Strengths and Weaknesses in Maths and Science at Second Year

This summary gives a snapshot of findings about the relative strengths and weaknesses of Second Year students in mathematics and science, based on a major international study (TIMSS) that took place in 2019.

We present relative strengths and weaknesses here. In other words, we know from previous research that Second Year students achieve significantly higher scores in maths and science than students in many other countries worldwide. This means that, where we talk about strengths and weaknesses here, they should be interpreted relative to the overall high performance of students in Ireland to identify areas where students may need more support.

Maths

How the TIMSS Framework links to Junior Cycle mathematics

TIMSS Content Domains	Junior Cycle Strand Area
Number	Number
Algebra	Algebra and Functions
Geometry	Geometry and Trigonometry
Data & Probability	Statistics and Probability

	Relative strength	Relative weakness
Content Domains	• Number • Data & Probability	• Algebra • Geometry
Subdomains	• Probability	
Topics	• Compute with fractions and decimals	• Simplify and compare algebraic expressions • Geometric transformations (translations, reflections, and rotations) in the plane

You can see some example items on the next two pages.

Example item assessing fractions and decimals

$\frac{8}{15}$		$\frac{2}{5}$
$\frac{1}{5}$	X	

- The numbers in each row add to 1.
- The numbers in each column add to 1, and
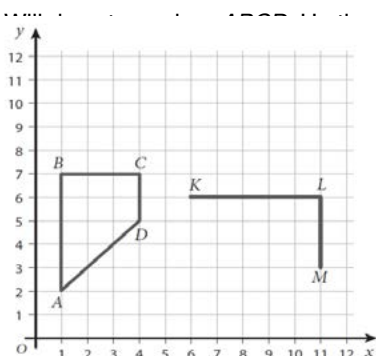- The numbers in both diagonals add to 1.

What is the value of X?

X = _____

Solution: $\frac{5}{15}$ **or equivalent**

Above International Average

Ireland: **24%**

International Average: **16%**

Example item assessing geometric shapes and measurement

Will drew trapezium ABCD. He then started drawing a congruent trapezium *KLMN*.

What will the coordinates of point N be when Will completes the figure?

Answer: (_____, _____)

Solution: (9, 3)

Below International Average

Ireland: **20%**

International Average: **24%**

Science

How the TIMSS Framework links to Junior Cycle science

TIMSS Content Domains	Junior Cycle Strand Area
Biology	Biological World
Chemistry	Chemical World
Physics	Physical World
Earth Science	Earth & Space Exploring the Physical World Strand (Junior Cycle geography)

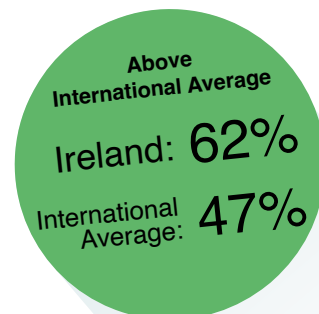|	Relative strength	Relative weakness
Content Domains	• Biology • Earth Science	• Physics • Chemistry
Subdomains	• Diversity, adaptation and natural selection • Properties of matter • Motion and forces • Energy transformation and transfer	• Ecosystems • Composition of matter • Physical states and changes in matter • Electricity and magnetism
Topics	• Motion • Weather and climate	• The flow of energy in ecosystems • Elements, compounds and mixtures

Example item assessing life cycles, reproduction, and heredity

Francisco had a male rabbit and a female rabbit. He kept them in a pen painted white on the inside. Both rabbits had black hair. When these rabbits bred, some of their offspring had white hair.

Which of the following explains how this pair of black-haired rabbits could produce offspring with white hair?
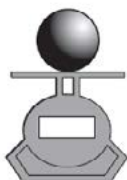
(a) When any black-haired male and female rabbits breed, they will eventually produce some white-haired offspring.

(b) The male and female black-haired rabbits can pass some traits on to their offspring, even though they do not express the trait themselves.

(c) If the male and female black-haired rabbits are old, they will only produce offspring with white hair.

(d) Male and female rabbits will produce offspring that blend in with the colour of their surroundings.

Above International Average
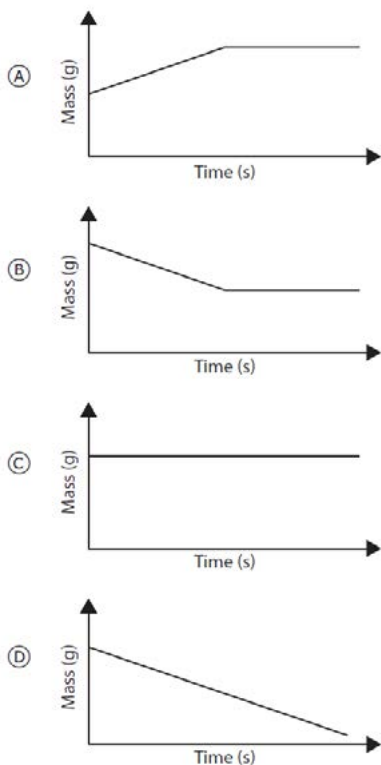
Ireland: **62%**

International Average: **47%**

Solution: (b)

Example item assessing physical changes

A metal ball is heated and placed on an electronic balance.

Below International Average

Ireland: **29%**

International Average: **37%**

Which graph best shows what happens to the reading of the balance as the metal ball cools down?

Ⓐ Mass (g) / Time (s)

Ⓑ Mass (g) / Time (s)

Ⓒ Mass (g) / Time (s)

Ⓓ Mass (g) / Time (s)

Solution: (C)

The **full report** on which this summary is based can be read for free at
https://doi.org/10.70092/2091319.0724.

The report is **aimed at teachers, professional development providers, and others working in education and curriculum development**. It contains more details on:

- **The performance of Second Year students in Ireland in 2019** compared to their peers internationally in maths and science;

- Specific areas (domains, subdomains, and topics) where pupils in Ireland showed **relative strengths or weaknesses**;

- **Links between the Irish curriculum and the TIMSS assessment framework** for maths and science. This analysis highlights where they align and also where topics are assessed in TIMSS but not yet expected to be taught in Ireland.

Other findings from TIMSS 2019 and other cycles of TIMSS in Ireland are available from https://www.erc.ie/studies/timss/reports.

An infographic summary of the main TIMSS 2019 findings can be found here: https://www.erc.ie/wp-content/uploads/2021/04/TIMSS-2019-infographic.pdf

The initial findings of TIMSS 2023 will be published on 4th December 2024 and will also be available from https://www.erc.ie/studies/timss/reports.