No ☒
- Don't know ☐

6a) If you have answered 'no' what should the alternative be? (e.g. combination of disciplines)

Mathematics should be a further "theme" with detailed subject content appropriate to the level of the diploma. It is a central component of all of the sciences, and its importance continues to grow. It is vital that students have a thorough grounding in the ideas and techniques of mathematics and see how these can be applied in science. The current idea of embedding mathematics within the science

teaching will not work. An inadequate level of mathematics will be covered, the same ideas will be taught over and over again in different contexts, leading to very inefficient teaching. Students will not see the basic mathematical ideas being transferre across many different applications, and hence a worse understanding and appreciation of mathematics

7. Do you believe that the Advanced Diploma including appropriate Additional and Specialist learning will allow progression into Higher Education to study…

	Yes	**No**	**Don't know**
Single sciences	☐	☐x	☐
Directly related science disciplines (e.g. medicine, pharmacy)	☐	☐x	☐

7a) If you have answered 'no' to either option, please could you give your reasons why?

Maths is primary for Physics degrees. It is also essential for medical related subjects, particularly statistics. The current ASL does not give sufficient preparation for these and of course for any degree with maths in the title.

8. The proposed approach for the Additional and Specialist Learning component of the Diploma in Science at Advanced Level would allow learners to take relevant content from existing A level units to supplement Principal Learning to give the equivalent depth and breadth of knowledge as a single subject A level (please refer to Appendix 5b in the Line of Learning Statement). Do you agree with this approach?

- Yes ☒x
- No ☐
- Don't know ☐

8a) If you have said 'no', please explain why and can you suggest an alternative approach?

PRINCIPAL LEARNING CONTENT – SECTION 2

Please note that these questions now refer to (Section 2) the proposed content of the Principal Learning component of the Diploma in Science (*further explanation about PL and the Diploma is available via the Consultation page of the Diploma in Science website*).

9. For each of the three levels, how well do you think the **topic summaries** reflect the topic content?

	Very well	Quite well	Not very well	Not well at all	Not sure
Foundation level	☐	☒x	☐	☐	☐
Higher level	☐	☒x	☐	☐	☐
Advanced level	☐	☒x	☐	☐	☐

9a) If you have said 'not at all well or 'very well 'please could you provide your reasons for doing so (noting the titles/level to which you are referring)?

The topics have been derived from both the findings of secondary research work on science education provision for 14-19 year olds and previous Diploma in Science consultations (see sections 1.4 and 1.5).

10. How successful do you think the Principal Learning content is at **FOUNDATION LEVEL** of the Diploma in Science in reflecting the following?

	Very unsuccessful	**Unsuccessful**	**Successful**	**Very successful**	**Don't know**
Content centred on science-based work requirements and on "real-world" problems and issue	☐	☐	☐	☐	☐
Integrated progression route for knowledge, understanding and skills in the sciences	☐	☐	☐	☐	☐
Application of mathematical skills and knowledge in a scientific context *(**NB:** mathematics units will also be made available to learners via Additional and Specialist Learning)*	☐**x**	☐	☐	☐	☐
Flexible, less-prescriptive content	☐	☐	☐	☐	☐
Emphasis on developing	☐	☐	☐	☐	☐

enquiry-based learning approaches among students					
Opportunities to develop relevant practical skills	☐	☐	☐	☐	☐
Critical writing and thinking skills	☐	☐	☐	☐	☐

10a) If you have said that the topics at Foundation level are either 'very unsuccessful' or 'very successful' in any of these areas, please could you provide your reasons (noting the topics to which you are referring)?

For the same reasons as already stated. The maths content is currently far too low, and is expressed incoherently.

11. How successful do you think the Principal Learning content is at **HIGHER LEVEL** of the Diploma in Science in reflecting the following?

	Very unsuccessful	**Unsuccessful**	**Successful**	**Very successful**	**Don't know**
Content centred on science-based work requirements and on "real-world" problems and issue	☐	☐	☐	☐	☐
Integrated progression route for knowledge, understanding and skills in the sciences	☐	☐	☐	☐	☐
Application of mathematical skills and knowledge in a scientific context ***(NB:*** *mathematics units will also be made available to learners via Additional and Specialist Learning)*	☐**x**	☐	☐	☐	☐
Flexible, less-prescriptive content	☐	☐	☐	☐	☐

	Very unsuccessful	Unsuccessful	Successful	Very successful	Don't know
Emphasis on developing enquiry-based learning approaches among students	☐	☐	☐	☐	☐
Opportunities to develop relevant practical skills	☐	☐	☐	☐	☐
Critical writing and thinking skills	☐	☐	☐	☐	☐

11a) If you have said that the topics at Higher level are either 'very unsuccessful' or 'very successful' in any of these areas, please could you provide your reasons (noting the topics to which you are referring)?

For the same reasons as already stated. The maths content is currently far too low, and is expressed incoherently.

12. How successful do you think the Principal Learning content is at **ADVANCED LEVEL** of the Diploma in Science in reflecting the following?

	Very unsuccessful	Unsuccessful	Successful	Very successful	Don't know
Content centred on science-based work requirements and on "real-world" problems and issue	☐	☐	☐	☐	☐
Integrated progression	☐	☐	☐	☐	☐

route for knowledge,
understanding and skills in
the sciences

	Very unsuccessful	Unsuccessful	Successful	Very successful	Don't know
Application of mathematical skills and knowledge in a scientific context *(**NB:** mathematics units will also be made available to learners via Additional and Specialist Learning)*	☐x	☐	☐	☐	☐
Flexible, less-prescriptive content	☐	☐	☐	☐	☐
Emphasis on developing enquiry-based learning approaches among students	☐	☐	☐	☐	☐
Opportunities to develop relevant practical skills	☐	☐	☐	☐	☐
Critical writing and thinking skills	☐	☐	☐	☐	☐

12a) If you have said that the topics are either 'very unsuccessful' or 'very successful' in any of these areas, please could you provide your reasons (noting the topics to which you are referring)?

For the same reasons as already stated. The maths content is currently far too low, and is expressed incoherently.

13. For each level, do you think the topics offer an accurate reflection of key science-related industries, activities and people?

	Yes	No	Don't know

Foundation level	☐	☐x	☐
Higher level	☐	☐x	☐
Advanced level	☐	☐x	☐

13a) If no – are there any key areas that you think need adding (noting the level/topics to which you are referring)?

The topics contain lists of many "buzz words", which carry little meaning. Many of the topics indicated are appropriate only for undergraduate or post-graduate study. There are far too many areas for a Diploma. The Diploma should aim to provide students with a sound understanding of appropriate fundamental areas of science, rather than giving a superficial treatment of advanced topics. Once students have a solid foundation of basic scientific subject knowledge at a particular level, they are then able to either apply this knowledge in work or progress to further study. It is not possible to study an advanced topic in more depth without this basic subject knowledge. We are highly concerned that rarely in the diagram is mathematics mentioned.

14. For each level, do you think the topics offer an accurate reflection of the contributions made by key science disciplines?

	Yes	**No**	**Don't know**
Foundation level	☐	☐	☐x
Higher level	☐	☐	☐x
Advanced level	☐	☐	☐x

14a) If no – are there any key disciplines that you think need adding (noting the level/topics to which you are referring)?

15. How appropriate do you think the overall amount of content for the Principal Learning is at each of the three levels of the Diploma in Science? (NB: Keeping in mind the maximum number of guided learning hours (glh) for Principal Learning at Foundation level is 240glh, Higher level is 420glh and at Advanced level is 540glh – see pages 40, 50 and 66 of the Line of Learning Statement of Content).

	Not enough content	**Just the right amount of content**	**Too much content**	**Not sure**
Foundation level	☐	☐	☐	☐
Higher level	☐	☐	☐	☐
Advanced level	☐	☐	☐	☐

15a) If you have said there is 'not enough' or 'too much' content please could you provide your reasons (noting the level to which you are referring)?

16. Within the topics for the three levels, how satisfied are you with the current balance between the theoretical knowledge and practical skills that learners will be required to develop?

	Not satisfied at all	**Not too satisfied**	**Quite satisfied**	**Very satisfied**	**Not sure**
Foundation level	☐x	☐	☐	☐	☐
Higher level	☐x	☐	☐	☐	☐
Advanced level	☐x	☐	☐	☐	☐

16a) If you have said you are 'not satisfied at all' or 'very satisfied please could you provide your reasons (noting the topic/level to which you are referring)?

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.

17. Do you think any of the proposed knowledge, understanding and skills within the topics are either not required, or should be moved to a different level?

	Yes – should be removed	**Yes – should be moved to a higher level**	**Yes – should be moved to a lower level**	**Yes - should be integrated with a topic at the same level**	**No – all seem appropriate at this level**	**Don't know**
Foundation level	☐	☐	☐	☐	☐	☐
Higher level	☐	☐	☐	☐	☐	☐
Advanced level	☐	☐	☐	☐	☐	☐

17a) If you have answered 'yes', please provide your reasons for doing so (noting the topic(s) and KUS to which you are referring)

18. How engaging do you think the proposed topics will be to learners (aged 14-19) at each level?

	Not engaging at all	Not very engaging	Quite engaging	Very engaging	Not sure
Foundation level	☐	☐	☐	☐	☐
Higher level	☐	☐	☐	☐	☐
Advanced level	☐	☐	☐	☐	☐

18a) If you have rated topics either 'not engaging at all' or 'very engaging' please could you provide your reasons for doing so (noting the level to which you are referring)?

19. To what extent do you agree that the proposed content for the Principal Learning at each of the three levels looks new and different to existing 14-19 science provision?

	Strongly disagree	Disagree	Agree	Strongly agree	Don't know
Foundation level	☐	☐	☐	☐	☐
Higher level	☐	☐	☐	☐	☐
Advanced level	☐	☐	☐	☐	☐

19a) if you have said that you 'strongly disagree' or 'strongly agree', please could you provide your reasons for doing so (noting the level to which you are referring)?

20. How do you find the 'multidisciplinary approach' to Principal Learning for the Advanced level Diploma?

- Appropriate ☐
- Inappropriate ☐
- Not sure ☒

20a) If you have answered 'inappropriate', please could you give your reasons why?

20b) If you have answered 'inappropriate', please can you suggest an alternative approach that you feel would be more appropriate?

21. For each level, if you wish, please select a topic that you think could be improved and tell us how it should be improved.

Foundation level…

Foundation Diploma: a minimum of functional mathematics at level 1 is required; for many students lower tier GCSE Mathematics will be appropriate

Higher level…

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.

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Advanced level…

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.

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ASSESSMENT

22. Which of the following possible assessment methods do you think would be appropriate at each level of the Diploma in Science? (tick as many as apply)

	Foundation level	**Higher level**	**Advanced level**
Closed-book examination: multiple-choice responses	☐	☐	☐
Closed-book examination: essay-based responses	☐	☐	☐
Closed-book examination: structured questions	☐	☐	☐
Development and production of coursework portfolios	☐	☐	☐
Development and production of an artefact	☐	☐	☐
Development and production of case studies	☐	☐	☐
Self-evaluation	☐	☐	☐
Demonstration of a practical task	☐	☐	☐
Viva voce (oral examination)	☐	☐	☐
Other - if you have any other suggestions of appropriate assessment methods please note them here			

22a) If you have any other suggestions of appropriate assessment methods please note them here (noting the level to which you are referring)

All assessment methods have advantages and disadvantages. The important thing is that we have appropriate content in the diplomas and that it is taught well.

EQUALITY OF OPPORTUNITY

23. How clearly do you think the content of the topics takes into account diversity and inclusion issues within science?

- Very clearly ☐
- Quite clearly ☐
- Not very clearly ☐
- Not clearly at all ☐
- Not sure ☐x

23a) Can you provide any examples of diversity and inclusion issues within science that may need to be considered within the topics (please note the topic to which you are referring)?

24. Considering the proposed topics, can you foresee any difficulties with **delivery** in terms of offering equality of opportunity for all learners at each of the three levels of the Diploma in Science? (e.g. considering the needs of learners with learning difficulties and/or disabilities)

At **Foundation level** there may be difficulties because…

At **Higher level** there may be difficulties because…

At **Advanced level** there may be difficulties because…

FINALLY…

25. Do you have any other comments you would like to make regarding the Diploma in Science Line of Learning Statement of Content, proposed topics, or the development of the Diploma in Science in general?

The Diplomas at all levels should have sufficient mathematical subject knowledge. There should be a separate "mathematics" theme with detailed mathematical subject content. The mathematics learned in each Diploma should then be applied to the scientific areas studied. Each Diploma must also enable students to progress further in their study of science or a different subject area. In particular, the Advanced Diploma must provide a suitable preparation for entry to undergraduate degrees in mathematics, science subjects, engineering and other areas such as business or social science. The current proposals do not achieve this aim.

There seems to us no good reason why the teaching of mathematics within the diploma should not simply use mathematics A-level. The content of maths A-level is entirely appropriate to the teaching and learning of science and it is regarded as essential preparation for all mathematics degrees, all engineering degrees, all physical sciences and very many other science degrees. At a time when qualified and experienced mathematics teachers are in desperately short supply, it does not seem sensible to add yet another strain on the essential teaching of mathematics when there is already a good, and indeed increasingly popular, course available for them to study. It is essential that the enormous challenges to teaching and delivery which the diploma can/will bring do not create obstacles for the progression to mathematics or mathematically rich courses in higher education.

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ABOUT YOU

Please could you provide the following information. The Market Research Society's Code of Conduct requires us to ensure the accuracy and validity of responses to surveys. The information you provide will be kept in strict confidence by the researchers, and only used for validating responses. Unless you specifically request that your details be used for receiving news, the details will be destroyed following the completion of the validation of the survey.

Name:

Prof Christopher Budd

Organisation:

London Mathematical Society

If you would like your details to be added to the distribution list to be kept informed of Diploma in Science developments, please provide your email address below:

Email:

mascjb@bath.ac.uk

Have you attended any of the current QCA Line of Learning Statement consultation events, prior to completing this survey? (i.e. London 9th February, Leeds 11th February, Newcastle 13th February, Birmingham 23rd February).

- Yes ☐
- No x☐

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