3 Distribution of attainment in TIMSS 2015

Chapter outline

This chapter outlines the distribution of attainment in mathematics and science in Northern Ireland in Year 6 (Y6, ages 9-10) in TIMSS 2015. It describes the TIMSS 'benchmarks' of attainment and the proportions of Northern Ireland pupils reaching each benchmark, and provides examples of questions at each of the benchmarks.

In addition, the chapter shows the score distributions for mathematics and science for Northern Ireland and the subset of seven main comparator countries (Australia, England, Finland, Hong Kong, Poland, the Republic of Ireland and Singapore).

Key findings

- Over a quarter of pupils in Northern Ireland reached the 'Advanced International Benchmark' in mathematics, the sixth highest percentage internationally.
- Only 5 per cent of Northern Ireland's pupils reached the Advanced International Benchmark for science.
- For mathematics and science respectively, 3 per cent and 5 per cent failed to reach the 'Low International Benchmark'. In the countries performing better than Northern Ireland, the equivalent figures were 0 to 1 per cent for mathematics, and 0 to 10 per cent for science.
- For mathematics, there was a significant[13] increase in the percentage of pupils in Northern Ireland reaching the Advanced International Benchmark in TIMSS 2015 compared with 2011 (27 per cent in 2015; 24 per cent in 2011).
- For science, the distribution of attainment across the International Benchmarks has remained stable since 2011.
- In Northern Ireland there was a relatively wide spread of attainment for mathematics, whereas for science the difference between the scores of the highest and lowest attainers was smaller.

3.1 Distribution of attainment in TIMSS

In TIMSS, achievement outcomes for each country are reported as an average scale score, as outlined in Chapter 1. In addition to knowing how well pupils in Northern Ireland performed overall (Chapter 1) and across the different content and cognitive domains assessed in TIMSS (see Chapter 4), it is also important, for the purposes of teaching and learning, to examine the spread in performance between the highest and lowest achievers. Amongst countries with similar mean scores there may be differences in the numbers of high- and low-scoring pupils (the highest and lowest attainers). A country with a wide spread

[13] Throughout this report, the term 'significant' refers to statistical significance.

of attainment may have large proportions of pupils who are underachieving as well as pupils performing at the highest levels. A country with a lower spread of attainment may have fewer very high achievers but may also have fewer underachievers.

The first way of examining the spread of attainment is by looking at Northern Ireland's performance at each of the TIMSS 'International Benchmarks' (that is, the levels of attainment within the overall achievement).

Tables 3.1 and 3.2 below summarise the International Benchmarks for mathematics and science respectively.

Interpreting the data: International Benchmarks

The TIMSS achievement scale summarises pupil performance on a scale with a centre point of 500 and a standard deviation of 100, and reports achievement at four points along the scale as 'International Benchmarks'. The Advanced International Benchmark is set at a scale score of 625, the High International Benchmark at 550, the Intermediate International Benchmark at 475, and the Low International Benchmark at 400. The benchmark descriptions summarise what pupils scoring at the TIMSS International Benchmark typically know and can do in the target subject.

Table 3.1 Summary of International Benchmarks for mathematics, Y6

625	**Advanced International Benchmark**	●
	Students can apply their understanding and knowledge in a variety of relatively complex situations and explain their reasoning. They can solve a variety of multi-step word problems involving whole numbers. Students at this level show an increasing understanding of fractions and decimals. They can apply knowledge of a range of two- and three-dimensional shapes in a variety of situations. They can interpret and represent data to solve multi-step problems.	
550	**High International Benchmark**	○
	Students can apply their knowledge and understanding to solve problems. They can solve word problems involving operations with whole numbers, simple fractions, and two-place decimals. Students demonstrate understanding of geometric properties of shapes and of angles that are less than or greater than a right angle. Students can interpret and use data in tables and a variety of graphs to solve problems.	
475	**Intermediate International Benchmark**	●
	Students can apply basic mathematical knowledge in simple situations. They demonstrate an understanding of whole numbers and some understanding of fractions and decimals. Students can relate two- and three-dimensional shapes and identify and draw shapes with simple properties. They can read and interpret bar graphs and tables.	
400	**Low International Benchmark**	○
	Students have some basic mathematical knowledge. They can add and subtract whole numbers, have some understanding of multiplication by one-digit numbers, and can solve simple word problems. They have some knowledge of simple fractions, geometric shapes, and measurement. Students can read and complete simple bar graphs and tables.	

Source: Exhibit 2.1, international mathematics report (Mullis et al., 2016a).

Table 3.2 Summary of International Benchmarks for science, Y6

625 Advanced International Benchmark

Students communicate understanding of life, physical, and Earth sciences and demonstrate some knowledge of the process of scientific inquiry. Students demonstrate knowledge of characteristics and life processes of a variety of organisms, communicate understanding of relationships in ecosystems and interactions between organisms and their environment, and communicate and apply knowledge of factors related to human health. They communicate understanding of properties and states of matter and physical and chemical changes, apply some knowledge of forms of energy and energy transfer, and show some knowledge of forces and an understanding of their effect on motion. Students communicate understanding of Earth's structure, physical characteristics, processes, and history and show knowledge of Earth's revolution and rotation. Students demonstrate basic knowledge and skills related to scientific inquiry, recognizing how a simple experiment should be set up, interpreting the results of an investigation, reasoning and drawing conclusions from descriptions and diagrams, and evaluating and supporting an argument.

550 High International Benchmark

Students communicate and apply knowledge of the life, physical, and Earth sciences in everyday and abstract contexts. Students communicate knowledge of characteristics of plants, animals, and their life cycles, and apply knowledge of ecosystems and of humans' and organisms' interactions with their environment. Students communicate and apply knowledge of states and properties of matter, and of energy transfer in practical contexts, as well as showing some understanding of forces and motion. Students apply knowledge of Earth's structure, physical characteristics, processes, and history and show basic understanding of the Earth-Moon-Sun system. Students compare, contrast, and make simple inferences using models, diagrams, and descriptions of investigations, and provide brief descriptive responses using science concepts, both in everyday and abstract contexts.

475 Intermediate International Benchmark

Students show basic knowledge and understanding of life, physical, and Earth sciences. Students demonstrate some knowledge of life processes of plants and humans, communicate and apply knowledge of the interaction of living things with their environments as well as impacts humans can have on their environment, and communicate knowledge of basic facts related to human health. They apply knowledge about some properties of matter and about some facts related to electricity and to energy transfer, and apply elementary knowledge of forces and motion. They show some understanding of Earth's physical characteristics and demonstrate some basic knowledge of Earth in the solar system. Students interpret information in diagrams, apply factual knowledge to everyday situations, and provide simple explanations for biological and physical phenomena.

400 Low International Benchmark

Students show basic knowledge of life and physical sciences. Students demonstrate some basic knowledge of behavioral and physical characteristics of plants and animals as well as of the interaction of living things with their environments, and apply knowledge of some facts related to human health. Students show basic knowledge of states of matter and physical properties of matter. They interpret simple diagrams, complete simple tables, and provide short, fact-based written responses.

Source: Exhibit 2.1, international science report (Martin et al., 2016a).

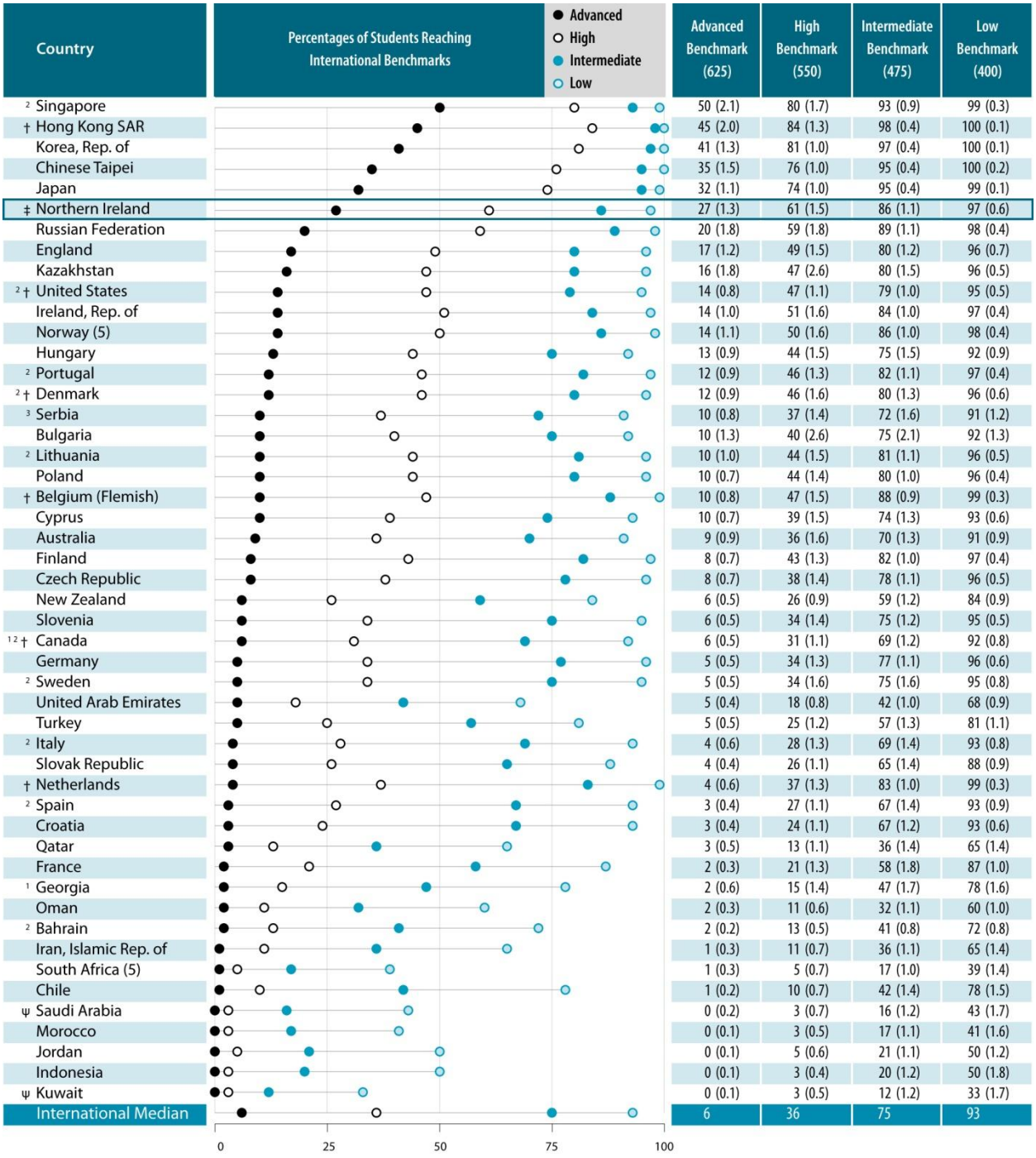
Further detail about each benchmark is given in the relevant international report (Mullis *et al.*, 2016a (mathematics); Martin *et al.*, 2016a (science)).

Tables 3.3 and 3.4 show the percentage of pupils reaching each benchmark for mathematics and science in Northern Ireland. The outcomes for Northern Ireland are then discussed for each subject in turn.

Interpreting the data: performance at the International Benchmarks

These tables indicate the percentage of pupils reaching each of the four benchmarks; the information is summarised in the series of dots on the charts. Percentages are cumulative (reading the charts from left to right). For each country, the black dot shows the percentage reaching at least the Advanced International Benchmark. The clear dot then shows the percentage reaching at least the High International Benchmark and this figure includes those who reached the Advanced International Benchmark. The darker shaded dot indicates the percentage reaching at least the Intermediate International Benchmark; it includes those in the two previous categories. The lighter shaded dot shows cumulatively how many pupils reached at least the Low International Benchmark. The position of that dot also indicates the percentage that did not reach any of the listed benchmarks.

Table 3.3 Percentages reaching each benchmark for mathematics, Y6



Country	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
[2] Singapore	50 (2.1)	80 (1.7)	93 (0.9)	99 (0.3)
† Hong Kong SAR	45 (2.0)	84 (1.3)	98 (0.4)	100 (0.1)
Korea, Rep. of	41 (1.3)	81 (1.0)	97 (0.4)	100 (0.1)
Chinese Taipei	35 (1.5)	76 (1.0)	95 (0.4)	100 (0.2)
Japan	32 (1.1)	74 (1.0)	95 (0.4)	99 (0.1)
‡ Northern Ireland	27 (1.3)	61 (1.5)	86 (1.1)	97 (0.6)
Russian Federation	20 (1.8)	59 (1.8)	89 (1.1)	98 (0.4)
England	17 (1.2)	49 (1.5)	80 (1.2)	96 (0.7)
Kazakhstan	16 (1.8)	47 (2.6)	80 (1.5)	96 (0.5)
[2] † United States	14 (0.8)	47 (1.1)	79 (1.0)	95 (0.5)
Ireland, Rep. of	14 (1.0)	51 (1.6)	84 (1.0)	97 (0.4)
Norway (5)	14 (1.1)	50 (1.6)	86 (1.0)	98 (0.4)
Hungary	13 (0.9)	44 (1.5)	75 (1.5)	92 (0.9)
[2] Portugal	12 (0.9)	46 (1.3)	82 (1.1)	97 (0.4)
[2] † Denmark	12 (0.9)	46 (1.6)	80 (1.3)	96 (0.6)
[3] Serbia	10 (0.8)	37 (1.4)	72 (1.6)	91 (1.2)
Bulgaria	10 (1.3)	40 (2.6)	75 (2.1)	92 (1.3)
[2] Lithuania	10 (1.0)	44 (1.5)	81 (1.1)	96 (0.5)
Poland	10 (0.7)	44 (1.4)	80 (1.0)	96 (0.4)
† Belgium (Flemish)	10 (0.8)	47 (1.5)	88 (0.9)	99 (0.3)
Cyprus	10 (0.7)	39 (1.5)	74 (1.3)	93 (0.6)
Australia	9 (0.9)	36 (1.6)	70 (1.3)	91 (0.9)
Finland	8 (0.7)	43 (1.3)	82 (1.0)	97 (0.4)
Czech Republic	8 (0.7)	38 (1.4)	78 (1.1)	96 (0.5)
New Zealand	6 (0.5)	26 (0.9)	59 (1.2)	84 (0.9)
Slovenia	6 (0.5)	34 (1.4)	75 (1.2)	95 (0.5)
[1 2] † Canada	6 (0.5)	31 (1.1)	69 (1.2)	92 (0.8)
Germany	5 (0.5)	34 (1.3)	77 (1.1)	96 (0.6)
[2] Sweden	5 (0.5)	34 (1.6)	75 (1.6)	95 (0.8)
United Arab Emirates	5 (0.4)	18 (0.8)	42 (1.0)	68 (0.9)
Turkey	5 (0.5)	25 (1.2)	57 (1.3)	81 (1.1)
[2] Italy	4 (0.6)	28 (1.3)	69 (1.4)	93 (0.8)
Slovak Republic	4 (0.4)	26 (1.1)	65 (1.4)	88 (0.9)
† Netherlands	4 (0.6)	37 (1.3)	83 (1.0)	99 (0.3)
[2] Spain	3 (0.4)	27 (1.1)	67 (1.4)	93 (0.9)
Croatia	3 (0.4)	24 (1.1)	67 (1.2)	93 (0.6)
Qatar	3 (0.5)	13 (1.1)	36 (1.4)	65 (1.4)
France	2 (0.3)	21 (1.3)	58 (1.8)	87 (1.0)
[1] Georgia	2 (0.6)	15 (1.4)	47 (1.7)	78 (1.6)
Oman	2 (0.3)	11 (0.6)	32 (1.1)	60 (1.0)
[2] Bahrain	2 (0.2)	13 (0.5)	41 (0.8)	72 (0.8)
Iran, Islamic Rep. of	1 (0.3)	11 (0.7)	36 (1.1)	65 (1.4)
South Africa (5)	1 (0.3)	5 (0.7)	17 (1.0)	39 (1.4)
Chile	1 (0.2)	10 (0.7)	42 (1.4)	78 (1.5)
ψ Saudi Arabia	0 (0.2)	3 (0.7)	16 (1.2)	43 (1.7)
Morocco	0 (0.1)	3 (0.5)	17 (1.1)	41 (1.6)
Jordan	0 (0.1)	5 (0.6)	21 (1.1)	50 (1.2)
Indonesia	0 (0.1)	3 (0.4)	20 (1.2)	50 (1.8)
ψ Kuwait	0 (0.1)	3 (0.5)	12 (1.2)	33 (1.7)
International Median	6	36	75	93

ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.

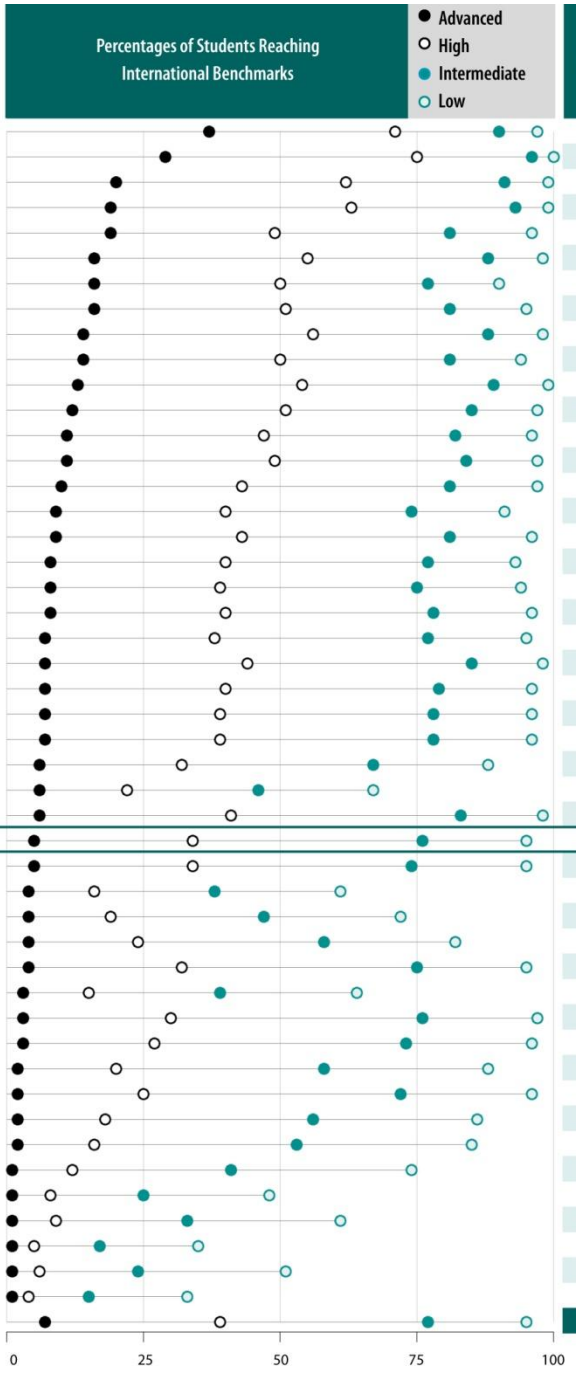
See Appendix C.1 for target population coverage notes 1, 2, and 3. See Appendix C.7 for sampling guidelines and sampling participation notes †, ‡, and ǂ.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Source: Exhibit 2.2, international mathematics report (Mullis *et al.*, 2016a).

Table 3.4 Percentages reaching each benchmark for science, Y6

Country	Percentages of Students Reaching International Benchmarks (Advanced, High, Intermediate, Low)	Advanced Benchmark (625)	High Benchmark (550)	Intermediate Benchmark (475)	Low Benchmark (400)
² Singapore		37 (2.0)	71 (1.8)	90 (1.1)	97 (0.5)
Korea, Rep. of		29 (1.6)	75 (1.1)	96 (0.5)	100 (0.1)
Russian Federation		20 (1.5)	62 (2.0)	91 (1.0)	99 (0.3)
Japan		19 (0.9)	63 (1.3)	93 (0.5)	99 (0.2)
Kazakhstan		19 (1.7)	49 (2.5)	81 (1.4)	96 (0.6)
† Hong Kong SAR		16 (1.2)	55 (1.8)	88 (1.1)	98 (0.4)
Bulgaria		16 (1.5)	50 (2.5)	77 (2.2)	90 (1.5)
²† United States		16 (0.8)	51 (1.1)	81 (0.9)	95 (0.5)
Chinese Taipei		14 (0.7)	56 (1.2)	88 (0.8)	98 (0.3)
Hungary		14 (1.1)	50 (1.5)	81 (1.6)	94 (0.9)
Finland		13 (0.9)	54 (1.4)	89 (0.9)	99 (0.4)
Poland		12 (0.9)	51 (1.4)	85 (1.3)	97 (0.4)
² Sweden		11 (1.1)	47 (2.1)	82 (1.5)	96 (0.8)
Slovenia		11 (0.9)	49 (1.4)	84 (1.0)	97 (0.5)
England		10 (0.8)	43 (1.5)	81 (1.2)	97 (0.5)
Slovak Republic		9 (0.6)	40 (1.4)	74 (1.2)	91 (0.8)
Czech Republic		9 (0.7)	43 (1.4)	81 (1.1)	96 (0.6)
³ Serbia		8 (0.7)	40 (1.5)	77 (1.7)	93 (1.1)
Australia		8 (0.7)	39 (1.6)	75 (1.4)	94 (0.8)
Germany		8 (0.6)	40 (1.7)	78 (1.3)	96 (0.6)
¹²† Canada		7 (0.5)	38 (1.2)	77 (1.4)	95 (0.7)
Norway (5)		7 (0.9)	44 (1.8)	85 (1.1)	98 (0.6)
Ireland, Rep. of		7 (0.9)	40 (1.6)	79 (1.2)	96 (0.6)
² Lithuania		7 (0.8)	39 (1.6)	78 (1.2)	96 (0.5)
²† Denmark		7 (0.6)	39 (1.5)	78 (1.3)	96 (0.5)
New Zealand		6 (0.6)	32 (1.1)	67 (1.4)	88 (0.9)
United Arab Emirates		6 (0.4)	22 (0.9)	46 (1.0)	67 (0.9)
Croatia		6 (0.7)	41 (1.3)	83 (1.1)	98 (0.4)
‡ Northern Ireland		5 (0.6)	34 (1.3)	76 (1.3)	95 (0.6)
² Spain		5 (0.5)	34 (1.3)	74 (1.6)	95 (0.7)
Oman		4 (0.4)	16 (0.8)	38 (1.2)	61 (1.0)
² Bahrain		4 (0.4)	19 (0.9)	47 (1.2)	72 (1.0)
Turkey		4 (0.5)	24 (1.1)	58 (1.4)	82 (1.2)
² Italy		4 (0.5)	32 (1.5)	75 (1.7)	95 (0.7)
Qatar		3 (0.5)	15 (1.2)	39 (1.7)	64 (1.6)
† Netherlands		3 (0.4)	30 (1.5)	76 (1.4)	97 (0.6)
† Belgium (Flemish)		3 (0.4)	27 (1.5)	73 (1.4)	96 (0.6)
France		2 (0.3)	20 (1.2)	58 (1.6)	88 (1.1)
² Portugal		2 (0.3)	25 (1.2)	72 (1.5)	96 (0.6)
Cyprus		2 (0.3)	18 (1.1)	56 (1.4)	86 (1.0)
Chile		2 (0.2)	16 (1.2)	53 (1.5)	85 (1.2)
¹ Georgia		1 (0.6)	12 (1.3)	41 (1.7)	74 (1.7)
Saudi Arabia		1 (0.3)	8 (0.9)	25 (1.4)	48 (1.8)
Iran, Islamic Rep. of		1 (0.3)	9 (0.8)	33 (1.5)	61 (1.7)
ψ Morocco		1 (0.3)	5 (0.7)	17 (1.3)	35 (1.8)
Indonesia		1 (0.2)	6 (0.7)	24 (1.8)	51 (2.1)
ψ Kuwait		1 (0.2)	4 (0.6)	15 (1.4)	33 (1.9)
International Median		7	39	77	95



ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.

See Appendix C.1 for target population coverage notes 1, 2, and 3. See Appendix C.7 for sampling guidelines and sampling participation notes †, ‡, and ǂ.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Source: Exhibit 2.2, international science report (Martin *et al.*, 2016a).

3.1.1 Distribution in mathematics attainment: TIMSS 2015 International Benchmarks

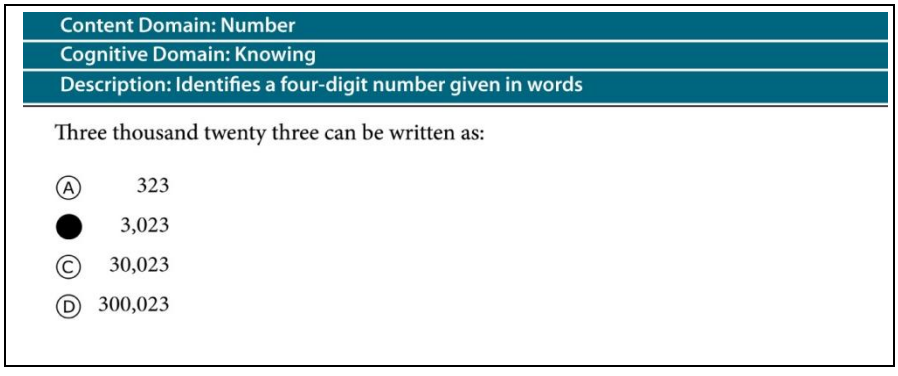
In Northern Ireland, 27 per cent of Y6 pupils reached the Advanced International Benchmark in mathematics, with a further 34 per cent reaching the High International Benchmark (i.e. 61 per cent in total reaching at least the High International Benchmark). This compared with 76 to 80 per cent reaching at least the High International Benchmark in the highest scoring Pacific Rim countries. The country with the most pupils reaching the Advanced International Benchmark was Singapore, with 50 per cent reaching that level in mathematics.

Compared with 2011 there has been a significant increase in the percentage of pupils in Northern Ireland reaching the Advanced International Benchmark (in 2011, this was 24 per cent). Among the subset of main comparator countries, Singapore, Hong Kong and the Republic of Ireland also had a significant increase in the percentage of pupils reaching this International Benchmark (an increase of 7 per cent, 8 per cent and 5 per cent respectively). In Finland on the other hand, the percentage of pupils reaching the Advanced International Benchmark has decreased significantly since 2011 from 12 to 8 per cent.

At the other end of the scale, 97 per cent of pupils in Northern Ireland reached at least the Low International Benchmark for Y6 mathematics, with 3 per cent achieving below that level. In the five countries performing better than Northern Ireland, 99 or 100 per cent of pupils reached at least the Low International Benchmark. This closely mirrors the findings from 2011.

Figures 3.1 to 3.4 below provide examples of mathematics items from TIMSS 2015 at each of the International Benchmarks. These items cover a range of the mathematics content and cognitive domains. Chapter 4 provides more information.

Figure 3.1 Example mathematics item – Low International Benchmark



Source: Exhibit 2.4.1, international mathematics report (Mullis *et al.*, 2016a).

Figure 3.2 Example mathematics item – Intermediate International Benchmark

Content Domain: Data Display
Cognitive Domain: Applying
Description: Reads data from a table

The table below shows the sizes of large snakes.

Type of snake	Weight (kilograms)	Length (meters)
Boa Constrictor	27	4
Burmese Python	90	5 to 7
Green Anaconda	227	6 to 9
King Cobra	9	4

A. James saw a snake that was 8 meters long. Which type of snake could it be?

Answer: Green Anaconda

B. Naima saw a snake that was 6 meters long and weighed about 80 kilograms. Which type of snake could it be?

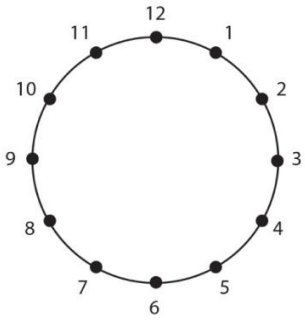
Answer: Burmese Python

Source: Exhibit 2.5.4, international mathematics report (Mullis *et al.*, 2016a).

Figure 3.3 Example mathematics item – High International Benchmark

Content Domain: Geometric Shapes and Measures
Cognitive Domain: Reasoning
Description: Draws a specified geometric shape by connecting dots on a circle

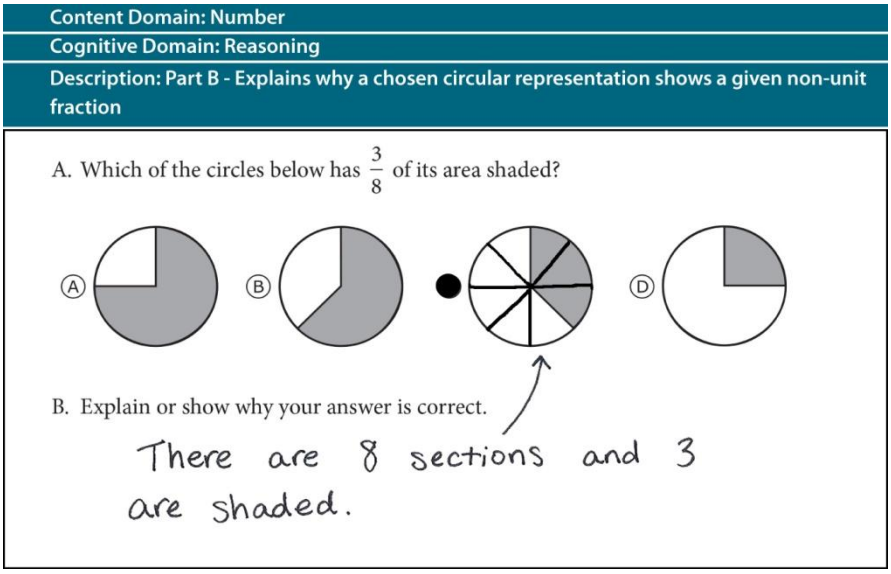
In the circle, draw a triangle with all sides the same length.



What points did you connect? 12, 4, 8, 12

Source: Exhibit 2.6.3, international mathematics report (Mullis *et al.*, 2016a).

Figure 3.4 Example mathematics item – Advanced International Benchmark



Source: Exhibit 2.7.2, international mathematics report (Mullis *et al.*, 2016a).

3.1.2 Distribution in science attainment: TIMSS 2015 International Benchmarks

For Y6 science, 5 per cent of pupils in Northern Ireland reached the Advanced International Benchmark, with a further 29 per cent achieving the High International Benchmark (making a total of 34 per cent reaching at least the High International Benchmark). This distribution of attainment at the highest International Benchmarks is similar to that achieved by Northern Ireland pupils in 2011.

Among the three highest scoring countries, the percentage reaching at least the High International Benchmark ranged from 62 to 75 per cent. The country with the most pupils reaching the Advanced International Benchmark was, again, Singapore, with 37 per cent reaching that level in science. All seven comparator countries had a higher percentage of pupils reaching the Advanced International Benchmark than Northern Ireland. This ranged from 37 to 7 per cent.

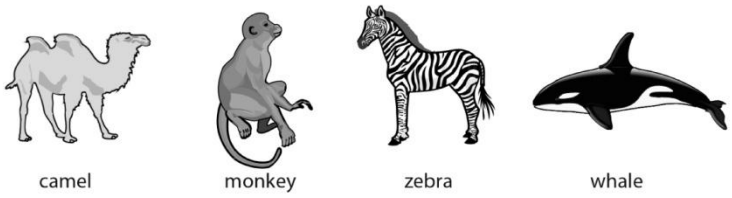
For science, 95 per cent of pupils in Northern Ireland reached at least the Low International Benchmark for Y6, with 5 per cent achieving below that level. Again, this was similar to the distribution in 2011. Among the three highest performers, the comparable percentages reaching at least the Low International Benchmark were 97 to 100 per cent. Compared with Northern Ireland, Australia was the only country among the subset of main comparator countries with a higher percentage of pupils failing to reach the Low International Benchmark.

Figures 3.5 to 3.8 below provide examples of science items from TIMSS 2015 at each of the International Benchmarks. These items cover a range of the science content and cognitive domains. Chapter 4 provides more information on this.

Figure 3.5 Example science item – Low International Benchmark

Content Domain: Life Science
Cognitive Domain: Knowing
Description: Completes a table by matching diagrams of animals to their ecosystems

The pictures below show four animals.



camel monkey zebra whale

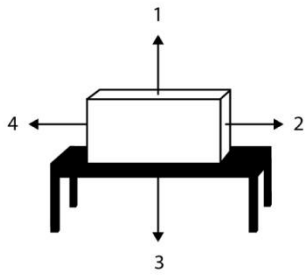
In the table below, write the name of the animal beside the ecosystem in which it is most likely to be found.

Ecosystem	Name of Animal
Tropical rain forest	monkey
Desert	camel
Ocean	whale
Grassland	zebra

Source: Exhibit 2.4.2, international science report (Martin *et al.*, 2016a).

Figure 3.6 Example science item – Intermediate International Benchmark

Content Domain: Physical Science
Cognitive Domain: Applying
Description: Identifies the direction of the force of Earth's gravity in a diagram



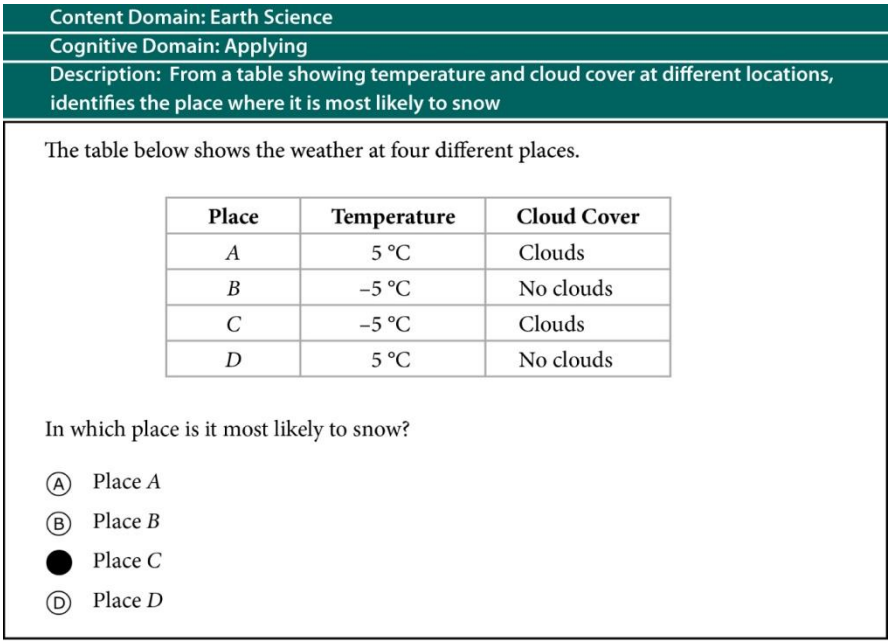
Look at the block on the table.

Which arrow shows the direction of the force of Earth's gravity?

Ⓐ 1
Ⓑ 2
● 3
Ⓓ 4

Source: Exhibit 2.5.3, international science report (Martin *et al.*, 2016a).

Figure 3.7 Example science item – High International Benchmark



Content Domain: Earth Science
Cognitive Domain: Applying
Description: From a table showing temperature and cloud cover at different locations, identifies the place where it is most likely to snow

The table below shows the weather at four different places.

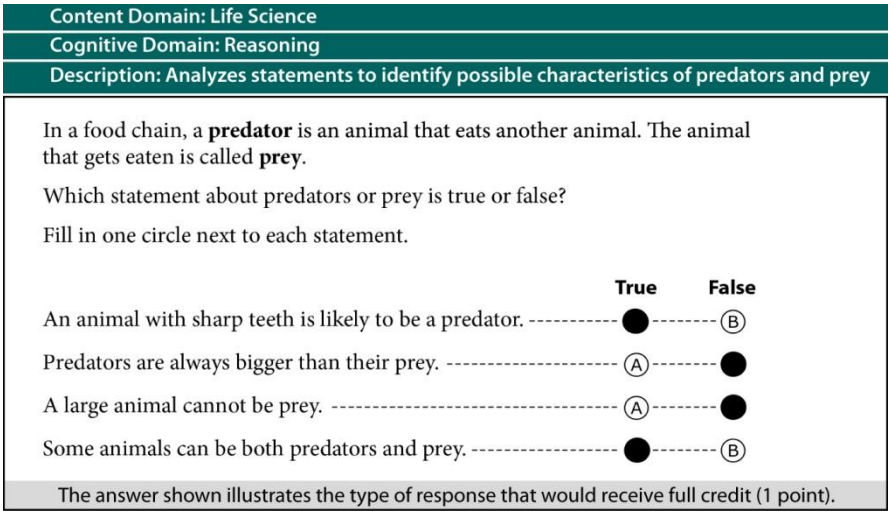
Place	Temperature	Cloud Cover
A	5 °C	Clouds
B	−5 °C	No clouds
C	−5 °C	Clouds
D	5 °C	No clouds

In which place is it most likely to snow?

Ⓐ Place *A*
Ⓑ Place *B*
● Place *C*
Ⓓ Place *D*

Source: Exhibit 2.5.5, international science report (Martin *et al.*, 2016a).

Figure 3.8 Example science item – Advanced International Benchmark



Content Domain: Life Science
Cognitive Domain: Reasoning
Description: Analyzes statements to identify possible characteristics of predators and prey

In a food chain, a **predator** is an animal that eats another animal. The animal that gets eaten is called **prey**.

Which statement about predators or prey is true or false?

Fill in one circle next to each statement.

	True	False
An animal with sharp teeth is likely to be a predator.	●	Ⓑ
Predators are always bigger than their prey.	Ⓐ	●
A large animal cannot be prey.	Ⓐ	●
Some animals can be both predators and prey.	●	Ⓑ

The answer shown illustrates the type of response that would receive full credit (1 point).

Source: Exhibit 2.7.1, international science report (Martin *et al.*, 2016a).

3.1.3 Distribution in mathematics attainment: score distribution

The second way in which the spread of performance can be examined is by looking at the distribution of TIMSS scale scores. Table 1.3 in Chapter 1 shows the TIMSS mathematics scores achieved by pupils at different percentiles. The 5th percentile is the score at which 5 per cent of pupils score lower, while the 95th percentile is the score at which 5 per cent score higher. The difference between the highest and lowest attainers at the 5th and 95th percentiles is a better measure of the spread of scores for comparing countries than using the lowest and highest scoring pupils, as the latter comparison may be affected by a small

number of pupils in a country with unusually high or low scores. Comparison of the 5th and the 95th percentiles gives a better indication of the typical spread of attainment.

The score of pupils in mathematics in Northern Ireland at the 5th percentile was 420, while the score at the 95th percentile was 702; a difference of 282 score points. Table 3.5 shows the difference for mathematics between the highest and lowest attaining pupils (95th percentile – 5th percentile) in Northern Ireland and the seven comparator countries. Among these countries only Singapore had a wider score distribution than Northern Ireland, with a difference of 288 score points between the highest and lowest attainers. Of the comparator countries, Hong Kong and Finland had the narrowest gaps between the highest and lowest attainers at 216 and 218 respectively.

Table 3.5 Y6 mathematics score difference between the highest and lowest attainers

Country	Y6 mathematics scale score	
	Average scale score	Range[1]
Singapore	618	288
Hong Kong	615	216
Republic of Ireland	547	239
England	546	275
Finland	535	218
Poland	535	234
Australia	517	275
Northern Ireland	**570**	**282**

[1] Difference between the highest and lowest attaining pupils (95th percentile – 5th percentile)

3.1.4 Distribution in science attainment: score distribution

As mentioned above, comparing the TIMSS scores at the 5th and the 95th percentiles gives a better indication of the typical spread of attainment. Table 1.4 in Chapter 1 shows the TIMSS science scores achieved by pupils at different percentiles.

The science score of pupils in Northern Ireland at the 5th percentile was 397, while the score of those at the 95th percentile was 627; a difference of 230 score points. This is a much narrower score distribution than that seen in mathematics. Table 3.6 shows the difference between the highest and lowest attaining pupils in science (95th percentile – 5th percentile) in Northern Ireland and the seven comparator countries. Three of these countries - England, the Republic of Ireland and Hong Kong had the same score distribution as Northern Ireland. As with mathematics, Singapore had the widest score distribution with a difference of 282 score points, followed by Australia (250 score points).

Table 3.6 Y6 science score difference between the highest and lowest attainers

Country	Y6 science scale score	
	Average scale score	Range[1]
Singapore	591	282
Hong Kong	557	230
Finland	554	209
Poland	547	225
England	536	230
Republic of Ireland	529	230
Australia	524	250
Northern Ireland	**520**	**230**

[1] Difference between the highest and lowest attaining pupils (95th percentile – 5th percentile)

3.2 Conclusion

Patterns in Northern Ireland's attainment in mathematics and science overall are reflected in the patterns of distribution of attainment: just as pupils scored better in mathematics than in science, so more pupils reached at least the High International Benchmark in mathematics than in science. Correspondingly, the 'tail' of low performance for each subject is relatively small, but marginally greater in science than for mathematics.

Since 2011, the distribution of attainment for science has remained relatively stable with similar percentages of pupils reaching each of the International Benchmarks. For mathematics, there has been a significant increase in the percentage of pupils reaching the Advanced International Benchmark. There is also a difference in the spread of score distributions for the two subjects. Mathematics has a relatively wide score distribution, whereas for science the difference in scores between the highest and lowest attainers is smaller and similar to that of four of the comparator countries (England, Hong Kong, Poland and the Republic of Ireland).