OECD Programme for
International Student Assessment 2015

PISA 2015 Item Submission Guidelines: Scientific Literacy

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Contents

Key Points

- All new item development for PISA 2015 Scientific Literacy will be for computer-delivered items.

- New units (e.g., stimuli with a set of associated questions) will be of two types:
  - **Interactive units,** which will include interactive stimulus materials and/or questions.
  - **Standard units** which will consist of stimulus materials and associated questions. Stimuli may include static materials (text, graphics, tables, graphs, etc.) and, to a more limited degree, animations or video presentations. Note that to avoid translation and operational issues, videos should not include narrations or sound. The range of response modes for questions associated with standard units will be more varied than they have been on paper and include drag and drop, hot-spot location, and dropdown selection.

- To better ensure that the pool of Scientific Literacy units reflects the cultural diversity across participating countries, the international test development consortium is seeking country submissions including:
  - sample contexts and ideas for simulation activities for interactive units, and
  - more fully developed units with defined stimuli and associated items for standard units.

- Submissions will be organised in two rounds.
  - For **Round 1,** countries are asked to submit sample contexts and ideas for interactive units. These materials are needed early in the development cycle as they require more implementation time. Submissions for standard units are encouraged in this round as well as units received early have a higher chance of being included for consideration in the Field Trial. **Round 1 submissions are to be received by 1 November 2012.**
  - For **Round 2**, countries are asked to submit standard units only. These units can be accepted later in the process as they can be readied for country review more quickly. Receiving these units by mid-December is necessary in order to integrate them into the country review cycle shown below, allowing all participating countries to review the materials proposed for the Field Trial. **Round 2 submissions are to be received between 2 November and 17 December 2012.**

- In addition to submission of contexts, problem situations and standard units, countries will also have the opportunity to review, and provide feedback on, units developed by the international test development consortium and participating countries at three points during the assessment development process. Those two-week **national review periods** are:
  - **29 October – 9 November 2012**
  - **3 December – 14 December 2012**
  - **7 January – 18 January 2013**

PISA 2015 ITEM SUBMISSION GUIDELINES: SCIENTIFIC LITERACY

Framework Specifications for Item Development[1]

The draft framework for PISA 2015 defines Scientific Literacy as follows:

> Scientific Literacy is the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen.
>
> A scientifically literate person, therefore, is willing to engage in reasoned discourse about science and technology which requires the competencies to:
>
> 1. **Explain phenomena scientifically**
>
> Recognise, offer, and evaluate explanations for a range of natural and technological phenomena.
>
> 2. **Evaluate and design scientific enquiry**
>
> Describe and appraise scientific investigations and propose ways of addressing questions scientifically.
>
> 3. **Interpret evidence and data scientifically**
>
> Analyse and evaluate scientific information, claims, and arguments in a variety of representations and draw appropriate conclusions.

The key components of the framework for development of units and items are:

A. COMPETENCIES (as defined above and further explained in Section A)

B. TYPES OF SCIENTIFIC KNOWLEDGE (including content, procedural and epistemic knowledge as defined in Section B)

C. CONTEXTS (including health, natural resource as indicated in the list provided in Section C)

Each unit will be situated in a CONTEXT.

Each item will assess a COMPETENCY, and will be coded for TYPE OF KNOWLEDGE.

[1] Information in this section is taken from the draft Scientific Literacy framework developed by Core 1 and the PISA 2015 Scientific Literacy Expert Group. Details and terminology used are subject to revision pending finalization of that framework.

A. COMPETENCIES

A more elaborated description of the kinds of performance expected for a display of the three critical Scientific Literacy competencies is provided in the boxes below. These are intended to convey the idea that the scientifically literate person both understands and is capable of undertaking a basic set of competencies which are essential for scientific literacy.

1. Explain phenomena scientifically

Recognise, offer and evaluate explanations for a range of natural and technological phenomena demonstrating the ability to:

- Recall and apply appropriate scientific knowledge;
- Identify, use, and generate explanatory models and representations;
- Make and justify appropriate predictions;
- Offer explanatory hypotheses;
- Explain the potential implications of scientific knowledge for society.

2. Evaluate and design scientific enquiry

Describe and appraise scientific enquiries and propose ways of addressing questions scientifically demonstrating the ability to:

- Identify the question explored in a given scientific study;
- Distinguish questions that are possible to investigate scientifically;
- Propose a way of exploring a given question scientifically;
- Evaluate ways of exploring a given question scientifically;
- Describe and evaluate a range of ways that scientists use to ensure the reliability of data and the objectivity and generalisability of explanations.

3. Interpret evidence and data scientifically

Analyse and evaluate scientific information, claims and arguments in a variety of representations and draw appropriate conclusions by demonstrating the ability to:

- Transform data from one representation to another;
- Analyse and interpret data and draw appropriate conclusions;
- Identify the assumptions, evidence and reasoning in science-related texts;
- Distinguish between arguments which are based on scientific evidence and theory and those based on other considerations;
- Evaluate scientific arguments and evidence from different sources (e.g., newspaper, Internet, journals).

B. TYPES OF SCIENTIFIC KNOWLEDGE

The ability of students to demonstrate these competencies is dependent on three types of scientific knowledge. These are defined as:

- **Content knowledge**, knowledge of the content of science (including physical systems, living systems, earth, and space science),
- **Procedural knowledge**, knowledge of the diversity of methods and practices that are used to establish scientific knowledge as well as its standard procedures, and
- **Epistemic knowledge**, knowledge of how our beliefs in science are justified as a result of understanding the functions of scientific practices, their justifications, and the meaning of terms such as theory, hypothesis, and observation

C. CONTEXTS

Finally, the PISA 2015 assessment will require evidence of these competencies and knowledge in a range of contexts including:

- **health,**
- **natural resources,**
- **the environment,**
- **hazards, and**
- **the frontiers of science and technology**

in

- **personal**,
- **local/national**, **and**
- **global settings.**

Item Development Goals

The PISA 2015 assessment design includes twelve 30-minute clusters of Scientific Literacy items for the Field Trial. It is expected that each cluster will include about five units. As per previous cycles, standard units will include one or more short stimuli with a number of associated items, or test questions, and will be designed to take about five minutes of testing time. Because PISA 2015 will be computer-delivered, each cluster is also expected to include one interactive unit. In these units, the "stimulus" will consist of an environment where students can interact with a simulation to perform tasks that may include manipulating variables, using information about a sample to make inferences about a population, etc. Interactive stimuli can be used to deliver assessment tasks that allow students to plan a scientific enquiry, collect empirical data, graphically represent raw data, analyse results, interpreting findings, and draw evidence-based conclusions.

For any given task, the computer can collect a variety of information including time spent, actions taken, and the sequence in which actions are completed. This information will provide direct evidence of the

processes and strategies that students use to solve the presented tasks, and therefore will broaden the type of inferences that can be made about their knowledge and skills. Given the possibility to capture process and strategy information, it is anticipated that the survey will yield an extensive amount of raw data. It is therefore important to use the framework variables, the hypotheses about task characteristics that will impact performance, and information from the cognitive labs to define those behaviours that provide the best evidence about performance and are therefore important to capture and score.

International Test Development Consortium

The Core 3 consortium working on development of the Scientific Literacy assessment includes item developers from several organisations including: Educational Testing Service (United States), the Centre for Educational Technology (Israel), the GESIS – Leibniz-Institute for the Social Sciences (Germany), the University of Luxembourg, and the University of Heidelberg (Germany). These groups will collaborate on tasks including item development, review, and user testing. The consortium will also work in close collaboration with the Scientific Literacy Expert Group, developing proof-of-concept units for the SEG's review and providing opportunities for the experts to review and comment on units during the development process. Integrating national submissions and responding to country review of the draft Scientific Literacy items will also be an important task of the test development consortium.

New units for Scientific Literacy will be of two types:

- interactive units that will include interactive stimulus materials and/or questions, and
- standard units that will consist of static stimulus materials and associated questions.

Please note that the test development consortium's request for national submissions is different for interactive and standard units both in content and timeline, as explained below.

National Contributions – Interactive Units

Development of the approximately 12 interactive units to be included in the PISA 2015 Field Trial will necessarily involve close collaboration with programmers and designers given the demands of building simulation environments. As this is beyond the scope of what can reasonably be expected from participating countries, the test development consortium is seeking country input of a more foundational nature. Countries are asked to share ideas, or abstracts, for simulation activities that reflect key components of the Scientific Literacy framework; that is, simulations that would provide evidence of students' skills and knowledge related to explaining phenomena scientifically, evaluating and designing scientific enquiry, and/or interpreting evidence and data scientifically, demonstrating their content, procedural, and epistemic knowledge.

Country submissions should include an overview of the proposed activity, a description of how the student would interact with the presented materials (available tools in the proposed environment, etc.) and identification of what the activity would measure in terms of competencies and knowledge types.

Submission Information – Interactive Units

Submissions for Scientific Literacy units that will involve interactive stimuli should be provided by completing the Abstract Submission Form for Interactive Units provided in Annex 1.

Due to the tight timeline for the development of PISA 2015, contexts and ideas for interactive Scientific Literacy items should be submitted **no later than 1 November 2012**. The test development consortium will review submissions and select those that seem most promising for further development. Some countries may be contacted for clarification or discussion about implementation issues. All countries will be informed about the status of their submissions.

Abstracts may be submitted in up to six languages including English, French, German, Japanese, Italian, and Spanish. Material submitted in other major languages of instruction among PISA countries may also be accepted upon prior consultation with Core 3.

National Contributions – Standard Units

As previously described, each of the estimated 48 standard units to be included in the Field Trial will be based on a static stimulus such as a short text, graph, table, or diagram or a non-interactive animation or video. Each will be accompanied by a set of items that may include standard multiple-choice items or a range of other computer-enabled item types as described below.

The item development process for standard units – both for the test development consortium and countries working to develop item submissions – includes steps related to selection of the stimulus, writing the associated items, and the development of coding guidelines. Each of these is discussed in turn in the following sections. A checklist summarising key item development and submission considerations is provided in Annex 2 as additional guidance for item writers.

Selecting Stimulus Materials

Stimuli for the Scientific Literacy assessment should be taken or adapted from real-world materials that are appropriate for 15-year-old students. Keeping in mind that the test will be administered in a large number of countries with both cultural and geographical differences, care must be taken to ensure that these materials are appropriate across cultures and languages. To avoid unfairly advantaging students from any one country, submissions should be not based on material from textbooks or other common resource materials routinely used by students in a participating country.

It is also important to review proposed stimulus materials to ensure they will not become too easily outdated. Stimulus materials which contain dates or references to contemporary individuals or events – particularly if such information is central to completing questions associated with those materials – may

become dated by the time the test is administered. Such materials also tend to become increasingly problematic in future testing cycles when trend items are needed.

When selecting potential stimuli, the fact that materials will need to be translated into multiple languages should be considered. Challenges related to displaying complex text, tables or graphs in languages that may be longer or use character sets with higher vertical displays than that of the submitting language should be kept in mind when selecting such stimulus materials.

While the consortium is most interested in receiving full units which include a stimulus, associated items, and coding guides, participating countries are also encouraged to submit additional stimulus materials without associated items. The consortium may opt to write items for such stimuli in order to ensure a mix of materials that reflects the diversity of cultural contexts represented across the participating countries.

Developing Items

Submitted items should match the *competencies* and *types of knowledge* identified in the Scientific Literacy framework. That is, they should assess students' skills and knowledge related to explaining phenomena scientifically, evaluating and designing scientific enquiry, and/or interpreting evidence and data scientifically, demonstrating their content, procedural, and epistemic knowledge. Released Scientific Literacy items that are exemplars for each of these components are included in Annex 3 for reference.

Item writers also should keep in mind that units for the Field Trial will need to come from a range of *contexts*, including health, natural resources, the environment, hazards, and the frontiers of science and technology as those occur in global, national, and local and personal settings.

In general, an effort should be made to submit multiple items for each stimulus. While very short or simple stimulus materials may only reasonably yield one or two items, for longer materials, three to five items are desirable both in terms of respondent testing time and to allow for the loss of some items during the Field Trial.

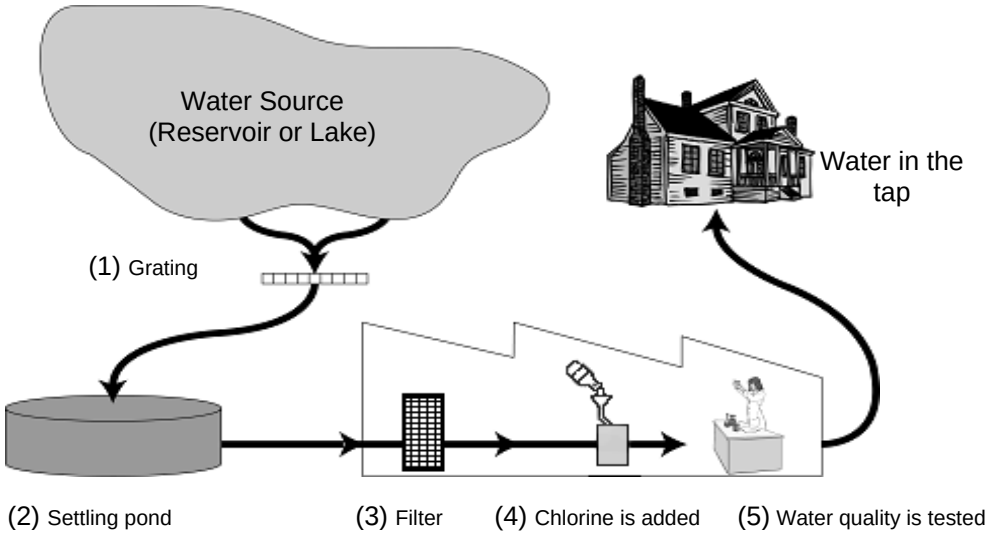
For all items that will be presented on the computer, response modes must be considered as items are being developed. Wherever reasonable, items should be written so they can be computer scored. However, where human-scored items are needed to address key components of the framework, those should be included as well.

Response Formats

The three types of response formats used in previous cycles of PISA will be included in the assessment for 2015. These include: simple multiple choice, complex multiple choice consisting of related "yes/no" questions, and constructed response. In addition, new response formats will be available for this computer-delivered assessment. These include allowing students to respond by selecting from dropdown lists to complete texts, and moving text or graphic elements on the screen to put them in order or into categories.

- **Simple multiple choice**
  (Format carried over from paper; on computer, students will click on a choice.)
  This standard format allows for selection from a list of provided responses:

  Sample question:



The figure above shows how water supplied to houses in cities is made fit for drinking.

The cleaning of water often happens in several steps, involving different techniques. The cleaning process shown in the figure involves four steps (numbered 1–4). In the second step, the water is collected in a settling pond.

In what way does this step make the water cleaner?

A The water becomes less acid.
B The bacteria in the water die.
C Oxygen is added to the water.
D Gravel and sand sink to the bottom.
E Toxic substances are broken down.

- **Complex multiple choice**
  (Format carried over from paper; on computer, students will click on their choices.)
  Typical examples of this response format call for the student to answer multiple "yes/no" or "true/false" questions.

Sample question:

Can drinking polluted water cause the following health problems?
Click on "Yes" or "No" in each case.

Can drinking polluted water cause this health problem?	**YES**	**NO**
Diabetes	○	○
Diarrhoea	○	○
HIV / AIDS	○	○
Intestinal worms / Tape worms	○	○

- **Constructed response**
  (Format carried over from paper; on computer, students will type their responses.)
  Constructed response items generally call for short responses ranging from a phrase to a sentence to a short paragraph of perhaps two to four sentences.

Sample question:

In the fourth step of the cleaning process, chlorine is added to the water.

Why is chlorine added to the water?

_____

_____

- **Multiple Selection**
  (Format carried over from paper; on computer, students will click on their choices.)
  As with simple multiple choice, the student selects from a list of provided choices but in this case the correct response can be more than a single selection.

Sample Question:

To form an image the ultrasound machine needs to calculate the *distance* between the foetus and the probe.

Which two pieces of information will the machine use in order to calculate the distance?

☐ Speed of ultrasound waves in m/s.
☐ Temperature of the room in degrees C
☐ Time of travel of the waves in s
☐ Average density of the tissues in the abdomen (g/m^3)
☐ Energy of the ultrasound waves

Score 01: Speed and time.
Score 00: Other responses and missing.

- **Completion Items**
  (New format for computer-presented items)
  The example below includes a sentence with a number of gaps. Students respond by selecting from dropdown lists to complete the sentence.

Sample Question:

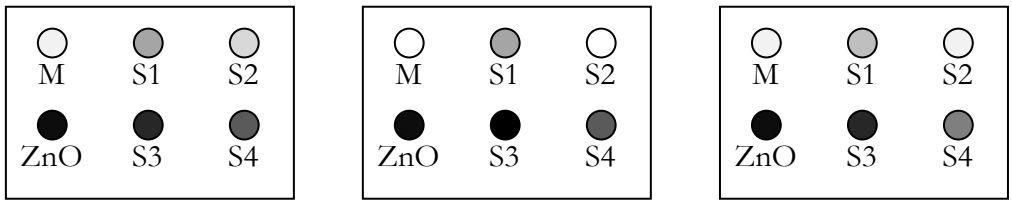
In the fourth step of the cleaning process, chlorine is added to the water for the purpose of [increasing ▾] levels of [bacteria ▾].

increasing	bacteria
stabilizing	chlorine
reducing	particle pollution

- **Drag and drop (order or categorise)**
  (New format for computer-presented items)
  With this response format students can drag and drop elements (text or graphics) to show an order – as in the example below – or a categorisation by dragging elements into different labeled boxes.

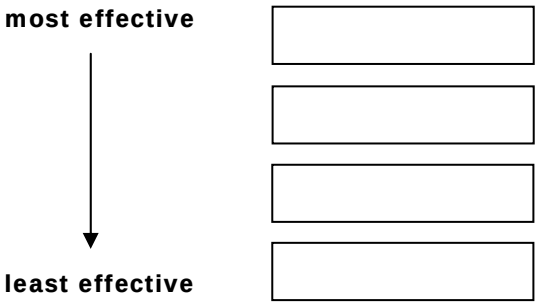
Sample Question:

Mimi and Dean conduct their experiment three times. The diagrams below depict the results from these three trials.



Drag and drop the sunscreens below, putting them in order from most to least effective in how well each product absorbs the ultraviolet radiation component of sunlight.

Sunscreen 1 (S1)	Sunscreen 2 (S2)	Sunscreen 3 (S3)	Sunscreen 4 (S4)



Score 1: S3, S4, S1, S2, in that order.
Score 0: Other responses and missing.

Coding Information for Scoring

It is important that items be submitted with the intended correct response(s) included as this greatly facilitates the review process. If the complexity of an item allows for partially successful responses, the criteria for partial credit should be defined as clearly as possible.

Submission Information – Standard Units

Due to the tight timeline for the development of PISA 2015, standard Scientific Literacy items should be submitted as early as possible, but **no later than 17 December 2012**. Items submitted earlier have a higher chance of being included for consideration in the assessment. Therefore, it is strongly recommended that items be submitted progressively as they are developed, rather than as a bundle close to the submission deadline. Items received after 17 December 2012 cannot be included in the Field Trial pool.

Submissions for Standard Scientific Literacy items should be provided by completing the Standard Unit Submission Form provided in Annex 4.

Graphics should be in a high-resolution format as a .jpg or .gif file. Photos should be at least 3 megapixels. Hard-copy submissions of images and graphics must be originals rather than copies.

Item developers are required to provide the following information about each item.

- Information about the source of the item (original, or from a book or other source)
- Information about any copyright considerations (who holds the copyright, who has been contacted to seek permission to use the item, and copyright permission when it is obtained). This is particularly important for diagrams and graphical material. Countries are responsible for obtaining copyright information for any submitted material.
- The classification of each item according to categories in the Scientific Literacy framework.

Abstracts can be submitted in up to six languages including English, French, German, Japanese, Italian, and Spanish. Material submitted in other major languages of instruction among PISA countries may also be accepted upon prior consultation with Core 3.

Items may be submitted in one of two ways:

- Send by email to mlennon@ets.org
- Send via mail to:

  Marylou Lennon
  Educational Testing Service
  MS 13-E
  Rosedale Road
  Princeton, NJ 08541

ANNEX

ANNEX 1. Abstract Submission Form – Interaction Science Units

Please include one completed copy of this form for each abstract submitted.

Abstract for PISA Scientific Literacy Interactive Unit

Unit Name: xxx

Submitted by (name/country): xxx

Unit Overview (What activity will be presented and what will the student do?)

The student will be presented with…

The activity will call for the student to ….

Note: Any sources or illustrations should be included below, in *Sources/Pictures/Graphics*.

Unit classifications (indicate selections with **boldface and underline**)

Context: Health | Natural Resources | Environmental Quality | Hazards | Frontiers of Science &Technology

System: Physical | Living | Earth & Space

Measurement Profile

Items within the unit will target these competencies and knowledge types.
(Use a "1" to mark areas of primary focus and a "2" to mark areas of secondary focus.)

Competency		**Knowledge Type**	
Explaining phenomena scientifically		Content	
Evaluating and designing scientific enquiry		Procedural	
Interpreting evidence and data scientifically		Epistemic	

Types of questions that might accompany this unit

Author comments and explanations (if any)

Sources/Pictures/Graphics

Contact information for questions or clarification if needed

ANNEX 2: Item Development Checklist for Standard Science Units

This checklist summarises key item development and submission considerations. It need not be submitted with items but as additional guidance for item writers.

Context	
• Relevant to the everyday lives of 15-year-old students	
• Reflects important aspect(s) of being a scientifically literate citizen	
• Authentic context	
• Reflects content that 15-year-old students should generally be expected to know	
• Reflects one or more key aspects of the construct as those are defined in the framework	
Sensitivity	
• Appropriate for international use – e.g., free of culturally specific knowledge or contexts	
• Free of gender bias	
Details for Standard Science Units to be included with submission	
• Coding/marking guidelines clearly defined	
• Translation or adaptation guidelines provided where appropriate (e.g., aspects of a stimulus or question that should or should not be changed are defined)	
• Construct coding is identified	
• Source for stimulus is included	
• Relevant copyright information is included	

ANNEX 3. Exemplar Items Illustrating Key Framework Components

The following exemplars, taken from released Scientific Literacy items, provide examples of items in each of the three competencies and three types of scientific knowledge for reference in coding submitted items.

A. COMPETENCIES

1. **Explain Phenomena Scientifically**
Recognise, offer, and evaluate explanations for a range of natural and technological phenomena.

FLIES

A farmer was working with dairy cattle at an agricultural experiment station. The population of flies in the barn where the cattle lived was so large that the animals' health was affected. So the farmer sprayed the barn and the cattle with a solution of insecticide A. The insecticide killed nearly all the flies. Some time later, however, the number of flies was again large. The farmer again sprayed with the insecticide. The result was similar to that of the first spraying. Most, but not all, of the flies were killed. Again, within a short time the population of flies increased, and they were again sprayed with the insecticide. This sequence of events was repeated five times: then it became apparent that insecticide A was becoming less and less effective in killing the flies. The farmer noted that one large batch of the insecticide solution had been made and used in all the sprayings. Therefore he suggested the possibility that the insecticide solution decomposed with age.

Source: *Teaching About Evolution and the Nature of Science*, National Academy Press, Washington, DC, 1998, p. 75.

The farmer's suggestion is that the insecticide decomposed with age. Give two alternate explanations as to why "insecticide A was becoming less and less effective . . . "

Explanation 1: _____

_____

Explanation 2:_____

_____

2. Evaluate and Design Scientific Enquiry
Describe and appraise scientific investigations and propose ways of addressing questions scientifically.

ACID RAIN

Below is a photo of statues called Caryatids that were built on the Acropolis in Athens more than 2500 years ago. The statues are made of a type of rock called marble. Marble is composed of calcium carbonate.

In 1980, the original statues were transferred inside the museum of the Acropolis and were replaced by replicas. The original statues were being eaten away by acid rain.

The effect of acid rain on marble can be modelled by placing chips of marble in vinegar overnight. Vinegar and acid rain have about the same acidity level. When a marble chip is placed in vinegar, bubbles of gas form. The mass of the dry marble chip can be found before and after the experiment.

Students who did this experiment also placed marble chips in pure (distilled) water overnight.

Explain why the students include this step in their experiment.

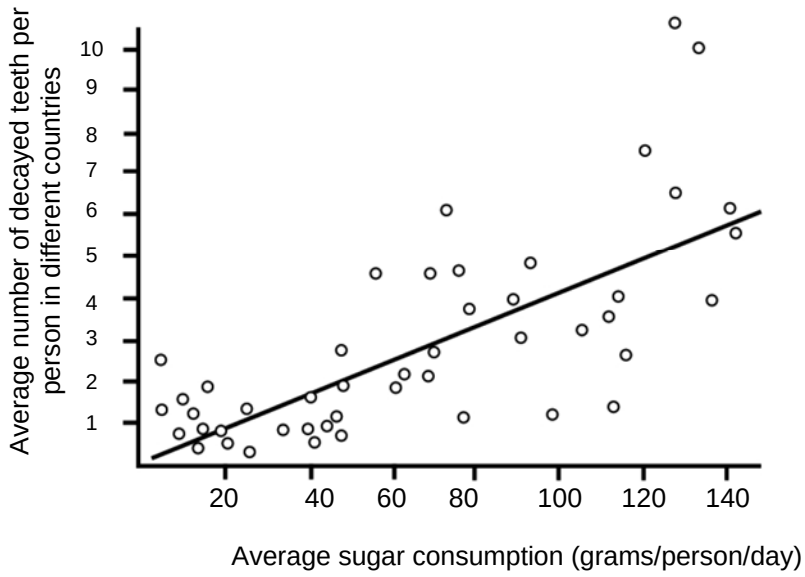
.....

.....

3. Interpret Evidence and Data Scientifically
Analyse and evaluate scientific information, claims, and arguments in a variety of representations and draw appropriate conclusions.

TOOTH DECAY

The following graph shows the consumption of sugar and the amount of caries in different countries. Each country is represented by a dot in the graph.



Which one of the following statements is supported **by the data given in the graph**?

A. In some countries, people brush their teeth more frequently than in other countries.
B. Eating less than 20 grams of sugar per day guarantees that you will not get caries.
C. The more sugar people eat, the more likely they are to get caries.
D. In recent years, the rate of caries has increased in many countries.
E. In recent years, the consumption of sugar has increased in many countries.

Types of Knowledge – Exemplar Items

1. Content Knowledge
Knowledge of the content of science (including physical systems, living systems, earth, and space science)

Mary Montagu

Read the following newspaper article and answer the questions that follow.

THE HISTORY OF VACCINATION

Mary Montagu was a beautiful woman. She survived an attack of smallpox in 1715 but she was left covered with scars. While living in Turkey in 1717, she observed a method called inoculation that was commonly used there. This treatment involved scratching a weak type of smallpox virus into the skin of healthy young people who then became sick, but in most cases only with a mild form of the disease.

Mary Montagu was so convinced of the safety of these inoculations that she allowed her son and daughter to be inoculated.

In 1796, Edward Jenner used inoculations of a related disease, cowpox, to produce antibodies against smallpox. Compared with the inoculation of smallpox, this treatment had less side effects and the treated person could not infect others. The treatment became known as vaccination.

What kinds of diseases can people be vaccinated against?

A. Inherited diseases like haemophilia.
B. Diseases that are caused by viruses, like polio.
C. Diseases from the malfunctioning of the body, like diabetes.
D. Any sort of disease that has no cure.

2. Procedural Knowledge
Knowledge of the diversity of methods and practices that are used to establish scientific knowledge as well as its standard procedures.

GENETICALLY MODIFIED CROPS

GM CORN SHOULD BE BANNED

Wildlife conservation groups are demanding that a new genetically modified (GM) corn be banned.

This GM corn is designed to be unaffected by a powerful new herbicide that kills conventional corn plants. This new herbicide will kill most of the weeds that grow in cornfields.

The conservationists say that because these weeds are feed for small animals, especially insects, the use of the new herbicide with the GM corn will be bad for the environment. Supporters of the use of the GM corn say that a scientific study has shown that this will not happen.

Here are details of the scientific study mentioned in the above article:

- Corn was planted in 200 fields across the country.
- Each field was divided into two. The genetically modified (GM) corn treated with the powerful new herbicide was grown in one half, and the conventional corn treated with a conventional herbicide was grown in the other half.
- The number of insects found in the GM corn, treated with the new herbicide, was about the same as the number of insects in the conventional corn, treated with the conventional herbicide.

What factors were deliberately varied in the scientific study mentioned in the article? Circle "Yes" or "No" for each of the following factors.

Was this factor deliberately varied in the study?	**Yes or No?**
The number of insects in the environment	Yes / No
The types of herbicide used	Yes / No

3. Epistemic Knowledge

Knowledge of how our beliefs in science are justified as a result of understanding the functions of scientific practices, their justifications, and the meaning of terms such as theory, hypothesis, and observation.

CLONING

Read the newspaper article and answer the questions that follow.

A copying machine for living beings?

Without any doubt, if there had been elections for the animal of the year 1997, Dolly would have been the winner! Dolly is a Scottish sheep that you see in the photo. But Dolly is not just a simple sheep. She is a clone of another sheep. A clone means: a copy. Cloning means copying 'from a single master copy'. Scientists succeeded in creating a sheep (Dolly) that is identical to a sheep that functioned as a 'master copy'.

It was the Scottish scientist Ian Wilmut who designed the 'copying machine' for sheep. He took a very small piece from the udder of an adult sheep (sheep 1). From that small piece he removed the nucleus, then he transferred the nucleus into the egg-cell of another (female) sheep (sheep 2). But first he removed from that egg-cell all the material that would have determined sheep 2 characteristics in a lamb produced from that egg-cell. Ian Wilmut implanted the manipulated egg-cell of sheep 2 into yet another (female) sheep (sheep 3). Sheep 3 became pregnant and had a lamb: Dolly.

Some scientists think that within a few years it will be possible to clone people as well. But many governments have already decided to forbid cloning of people by law.

In the last sentence of the article it is stated that many governments have already decided to forbid cloning of people by law.

Two possible reasons for this decision are mentioned below.

Are these reasons scientific reasons?
Circle either "Yes" or "No" for each.

Reason:	**Scientific?**
Cloned people could be more sensitive to certain diseases than normal people.	Yes / No
People should not take over the role of a Creator.	Yes / No

Note: This item has been classified as assessing Epistemic Knowledge because the student's response indicates an understanding of the nature of science, and specifically what kinds of questions can be answered by scientific enquiry.

ANNEX 4. Scientific Literacy Standard Unit Submission Form

Please include one completed copy of this form for each unit (stimulus + set of associated items) submitted.

Name of sender: xxx

Country of sender: xxx

Unit title: xxx

Please indicate the following for this stimulus (indicate selections with **boldface and underline**)

Context (1): Health Natural Resources Environmental Quality
Hazards Frontiers of Science & Technology

Copyright permission (Put an "X" in the appropriate box.)

	Not required	Original material
	Not required	Not applicable (explanation attached)
	Obtained	Copy of authorisation from copyright holder attached[2]
	Being negotiated	Details attached

Please complete one form for each **computer-scored item.**

Unit name	Xxx
Question	xxx
Correct Answer	Xxx
Item type (indicate selection with **boldface and underline**)	Multiple choice Multiple selection Completion Ordering Categorisation
Competency (indicate selection with **boldface and underline**)	Explaining phenomena scientifically Evaluating and designing scientific enquiry Interpreting evidence and data scientifically
Knowledge Type (indicate selection with **boldface and underline**)	Content Procedural Epistemic
Source	

Please complete one form for each **human-scored constructed response item.**

Unit name	Xxx
Question	xxx
Coding Guide	Xxx
Competency (indicate selection with **boldface and underline**)	Explaining phenomena scientifically Evaluating and designing scientific enquiry Interpreting evidence and data scientifically
Knowledge Type (indicate selection with **boldface and underline**)	Content Procedural Epistemic
Source	