

## 5 Performance in the content and cognitive domains

In TIMSS 2007, as in previous surveys, the items have been written to match an assessment framework with content domains. In mathematics the content domains are number, algebra, geometric shapes and measures, and data display in grade 4. The actual content is quite similar to the national curriculum in England, and the structure is similar in that measures are combined with geometry. Grade 8 has content domains of number, algebra, geometry, and data and chance, again not unlike the national curriculum in England. The similarity can be shown by looking at number. At grade 8 the sub-domains are whole numbers; fractions and decimals; integers; ratio, proportion and percent. At grade 4 the equivalents are: whole numbers; fractions and decimals; number sentences with whole numbers; patterns and relationships.

In science at grade 4 the content is divided into life science, physical science and earth science. The use of earth science as a structural element is not mirrored in England and the chemistry and physics elements of the national curriculum are combined in TIMSS, unlike in England. At grade 8 the TIMSS domains are biology, chemistry, physics and earth science. Again, the main difference is earth science and TIMSS includes in earth science material that would be included in other subjects in England, notably geography.

For 2007, items were also classified in cognitive domains. These domains - knowing, applying and reasoning - are the same for both grades and subjects. In mathematics, knowing includes recall of definitions and facts and basic computation. Applying includes solving routine problems, while reasoning covers analysing, generalising, synthesising, justifying and solving non-routine problems.

In science, knowing is similar, involving recalling, for example, and using tools and procedures. Applying includes using models, interpreting information and explaining. Reasoning again includes analysing, generalising, synthesising, justifying and designing and planning.

*See the TIMSS 2007 Assessment Frameworks at <http://timss.bc.edu> for more detailed descriptions of the content and cognitive domains.*

### 5.1 Grade 4 science: performance in the content and cognitive domains

Exhibit 5.1 shows how the higher scoring countries in TIMSS performed in the content and cognitive domains. The lowest scoring countries are not shown so that the different patterns of performance are more obvious for countries scoring higher than England, at a similar level to England (boxed) and at a somewhat lower level.

In each domain, the difference between the country's score and the TIMSS scale average (of 500 in each case) is shown so that the relative strengths and weaknesses of each

#### Erratum

Due to a labelling error in the international dataset, all findings related to the cognitive domains of 'Knowing' and 'Applying' have been inadvertently reversed in the national report for England. Findings reported as 'Knowing' actually relate to the 'Applying' domain, and findings reported as 'Applying' actually relate to the 'Knowing' domain. This applies to chapters 1, 5 and 6 of the national report and to the separate executive summary booklet.

Exhibit 5.1 Average achievement in the science content and cognitive domains

Country	Overall Scale Score	Average Scale Scores for Science Content Domains						Average Scale Scores for Science Cognitive Domains					
		Life Science		Physical Science		Earth Science		Knowing		Applying		Reasoning	
Singapore	587	582 (4.1)	82	585 (3.9)	85	554 (3.3)	54	579 (3.7)	79	587 (4.1)	87	568 (3.7)	68
Chinese Taipei	557	541 (2.1)	41	559 (2.5)	59	553 (1.9)	53	556 (2.1)	56	536 (2.5)	36	571 (2.4)	71
Hong Kong SAR	554	532 (3.5)	32	558 (3.5)	58	560 (3.2)	60	549 (3.0)	49	546 (3.2)	46	561 (4.4)	61
Japan	548	530 (2.0)	30	564 (2.3)	64	529 (2.7)	29	542 (2.7)	42	528 (2.2)	28	567 (2.1)	67
Russian Federation	546	539 (4.1)	39	547 (4.6)	47	536 (4.3)	36	546 (4.7)	46	542 (4.8)	42	542 (4.6)	42
1 Latvia	542	535 (2.1)	35	544 (2.4)	44	536 (2.2)	36	535 (2.4)	35	540 (2.2)	40	551 (2.7)	51
England	542	532 (2.7)	32	543 (2.7)	43	538 (2.9)	38	536 (2.7)	36	543 (2.9)	43	537 (2.7)	37
2 † United States	539	540 (2.5)	40	534 (2.3)	34	533 (2.6)	33	533 (2.8)	33	541 (2.3)	41	535 (2.6)	35
Hungary	536	548 (2.8)	48	529 (3.3)	29	517 (3.5)	17	531 (3.2)	31	540 (3.0)	40	529 (3.7)	29
Italy	535	549 (3.0)	49	521 (3.1)	21	526 (3.0)	26	539 (3.1)	39	530 (3.9)	30	526 (3.8)	26
1 Kazakhstan	533	528 (5.0)	28	528 (5.8)	28	534 (5.2)	34	536 (4.9)	36	534 (5.8)	34	519 (5.3)	19
Germany	528	529 (2.0)	29	524 (2.5)	24	524 (2.4)	24	526 (2.2)	26	527 (2.2)	27	525 (2.3)	25
Australia	527	528 (3.4)	28	522 (3.1)	22	534 (3.2)	34	523 (3.3)	23	529 (3.1)	29	530 (3.4)	30
Slovak Republic	526	532 (4.0)	32	513 (4.6)	13	530 (4.8)	30	527 (4.4)	27	527 (4.4)	27	513 (4.9)	13
Austria	526	526 (2.0)	26	514 (2.4)	14	532 (1.9)	32	526 (2.2)	26	529 (2.0)	29	513 (2.3)	13
Sweden	525	531 (2.5)	31	508 (2.7)	8	535 (2.7)	35	521 (2.9)	21	526 (2.5)	26	527 (3.5)	27
‡ Netherlands	523	536 (2.2)	36	503 (2.3)	3	524 (2.5)	24	525 (2.2)	25	518 (2.5)	18	525 (2.3)	25
Slovenia	518	511 (2.2)	11	530 (1.6)	30	517 (2.5)	17	525 (2.1)	25	511 (1.6)	11	527 (1.8)	27
† Denmark	517	527 (2.4)	27	502 (2.5)	2	522 (2.7)	22	515 (2.6)	15	516 (2.9)	16	525 (3.8)	25
Czech Republic	515	520 (2.9)	20	511 (2.8)	11	518 (2.6)	18	516 (3.1)	16	520 (2.7)	20	510 (2.9)	10
1 Lithuania	514	516 (1.8)	16	514 (1.4)	14	511 (2.5)	11	515 (2.8)	15	511 (1.7)	11	524 (2.4)	24
New Zealand	504	506 (2.5)	6	498 (2.5)	-2	515 (2.6)	15	500 (2.4)	0	511 (2.5)	11	505 (2.9)	5
† Scotland	500	504 (2.2)	4	499 (1.9)	-1	508 (2.5)	8	494 (2.4)	-6	511 (2.0)	11	501 (2.2)	1
<b>TIMSS Scale Avg.</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>
Armenia	484	489 (5.9)	-11	492 (5.1)	-8	479 (5.5)	-21	487 (5.6)	-13	486 (5.2)	-14	484 (5.3)	-16
Norway	477	487 (2.5)	-13	469 (2.7)	-31	497 (2.9)	-3	478 (2.8)	-22	485 (2.4)	-15	480 (3.2)	-20
Ukraine	474	482 (2.5)	-18	475 (2.7)	-25	474 (3.1)	-26	477 (3.2)	-23	476 (2.4)	-24	478 (3.0)	-22

For each domain, three columns of figures appear: the scale score; the standard error in parentheses; and the difference between the scale score and the scale average.

† Met guidelines for sample participation rates only after replacement schools were included (see Appendix A).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Appendix A).

1 National Target Population does not include all of the International Target Population defined by TIMSS (see Appendix A).

2 National Defined Population covers 90% to 95% of National Target Population (see Appendix A).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007

Exhibit 5.2 Average achievement in the mathematics content and cognitive domains

Country	Overall Scale Score	Average Scale Scores for Mathematics Content Domains						Average Scale Scores for Mathematics Cognitive Domains					
		Number		Geometric Shapes and Measures		Data Display		Knowing		Applying		Reasoning	
Hong Kong SAR	607	606 (3.8)	106	599 (3.1)	99	585 (2.7)	85	599 (3.4)	99	617 (3.5)	117	589 (3.5)	89
Singapore	599	611 (4.3)	111	570 (3.6)	70	583 (3.2)	83	590 (3.7)	90	620 (4.0)	120	578 (3.8)	78
Chinese Taipei	576	581 (1.9)	81	556 (2.2)	56	567 (2.0)	67	569 (1.7)	69	584 (1.7)	84	566 (1.9)	66
Japan	568	561 (2.2)	61	566 (2.2)	66	578 (2.8)	78	566 (2.0)	66	565 (2.1)	65	563 (2.1)	63
1 Kazakhstan	549	556 (6.6)	56	542 (7.4)	42	522 (5.8)	22	547 (7.2)	47	559 (7.3)	59	539 (6.1)	39
Russian Federation	544	546 (4.4)	46	538 (5.1)	38	530 (4.9)	30	547 (4.8)	47	538 (4.5)	38	540 (4.8)	40
England	541	531 (3.2)	31	548 (2.7)	48	547 (2.5)	47	540 (3.1)	40	544 (3.6)	44	537 (3.1)	37
1 Latvia	537	536 (2.1)	36	532 (2.6)	32	536 (3.0)	36	540 (2.5)	40	530 (2.2)	30	537 (2.5)	37
‡ Netherlands	535	535 (2.2)	35	522 (2.3)	22	543 (2.3)	43	540 (2.0)	40	525 (2.2)	25	534 (2.4)	34
1 Lithuania	530	533 (2.3)	33	518 (2.4)	18	530 (2.9)	30	539 (2.4)	39	520 (2.8)	20	526 (2.5)	26
2 † United States	529	524 (2.7)	24	522 (2.5)	22	543 (2.4)	43	524 (2.6)	24	541 (2.6)	41	523 (2.2)	23
Germany	525	521 (2.2)	21	528 (2.0)	28	534 (3.1)	34	531 (2.2)	31	514 (2.0)	14	528 (2.5)	28
† Denmark	523	509 (2.9)	9	544 (2.6)	44	529 (3.4)	29	528 (2.5)	28	513 (2.7)	13	524 (2.1)	24
Australia	516	496 (3.7)	-4	536 (3.1)	36	534 (3.1)	34	523 (3.5)	23	509 (4.2)	9	516 (3.4)	16
Hungary	510	510 (3.7)	10	510 (3.3)	10	504 (3.5)	4	507 (3.5)	7	511 (3.4)	11	509 (3.8)	9
Italy	507	505 (3.2)	5	509 (3.0)	9	506 (3.4)	6	501 (2.9)	1	514 (3.2)	14	509 (3.1)	9
Austria	505	502 (2.2)	2	509 (2.4)	9	508 (2.6)	8	507 (1.8)	7	505 (2.0)	5	506 (2.1)	6
Sweden	503	490 (2.5)	-10	508 (2.3)	8	529 (2.7)	29	508 (2.2)	8	482 (2.5)	-18	519 (2.5)	19
Slovenia	502	485 (1.9)	-15	522 (1.8)	22	518 (2.5)	18	504 (1.9)	4	497 (1.8)	-3	505 (2.1)	5
<b>TIMSS Scale Avg.</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>	<b>500</b>
Armenia	500	522 (4.0)	22	483 (4.7)	-17	458 (4.3)	-42	493 (4.1)	-7	518 (4.8)	18	489 (4.7)	-11
Slovak Republic	496	495 (3.9)	-5	499 (4.3)	-1	492 (4.2)	-8	498 (4.0)	-2	492 (3.9)	-8	499 (4.0)	-1
† Scotland	494	481 (2.6)	-19	503 (2.6)	3	516 (2.2)	16	500 (2.4)	0	489 (2.6)	-11	497 (2.2)	-3
New Zealand	492	478 (2.7)	-22	502 (2.3)	2	513 (2.6)	13	495 (2.3)	-5	482 (2.5)	-18	503 (2.8)	3
Czech Republic	486	482 (2.8)	-18	494 (2.8)	-6	493 (3.3)	-7	496 (2.7)	-4	473 (2.4)	-27	493 (3.4)	-7
Norway	473	461 (2.8)	-39	490 (3.0)	-10	487 (2.6)	-13	479 (2.8)	-21	461 (2.9)	-39	489 (2.7)	-11
Ukraine	469	480 (2.9)	-20	457 (2.8)	-43	462 (3.2)	-38	466 (3.1)	-34	472 (3.0)	-28	474 (3.2)	-26

For each domain, three columns of figures appear: the scale score; the standard error in parentheses; and the difference between the scale score and the scale average.

† Met guidelines for sample participation rates only after replacement schools were included (see Appendix A).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Appendix A).

1 National Target Population does not include all of the International Target Population defined by TIMSS (see Appendix A).

2 National Defined Population covers 90% to 95% of National Target Population (see Appendix A).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007

country are indicated. England's scale score was 543 for physical science, higher than the 532 for life science. For earth science England's score was 538. Looking at Exhibit 5.1, there are no obvious consistent patterns associated with particular levels of country performance. Countries scoring at a similar level to England, for example, show different patterns of strengths and weaknesses across the content domains.

In the cognitive domains, England's scores, 536 for knowing, 543 for applying and 537 for reasoning, are quite similar to each other. Again, no obvious patterns emerge relating the cognitive domains to performance levels. Among the highest scorers, Singapore's best score is for applying while, for Chinese Taipei, the highest is for reasoning. Again, countries scoring at a similar level to England show different patterns of strengths and weaknesses. Several of these countries have a flat profile like England, while others demonstrate marked strengths and weaknesses.

It is not possible to look at trends in the content and cognitive domains since those used in 2007 were not the same as earlier ones. The number of domains has been reduced to give better measurement properties as domains assessed by small numbers of items have been removed.

*See Chapter 3 of the international mathematics and science reports for more information on performance in the content and cognitive domains*

## 5.2 Grade 4 mathematics: performance in the content and cognitive domains

For grade 4 mathematics, the content domains are number, geometric shapes and measures, and data display. Exhibit 5.2 shows how the higher scoring countries in TIMSS performed in the content and cognitive domains.

England's scale scores for geometric shapes and measures and for data display were similar, 548 and 547 respectively. At 531, the score for number is rather lower, indicating a relative weakness. This profile is not shared by any of the countries performing at a similar level to England, but Japan, a higher scorer, also has a relative weakness in number. At the item level, the weakness is most evident in division and the completion of number sentences.

In the cognitive domains, England's scores, 540 for knowing, 544 for applying and 537 for reasoning, are quite similar to each other as for grade 4 science. Again, no obvious patterns emerged relating the cognitive domains to performance levels. Countries scoring at a similar level to England show different patterns of strengths and weaknesses. Again, Japan has a similar profile to England.

Exhibit 5.3 Average achievement in the science content and cognitive domains

Country	Overall Scale Score	Average Scale Scores for Science Content Domains								Average Scale Scores for Science Cognitive Domains					
		Biology		Chemistry		Physics		Earth Science		Knowing		Applying		Reasoning	
Singapore	567	564 (4.2)	64	560 (4.1)	60	575 (3.9)	75	541 (4.1)	41	567 (4.2)	67	554 (4.5)	54	564 (4.1)	64
Chinese Taipei	561	549 (3.4)	49	573 (4.2)	73	554 (3.7)	54	545 (2.9)	45	560 (3.4)	60	565 (3.5)	65	541 (3.5)	41
Japan	554	553 (1.9)	53	551 (1.9)	51	558 (1.9)	58	533 (2.5)	33	555 (2.0)	55	534 (2.2)	34	560 (2.0)	60
Korea, Rep. of	553	548 (1.9)	48	536 (2.4)	36	571 (2.4)	71	538 (2.2)	38	547 (2.0)	47	543 (2.0)	43	558 (2.0)	58
† England	542	541 (4.4)	41	534 (4.0)	34	545 (4.0)	45	529 (4.3)	29	538 (4.0)	38	530 (4.9)	30	547 (4.0)	47
Hungary	539	534 (2.7)	34	536 (3.5)	36	541 (3.2)	41	531 (2.9)	31	549 (3.0)	49	524 (3.0)	24	530 (3.0)	30
Czech Republic	539	531 (2.1)	31	535 (2.7)	35	537 (2.1)	37	534 (2.0)	34	539 (1.9)	39	533 (2.1)	33	534 (2.3)	34
Slovenia	538	530 (2.3)	30	539 (2.5)	39	524 (2.0)	24	542 (2.2)	42	533 (2.2)	33	533 (2.0)	33	538 (2.2)	38
† Hong Kong SAR	530	527 (4.6)	27	517 (4.6)	17	528 (4.8)	28	532 (4.5)	32	522 (4.9)	22	532 (4.5)	32	533 (5.0)	33
Russian Federation	530	525 (3.6)	25	535 (3.7)	35	519 (4.0)	19	525 (3.4)	25	527 (3.8)	27	534 (4.3)	34	520 (3.7)	20
2+ United States	520	530 (2.8)	30	510 (2.7)	10	503 (2.7)	3	525 (3.1)	25	516 (2.7)	16	512 (2.9)	12	529 (2.9)	29
1 Lithuania	519	527 (2.3)	27	507 (2.3)	7	505 (2.9)	5	515 (2.5)	15	512 (2.2)	12	513 (2.4)	13	527 (2.5)	27
Australia	515	518 (3.4)	18	505 (3.6)	5	508 (4.2)	8	519 (3.8)	19	510 (3.2)	10	501 (3.1)	1	530 (3.6)	30
Sweden	511	515 (2.4)	15	499 (2.4)	-1	506 (2.7)	6	510 (3.0)	10	509 (2.7)	9	505 (2.3)	5	517 (2.6)	17
TIMSS Scale Avg.	500	500		500		500		500		500		500		500	
† Scotland	496	495 (3.2)	-5	497 (3.2)	-3	494 (3.7)	-6	498 (3.2)	-2	495 (3.1)	-5	480 (3.9)	-20	511 (3.6)	11
Italy	495	502 (3.0)	2	481 (2.9)	-19	489 (3.1)	-11	503 (3.1)	3	498 (2.9)	-2	494 (3.3)	-6	493 (2.6)	-7
Armenia	488	490 (5.9)	-10	478 (6.3)	-22	503 (5.6)	3	475 (5.8)	-25	502 (5.4)	2	493 (6.4)	-7	459 (6.5)	-41
Norway	487	487 (2.3)	-13	483 (2.2)	-17	475 (3.0)	-25	502 (2.5)	2	486 (2.3)	-14	486 (2.0)	-14	491 (2.8)	-9
Ukraine	485	477 (3.4)	-23	490 (3.3)	-10	492 (3.9)	-8	482 (4.0)	-18	488 (3.7)	-12	477 (3.8)	-23	488 (3.9)	-12
Jordan	482	478 (3.8)	-22	491 (4.1)	-9	479 (4.2)	-21	484 (3.6)	-16	485 (4.1)	-15	491 (4.5)	-9	471 (4.1)	-29
Thailand	471	478 (4.5)	-22	462 (4.1)	-38	458 (4.2)	-42	488 (3.8)	-12	472 (4.1)	-28	473 (4.4)	-27	473 (4.0)	-27
Malaysia	471	469 (5.8)	-31	479 (5.0)	-21	484 (5.7)	-16	463 (5.4)	-37	473 (5.9)	-27	458 (6.5)	-42	487 (4.9)	-13
1 2 Serbia	470	474 (3.2)	-26	467 (3.7)	-33	467 (3.0)	-33	466 (3.8)	-34	469 (3.6)	-31	485 (2.8)	-15	455 (3.5)	-45
3 Bulgaria	470	467 (6.0)	-33	472 (6.1)	-28	466 (5.6)	-34	480 (5.5)	-20	471 (6.1)	-29	489 (5.8)	-11	448 (6.1)	-52

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007

For each domain, three columns of figures appear: the scale score; the standard error in parentheses; and the difference between the scale score and the scale average.

† Met guidelines for sample participation rates only after replacement schools were included (see Appendix A).

1 National Target Population does not include all of the International Target Population defined by TIMSS (see Appendix A).

2 National Defined Population covers 90% to 95% of National Target Population (see Appendix A).

3 National Defined Population covers less than 90% of National Target Population (but at least 77%, see Appendix A).

Exhibit 5.4 Average achievement in the mathematics content and cognitive domains

Country	Overall Scale Score	Average Scale Scores for Mathematics Content Domains							Average Scale Scores for Mathematics Cognitive Domains						
		Number		Algebra		Geometry		Data and Chance	Knowing		Applying		Reasoning		
Chinese Taipei	598	577 (4.2)	77	617 (5.4)	117	592 (4.6)	92	566 (3.6)	66	592 (4.2)	92	594 (4.5)	94	591 (4.1)	91
Korea, Rep. of	597	583 (2.4)	83	596 (3.0)	96	587 (2.3)	87	580 (2.0)	80	595 (2.8)	95	596 (2.5)	96	579 (2.3)	79
Singapore	593	597 (3.5)	97	579 (3.7)	79	578 (3.4)	78	574 (3.9)	74	593 (3.6)	93	581 (3.4)	81	579 (4.1)	79
† Hong Kong SAR	572	567 (5.6)	67	565 (5.6)	65	570 (5.5)	70	549 (4.7)	49	569 (5.9)	69	574 (5.4)	74	557 (5.6)	57
Japan	570	551 (2.3)	51	559 (2.5)	59	573 (2.2)	73	573 (2.2)	73	565 (2.2)	65	560 (2.2)	60	568 (2.4)	68
Hungary	517	517 (3.6)	17	503 (3.6)	3	508 (3.6)	8	524 (3.3)	24	513 (3.1)	13	518 (3.3)	18	513 (3.2)	13
† England	513	510 (5.0)	10	492 (4.6)	-8	510 (4.4)	10	547 (5.0)	47	514 (4.9)	14	503 (4.0)	3	518 (4.3)	18
Russian Federation	512	507 (3.8)	7	518 (4.5)	18	510 (4.1)	10	487 (3.8)	-13	510 (3.7)	10	521 (3.9)	21	497 (3.6)	-3
2+ United States	508	510 (2.7)	10	501 (2.7)	1	480 (2.5)	-20	531 (2.8)	31	503 (2.9)	3	514 (2.6)	14	505 (2.4)	5
1 Lithuania	506	506 (2.7)	6	483 (2.7)	-17	507 (2.6)	7	523 (2.3)	23	511 (2.4)	11	508 (2.5)	8	486 (2.5)	-14
Czech Republic	504	511 (2.5)	11	484 (2.4)	-16	498 (2.7)	-2	512 (2.8)	12	504 (2.7)	4	502 (2.5)	2	500 (2.6)	0
Slovenia	501	502 (2.3)	2	488 (2.4)	-12	499 (2.4)	-1	511 (2.3)	11	503 (2.0)	3	500 (2.2)	0	496 (2.5)	-4
TIMSS Scale Avg.	500	500		500		500		500		500		500		500	
Armenia	499	492 (3.1)	-8	532 (2.5)	32	493 (4.1)	-7	427 (3.9)	-73	493 (3.8)	-7	507 (3.1)	7	489 (3.8)	-11
Australia	496	503 (3.7)	3	471 (3.7)	-29	487 (3.6)	-13	525 (3.2)	25	500 (3.4)	0	487 (3.3)	-13	502 (3.3)	2
Sweden	491	507 (1.8)	7	456 (2.4)	-44	472 (2.5)	-28	526 (3.0)	26	497 (2.0)	-3	478 (2.0)	-22	490 (2.6)	-10
Malta	488	496 (1.3)	-4	473 (1.4)	-27	495 (1.1)	-5	487 (1.4)	-13	492 (1.0)	-8	490 (1.6)	-10	475 (1.3)	-25
† Scotland	487	489 (3.7)	-11	467 (3.7)	-33	485 (3.9)	-15	517 (3.5)	17	489 (3.7)	-11	481 (3.3)	-19	495 (3.3)	-5
1 2 Serbia	486	478 (2.9)	-22	500 (3.2)	0	486 (3.6)	-14	458 (3.0)	-42	478 (3.3)	-22	500 (3.2)	0	474 (3.3)	-26
Italy	480	478 (2.8)	-22	460 (3.2)	-40	490 (3.1)	-10	491 (3.1)	-9	483 (2.9)	-17	476 (3.0)	-24	483 (2.8)	-17
Malaysia	474	491 (5.1)	-9	454 (4.3)	-46	477 (5.6)	-23	469 (4.1)	-31	478 (4.9)	-22	477 (4.8)	-23	468 (3.8)	-32
Norway	469	488 (2.0)	-12	425 (2.8)	-75	459 (2.3)	-41	505 (2.5)	5	477 (2.2)	-23	458 (1.8)	-42	475 (2.3)	-25

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2007

For each domain, three columns of figures appear: the scale score; the standard error in parentheses; and the difference between the scale score and the scale average.

† Met guidelines for sample participation rates only after replacement schools were included (see Appendix A).

1 National Target Population does not include all of the International Target Population defined by TIMSS (see Appendix A).

2 National Defined Population covers 90% to 95% of National Target Population (see Appendix A).

(-) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

### 5.3 Grade 8 science: performance in the content and cognitive domains

For grade 8 science, the four content domains are biology, chemistry, physics and earth science.

Exhibit 5.3 shows how the higher scoring countries in TIMSS performed in the content and cognitive domains.

England's highest score, 545, was for physics, and the lowest, 529, was for earth science. Biology, at 541, was similar to physics, and for chemistry the score was 534.

Looking at Exhibit 5.3, a range of profiles of performance is evident. High scoring countries, for example, do not all possess the same profile and overall scores similar to England's are accompanied by a variety of performance profiles. Countries scoring at a similar level to England also show different patterns of strengths and weaknesses.

In the cognitive domains, England's scores, 538 for knowing, 530 for applying and 547 for reasoning, are more varied than was seen at grade 4, with relative strength in reasoning. Two high scoring countries, Japan and Korea, also have a strength in reasoning.

### 5.4 Grade 8 mathematics: performance in the content and cognitive domains

For grade 8, the four mathematics content domains are number, algebra, geometry, and data and chance. Exhibit 5.4 shows how the higher scoring countries in TIMSS performed in these domains.

England's profile is quite differentiated with the highest performance, 547, in data and chance and its lowest, 492, in algebra. The scores for number and geometry were similar to each other, at 510. This relative weakness in algebra was shared by several of the countries performing at a similar level to England, but not by countries scoring at a higher level than England. At item level, the weakness can be seen to extend to basic algebraic manipulation.

In the cognitive domains, England's scores, 514 for knowing, 503 for applying and 518 for reasoning, indicate a relative weakness in applying. This profile is not shared by other countries performing at a similar level to England or at a higher level.

### 5.5 Summary

England's performance in the different content areas was reasonably consistent in grade 4 science, but at grade 8 pupils scored highest in physics and lowest in earth science. Differences in mathematics were more marked. In grade 4 the score for number was significantly lower than that for geometric shapes and measures or data display. At grade 8, data display was England's real strength and algebra a large weakness.

In the cognitive domains, performance at grade 4 was reasonably consistent. In grade 8 science, items assessing reasoning were England's strong point, while in grade 8 mathematics scores for applying were lower than those for knowing and reasoning.

One consistent message is apparent from comparing England's profile across the content and cognitive domains with those of countries performing at a higher level than England or at a similar level. There is no one profile that leads to a high score in TIMSS: successful countries have different profiles across the domains. This is true for both mathematics and science at both grades. It is apparent that various combinations of relative strengths and weaknesses lead to similar overall levels of performance. Curriculum differences are likely to be a cause of some particular strengths and weaknesses. In England, for example, data handling features prominently in the key stage 2 curriculum and is an area of strength for England in TIMSS.

*For a comparison of England's key stage 2 science and mathematics curricula with those of other high scoring countries in TIMSS see Ruddock et al. (2008).*