

# PISA Sample Tasks, Texts, Item Statistics, and Item Maps for Mathematics, Reading Literacy, Science, and Problem Solving

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# Interpreting the Tables of the PISA Item Statistics

Sample tasks and items for mathematics and problem solving have been adapted from the OECD's initial reports for PISA 2003 (OECD, 2004a, 2004b). The layout has been compacted somewhat and is not identical to that presented to students in the test booklets. As no new items for reading literacy or science were released following the PISA 2003 assessment, sample items for these domains are drawn from a pool of items released following the 2000 assessment (see OECD, 2001; Shiel et al., 2001). Sample tasks for mathematics originate from both PISA 2000 and PISA 2003. The PISA cycle from which the task originates is given in brackets after the title.

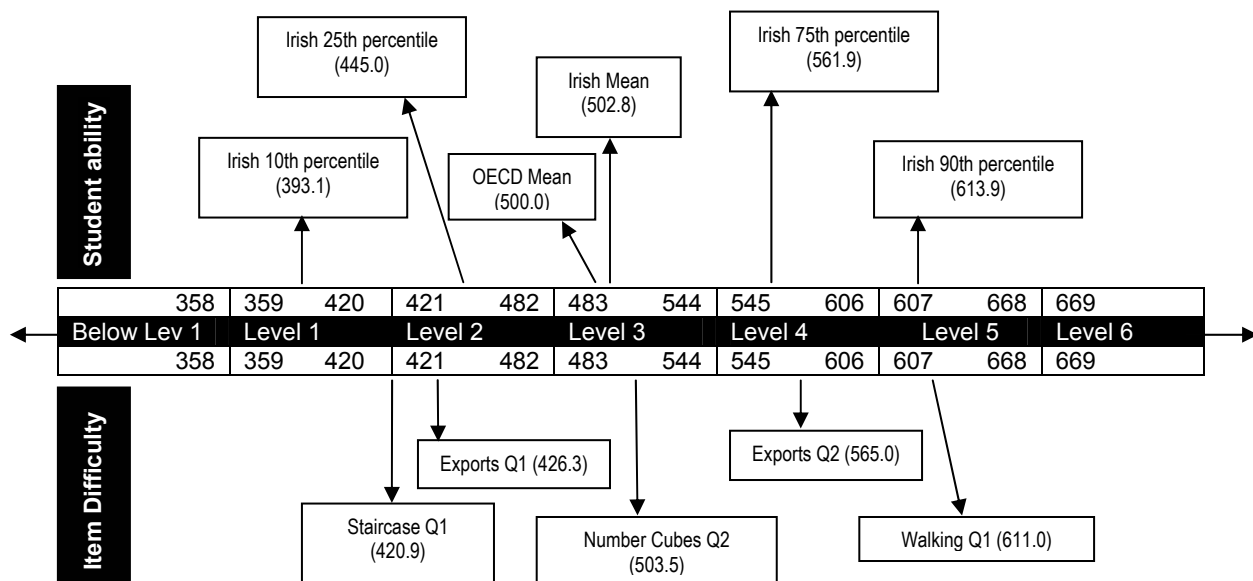
For items shown, their classification in the framework is given (e.g., content area, process, context and item type). The science items are categorised according to science processes as described in the PISA 2000 framework. These have been changed since 2000. Since there is no one-to-one match between the two sets of processes, the science items shown here are classified by the 2000 framework.

The first and second PISA 2000 science processes, 'recognising questions that can be answered via scientific research' and 'identifying scientific evidence', are similar to the PISA 2003 science process of 'understanding scientific investigation'. The third PISA 2000 science process, 'applying scientific knowledge in the situation presented', is similar to the PISA 2003 science process of 'describing, explaining and predicting scientific phenomena', although some of these items might also be classified as 'interpreting scientific evidence and conclusions'. The fourth PISA 2000 science process, 'critically evaluating scientific evidence/data', is similar to 'interpreting scientific evidence and conclusions'.

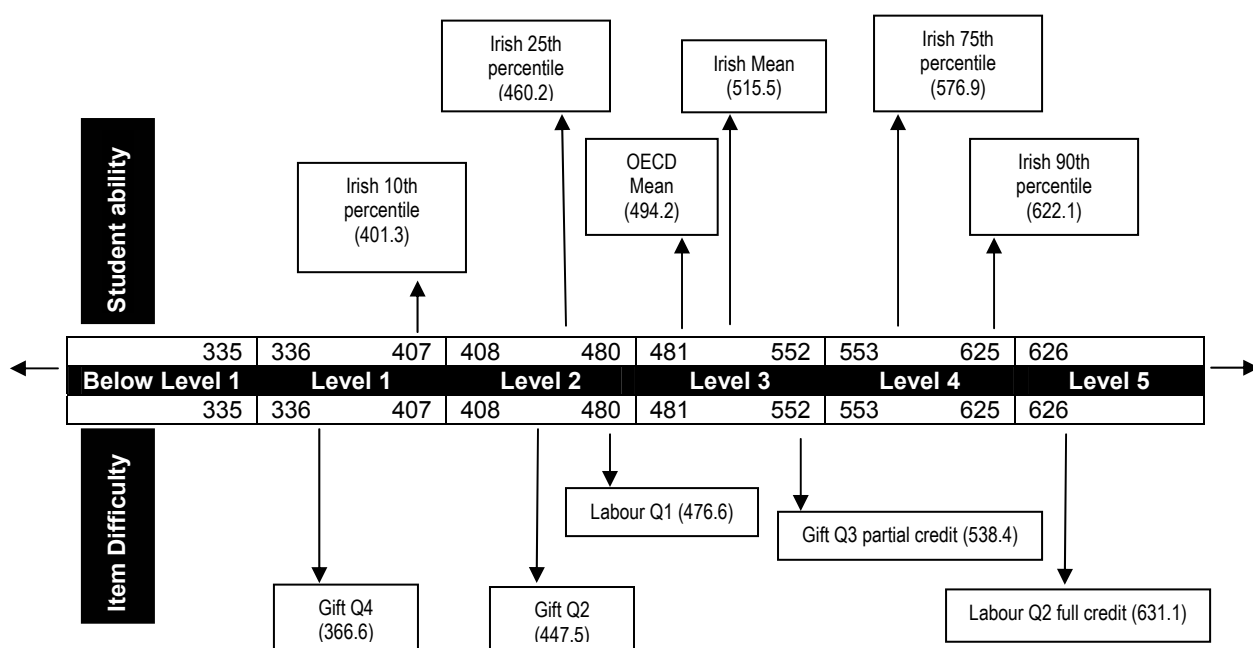
The item statistics that are provided here include the percentage of students providing a correct response, the percentages giving an incorrect response and the percentages not responding, for Ireland and the OECD. These statistics are from the 2000 and 2003 PISA databases (<http://www.pisa.oecd.org>). Item difficulties are reported in terms of the proficiency levels at which the items are located in case of mathematics, reading, and problem solving. In cases where an item offers both partial credit (PC) and full credit (FC), item difficulties and proficiency levels for both levels of credit are given. Marking guides for the questions are also given.

## PISA Item Difficulty

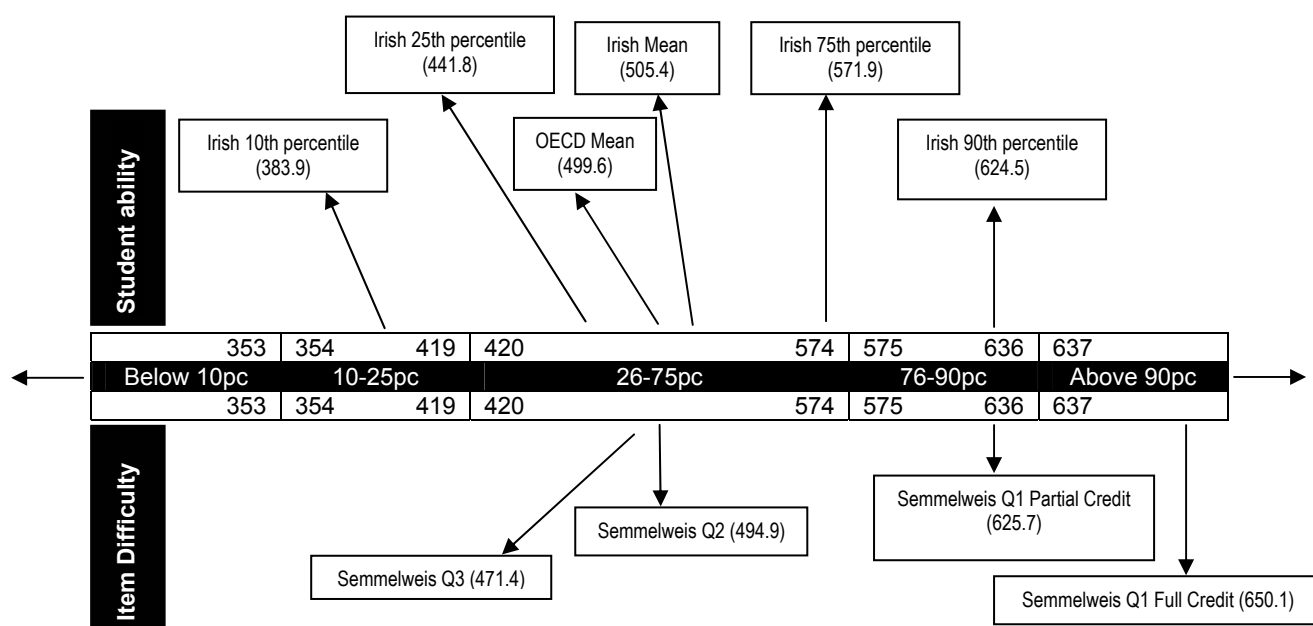
For each item, whether from 2000 or 2003, the information under 'PISA Item Difficulty' gives the scale score that represents the location of the item on the relevant achievement scale (in terms of average performance of a fixed number of pupils drawn from each OECD country). Each scale has a mean of 500.0 and a standard deviation of 100.0. The reader is referred to the four item maps that follow, for examples of how items can be located along achievement/proficiency scales.



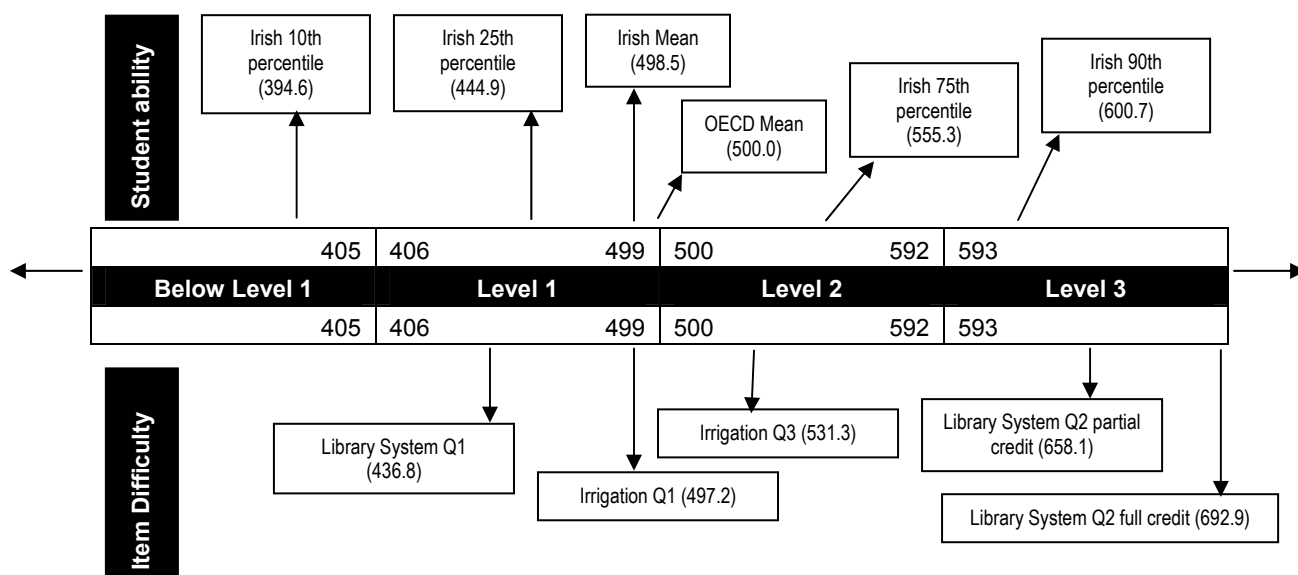
*The PISA 2003 Combined Mathematics Scale: Cut-points for Proficiency Levels, Scores of Students in Ireland at Key Markers, and Difficulties of Selected Items*



*The PISA 2003 Reading Literacy Scale: Cut-points for Proficiency Levels, Scores of Students in Ireland at Key Markers, and Difficulties of Selected Items*



*The PISA 2003 Science Scale: Cut-points for Key Percentile Intervals, Scores of Students in Ireland at Key Markers, and Difficulties of Selected Items*



*The PISA 2003 Problem Solving Scale: Cut-points for Proficiency Levels, Scores of Students in Ireland at Key Markers, and Difficulties of Selected Items*

The raw item difficulties (Deltas) were transformed to the 500–100 scales which assume a response probability of 0.62 using the following linear transformations:

- $((\text{Delta} - (-0.1344))/1.2838)*100 + 500$  for mathematics
- $((\text{Delta} - (0.5076))/1.1002)*100 + 500$  for reading
- $((\text{Delta} - (-0.0933))/1.1086)*100 + 500$  for science
- $((\text{Delta} - (-0.0973))/1.1751)*100 + 500$  for problem solving.

### **Example Interpretations of PISA Sample Items**

In the sample mathematics item Exchange Rate Question 1, the item difficulty across OECD countries is 406.1 points. This means that the item is located almost a full standard deviation below the OECD mean of 500.0. Further, since the item is between 358.3 and 420.4 score points on the mathematics scale, the item is at proficiency Level 1. The OECD average percentage correct for the item is 79.7%, while, in Ireland, it is slightly higher at 83.2%. The OECD average ‘missingness’ for the item is 6.6%, while in Ireland, it is 3.5%.

The sample mathematics item Growing Up Question 2 is an item on which both partial and full credit are available, depending on the completeness of a student’s answer. The fully-correct version of the item has a difficulty estimate of 525.3, while the partially-correct version has an estimate of 419.3. The full-credit estimate is at proficiency Level 3, while the partial credit version is on the border between Levels 1 and 2. On average across OECD countries, 54.7% of students received full credit for their responses, while in Ireland, 51.5% did so. The corresponding percentages for partial credit were 28.1% and 35.8% respectively. Again, missingness in Ireland (3.4%) is lower than the OECD average level (7.5%).

## MATHEMATICS

### UNIT: EXCHANGE RATE (2003)

**Context:** *Public.*

Mei-Ling from Singapore was preparing to go to South Africa for 3 months as an exchange student. She needed to change some Singapore dollars (SGD) into South African rand (ZAR).

#### EXCHANGE RATE QUESTION 1 (Item code: M413Q01)

**Domain:** *Quantity.* **Item type:** *Short constructed response.*

Mei-Ling found out that the exchange rate between Singapore dollars and South African rand was:

1 SGD = 4.2 ZAR.

Mei-Ling changed 3000 Singapore dollars into South African rand at this exchange rate. How much money in South African rand did Mei-Ling get?

**Key:** *Full credit:* 12 600 ZAR (unit not required); *no credit:* Other responses, missing.

**Process:** *Reproduction.* Understand a simple problem, and link the given information to the required calculation.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	79.7	83.2
406.1	Incorrect	13.8	13.4
Level	Missing	6.6	3.5
1	Total	100	100

#### EXCHANGE RATE QUESTION 2 (Item code: M413Q02)

**Domain:** *Quantity.* **Item type:** *Short constructed response.*

On returning to Singapore after 3 months, Mei-Ling had 3 900 ZAR left. She changed this back to Singapore dollars, noting that the exchange rate had changed to: 1 SGD = 4.0 ZAR.

How much money in Singapore dollars did Mei-Ling get?

**Key:** *Full credit:* 975 SGD (unit not required); *no credit:* Other responses, missing.

**Process:** *Reproduction.* Understand a simple problem, and decide that division is the right procedure to go with.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	73.9	76.3
438.8	Incorrect	17.3	18.2
Level	Missing	8.8	5.5
2	Total	100	100

### EXCHANGE RATE QUESTION 3

(Item code: M413Q03)

**Domain:** *Quantity*. **Item type:** *Open constructed response*.

During these 3 months the exchange rate had changed from 4.2 to 4.0 ZAR per SGD.  
Was it in Mei-Ling's favour that the exchange rate now was 4.0 ZAR instead of 4.2 ZAR, when she changed her South African rand back to Singapore dollars? Give an explanation to support your answer.

**Key:** *Full credit:* 'Yes', with adequate explanation; *no credit:* 'Yes', with no explanation or with inadequate explanation, other responses, missing.

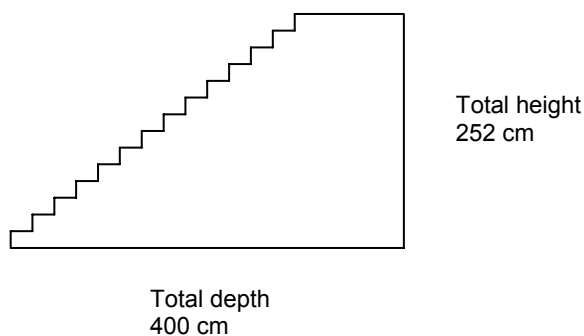
**Process:** *Reflection.* Identify the relevant mathematics, reduce the task to a problem within the mathematical world, and construct an explanation of the conclusion.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	40.3	40.8
585.3	Incorrect	42.3	46.5
Level	Missing	17.4	12.7
4	Total	100	100

## UNIT: STAIRCASE (2003)

**Context:** Occupational.

The diagram below illustrates a staircase with 14 steps and a total height of 252 cm:



### STAIRCASE QUESTION 1 (Item code: M547Q01)

**Domain:** Space and shape. **Item type:** Short open constructed response.

What is the height of each of the 14 steps? Height: \_\_\_\_\_ cm.

**Key:** Full credit: 18; no credit: Other responses, missing.

**Process:** Reproduction. Carry out a simple division; extract the relevant information from a single source.

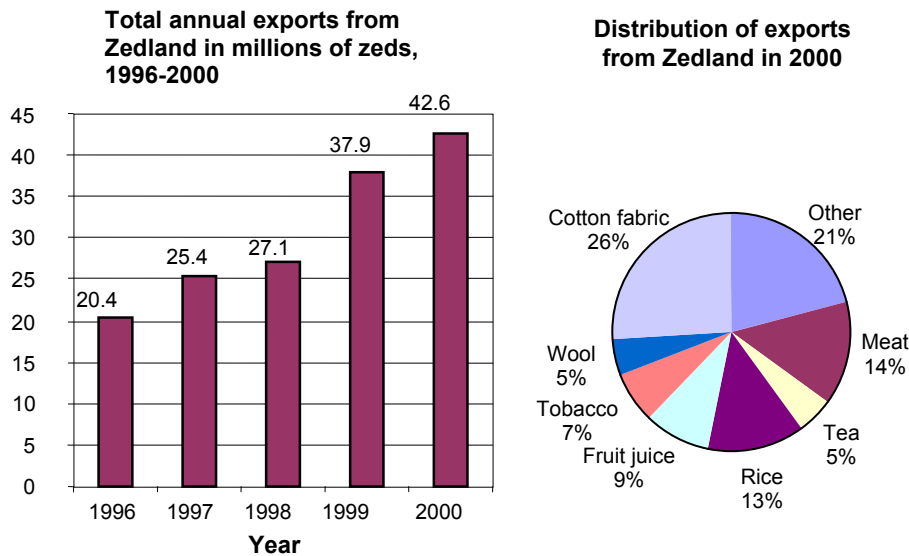
PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	78.0	79.7
420.9	Incorrect	11.6	11.2
Level	Missing	10.4	9.1
2	Total	100	100



## UNIT: EXPORTS (2003)

**Context:** *Public*

The graphics below show information about exports from Zedland, a country that uses zeds as its currency.



### EXPORTS QUESTION 1 (Item code: M438Q01)

**Domain:** *Uncertainty*. **Item type:** *Closed constructed response*.

What was the total value (in millions of zeds) of exports from Zedland in 1998?

**Key:** *Full credit:* 27.1 million zeds or 27 100 000 zeds or 27.1 (unit not required), accept also rounding to 27; *no credit:* Other responses.

**Process:** *Reproduction*. Follow the written instructions, decide which of the two graphs is relevant, and locate the correct information in that graph.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	78.7	85.4
426.3	Incorrect	13.8	12.8
Level	Missing	7.5	1.8
2	Total	100	100

## EXPORTS QUESTION 2 (Item code: M438Q02)

**Domain:** *Uncertainty*. **Item type:** *Multiple choice*.

What was the value of fruit juice exported from Zedland in 2000?

- A 1.8 million zeds
- B 2.3 million zeds
- C 2.4 million zeds
- D 3.4 million zeds
- E 3.8 million zeds

**Key:** *Full credit:* E (3.8 million zeds); *no credit:* Other responses, missing.

**Process:** *Connections.* Combine the information of two graphs, connect the numbers, and apply the appropriate basic mathematical routine.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	48.3	50.8
565.0	Incorrect	44.8	46.2
Level	Missing	6.9	3.0
4	Total	100	100

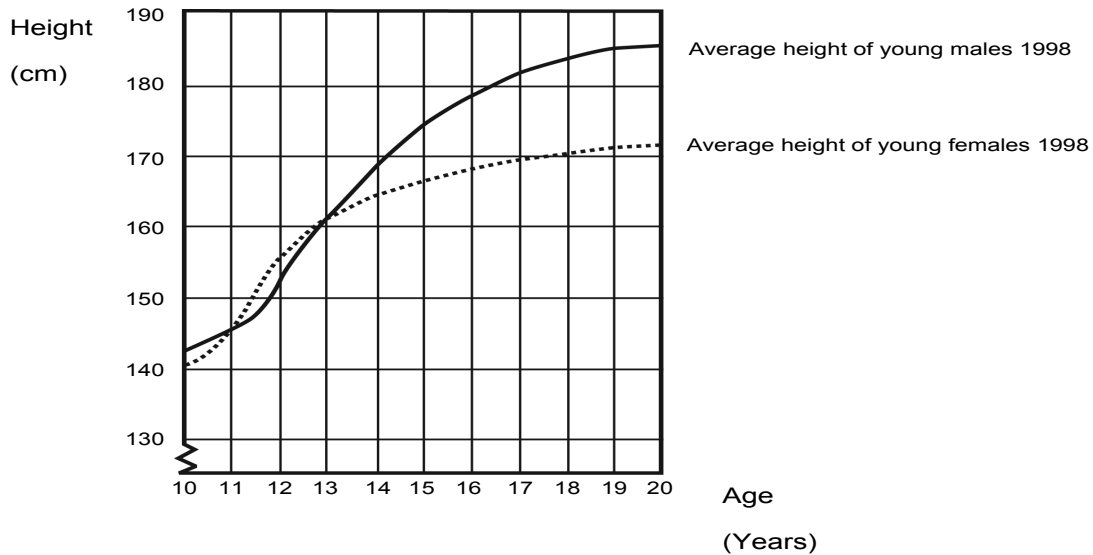
Response	% OECD	% Ireland
A	10.5	12.8
B	10.2	10.8
C	16.3	15.7
D	7.8	6.9
E*	48.3	50.8
Missing	6.9	3.03
Total	100	100

\* Key.

## UNIT: GROWING UP (2000)

**Context:** *Scientific.*

### Young population grows taller



The average height of both young males and young females in the Netherlands in 1998 is represented in this graph.

### GROWING UP QUESTION 1 (Item code: M150Q01)

**Domain:** *Change and relationships.* **Item type:** *Closed constructed response.*

Since 1980 the average height of 20-year-old females has increased by 2.3 cm, to 170.6 cm. What was the average height of a 20-year-old female in 1980? Answer: \_\_\_\_\_ cm.

**Key:** *Full credit:* 168.3 cm (unit already given); *no credit:* Other responses, missing.

**Process:** *Reproduction.* Extract the information from a single source, and ignore redundant information. Make use of a single representational mode, and employ a basic subtraction algorithm.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	67.0	65.6
477.8	Incorrect	24.7	28.0
Level	Missing	8.3	6.4
2	Total	100	100

## GROWING UP QUESTION 2 (Item code: M150Q02)

**Domain:** *Change and relationships.* **Item type:** *Closed constructed response.*

According to this graph, on average, during which period in their life are females taller than males of the same age?

**Key:** *Full credit:* Gives the correct interval, from 11-13 years (using mathematical or daily-life language); *partial credit:* Other subsets of 11, 12, 13 years, not included in the full credit section; *no credit:* Other responses, missing.

**Process:** *Reproduction.* Interpret and decode standard representations of well known mathematical objects, compare the two graphs, and report the results.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Fully correct	54.7	51.5
419.3 (PC);525.3 (FC)	Partially correct	28.1	35.8
Level	Incorrect	9.7	9.2
between 1 and 2 (PC);	Missing	7.5	3.4
3 (FC)	Total	100	100

## GROWING UP QUESTION 3 (Item code: M150Q03)

**Domain:** *Change and relationships.* **Item type:** *Open constructed response.*

Explain how the graph shows that on average the growth rate for girls slows down after 12 years of age.

**Key:** *Full credit:* The response should refer to the “change” of the gradient of the graph for female (explicitly or implicitly, in mathematical language or using daily-life language), or the student should mention that the female graph becomes less steep, as well as the fact that the graph falls below the male graph; *no credit:* Student indicates that female height drops below male height, but does not mention the steepness of the female graph or makes a comparison of the female growth rate before and after 12 years, other responses, missing.





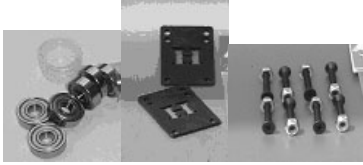
**Process:** *Connections.* Combine ‘growing’ and ‘slowing down’, link different ideas and information, and communicate the results.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	44.8	56.5
573.6	Incorrect	34.1	32.8
Level	Missing	21.1	10.7
4	Total	100	100

## UNIT: SKATEBOARD (2003)

**Context:** *Personal.*

Eric is a great skateboard fan. He visits a shop called SKATERS to check some prices. At this shop you can buy a complete board. Or you can buy a deck, a set of 4 wheels, a set of 2 trucks and a set of hardware, and assemble your own board. The prices for the shop's products are:

Product	Price in zeds	
Complete skateboard	82 or 84	
Deck	40, 60 or 65	
One set of 4 Wheels	14 or 36	
One set of 2 Trucks	16	
One set of hardware (bearings, rubber pads, bolts and nuts)	10 or 20	

### SKATEBOARD QUESTION 1 (Item code: M520Q01b)

**Domain:** *Quantity.* **Item type:** *Short constructed response.*

Eric wants to assemble his own skateboard. What is the minimum price and the maximum price in this shop for self-assembled skateboards?

- (a) Minimum price: \_\_\_\_\_ zeds.  
 (b) Maximum price: \_\_\_\_\_ zeds.

**Key:** *Full credit:* Both the minimum (80) and the maximum (137) are correct; *partial credit:* Only the minimum (80) is correct, or only the maximum (137) is correct; *no credit:* Other responses, missing.

**Process:** *Reproduction.* Find a simple strategy to come up with the maximum and minimum, use of a routine addition procedure, use of a simple table.

PISA Item Difficulty
Scale score
463.7 (PC); 496.5 (FC)
Level
2 (PC); 3 (FC)

Item statistics	% OECD	% Ireland
Fully correct	66.7	69.0
Partially correct	10.6	8.2
Incorrect	18.0	20.8
Missing	4.7	2.0
Total	100.0	100.0

## SKATEBOARD QUESTION 2 (Item code: M520Q02)

**Domain:** *Quantity*. **Item type:** *Multiple choice*.

The shop offers three different decks, two different sets of wheels and two different sets of hardware. There is only one choice for a set of trucks.  
How many different skateboards can Eric construct?

- A 6
- B 8
- C 10
- D 12

**Key:** *Full credit:* D; *no credit:* Other responses, missing.

**Process:** *Reproduction*. Interpret a text in combination with a table correctly; apply a simple enumeration algorithm accurately.

PISA Item Difficulty
Scale score
569.7
Level
4

Item statistics	% OECD	% Ireland
Correct	45.5	30.2
Incorrect	50.0	66.9
Missing	4.5	2.9
Total	100	100

Response	% OECD	% Ireland
A	25.4	33.2
B	18.3	27.7
C	6.3	6.0
D*	45.5	30.2
Missing	4.5	2.9
Total	100	100

\*Key.

### SKATEBOARD QUESTION 3 (Item code: M520Q03)

**Domain:** *Quantity*. **Item type:** *Short constructed response*.

Eric has 120 zeds to spend and wants to buy the most expensive skateboard he can afford. How much money can Eric afford to spend on each of the 4 parts? Put your answer in the table below.

Part	Amount (zeds)
Deck	65 zeds
Wheels	14 zeds
Trucks	16 zeds
Hardware	20 zeds

**Key:** *Full credit:* See in table above; *no credit:* Other responses, missing.

**Process:** *Connections.* Relate text based information to a table representation, apply a non-standard strategy, and carry out routine calculations.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Fully correct	49.8	50.3
554.1	Incorrect	44.7	47.9
Level	Missing	5.5	1.8
4	Total	100	100

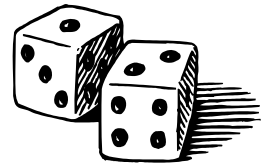
Number of correct responses	% OECD	% Ireland
0	5.1	3.7
1	5.6	5.9
2	17.3	19.4
3	16.7	18.9
4	49.8	50.3
Missing	5.5	1.8
Total	100	100

## UNIT: NUMBER CUBES (2003)

**Context:** *Personal.*

On the right, there is a picture of two dice.

Dice are special number cubes for which the following rule applies:



The total number of dots on two opposite faces is always seven. You can make a simple number cube by cutting, folding and gluing cardboard. This can be done in many ways.

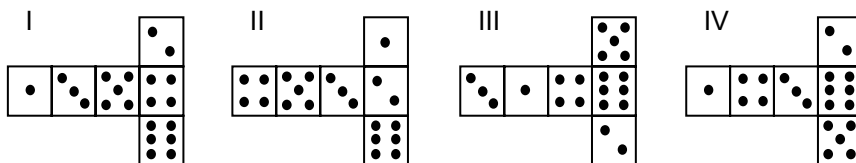
### NUMBER CUBES QUESTION 2

(Item code: M555Q02)

**Domain:** *Space and shape.* **Item type:** *Complex multiple choice.*

In the figure below you can see four cuttings that can be used to make cubes, with dots on the sides.

Which of the following shapes can be folded together to form a cube that obeys the rule that the sum of opposite faces is 7? For each shape, circle either “Yes” or “No” in the table below.



Shape	Obeys the rule that the sum of opposite faces is 7?
I	Yes / No
II	Yes / No
III	Yes / No
IV	Yes / No



**Key:** *Full credit:* No, yes, yes, and no, in that order; *no credit:* Other responses, missing.

**Process:** *Connections.* Encode and interpret 2-dimensional objects, interpret the connected 3-dimensional object, and check certain basic computational relations.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Fully correct	63.0	57.4
503.5	Incorrect	34.7	40.9
Level	Missing	2.3	1.7
3	Total	100	100

Number of correct responses	% OECD	% Ireland
0	2.7	3.1
1	7.2	8.9
2	8.9	8.2
3	16.0	20.7
4	63.0	57.4
Missing	2.3	1.7
Total	100	100

## UNIT: WALKING (2000)

**Context:** *Personal.*



The picture shows the footprints of a man walking. The pace length  $P$  is the distance between the rear of two consecutive footprints. For men, the formula,  $n/P = 140$ , gives an approximate relationship between  $n$  and  $P$  where  $n$  = number of steps per minute and  $P$  = pace length in metres.

### WALKING QUESTION 1

(Item code: M124Q01)

**Domain:** *Change and relationships.* **Item type:** *Open constructed response.*

If the formula applies to Mark's walking and Mark takes 70 steps per minute, what is Mark's pace length? Show your work.

**Key:** *Full credit:* 0.5 m or 50 cm,  $\frac{1}{2}$  (unit not required).  $70/p = 140$ ,  $70 = 140p$ ,  $p = 0.5$ .  $70/140$ ; *no credit:* Other responses, missing.

**Process:** *Reproduction.* Reflect on and realise the embedded mathematics, solve the problem successfully through substitution in a simple formula, and carry out a routine procedure.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	36.3	22.9
611.0	Incorrect	42.7	62.8
Level	Missing	21.0	14.3
5	Total	100	100

### WALKING QUESTION 3

(Item code: M124Q03)

**Domain:** *Change and relationships.* **Item type:** *Open constructed response.*

Bernard knows his pace length is 0.80 metres. The formula applies to Bernard's walking. Calculate Bernard's walking speed in metres per minute and in kilometres per hour. Show your working out.

**Key:** *Full credit:* Correct answers (unit not required) for both metres/minute and km/hour:  $n = 140 \times .80 = 112$ . Per minute he walks  $112 \times .80$  metres = 89.6 metres, or as long as both correct answers are given (89.6 and 5.4), whether working out is shown or not. Errors due to rounding are acceptable; *partial credit (2-point):* Student fails to multiply by 0.80 to convert from steps per minute to metres per minute, or if the speed in metres per minute correct (89.6 metres per minute) but conversion to kilometres per hour incorrect or missing, or correct method (explicitly shown) with minor calculation error(s) with no answers correct, or only 5.4 km/hr is given, but not 89.6 metres/minute (intermediate calculations not shown); *partial credit (1-point):*  $n = 140 \times .80 = 112$ . No further working out is shown or incorrect working out from this point; *no credit:* Other responses, missing.

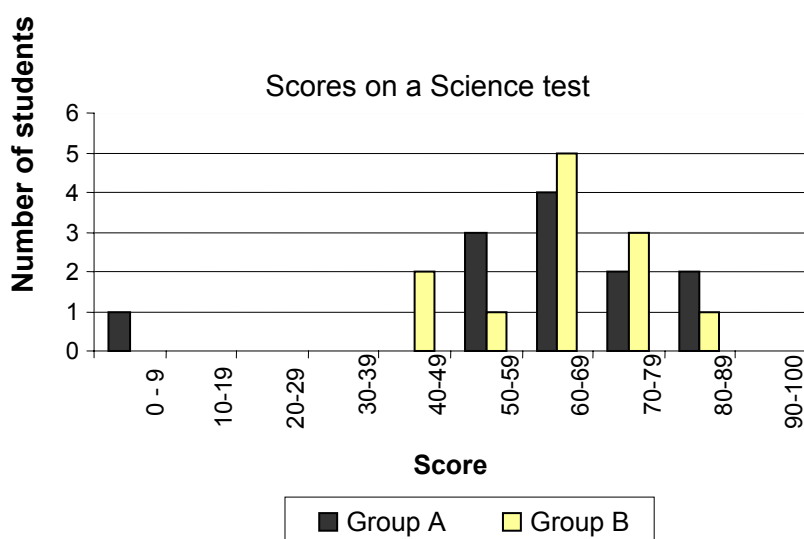
**Process:** *Connections.* Substitute in an algebraic expression, do a sequence of different but connected calculations that need proper understanding of transforming formulas and units of measures.

<b>PISA Item Difficulty</b>	<b>Item statistics</b>	<b>% OECD</b>	<b>% Ireland</b>
Scale score	Fully correct	8.0	3.7
604.7 (PC 1-point);	Partially correct (2-point)	9.0	4.8
666.3 (PC 2-point);	Partially correct (1-point)	19.9	20.4
722.3 (FC)	Incorrect	24.4	39.1
Level	Missing	38.7	31.9
4 (PC 1-point);	Total	100	100
5 (PC 2-point); 6 (FC)			

## UNIT: TEST SCORES (2003)

**Context:** *Educational.*

The diagram below shows the results on a Science test for two groups, labelled as Group A and Group B.



The mean score for Group A is 62.0 and the mean for Group B is 64.5. Students pass this test when their score is 50 or above.

### TEST SCORES QUESTION 1 (Item code: M513Q01)

**Domain:** *Uncertainty.* **Item type:** *Open constructed.*

Looking at the diagram, the teacher claims that Group B did better than Group A in this test. The students in Group A don't agree with their teacher. They try to convince the teacher that Group B may not necessarily have done better.

Give one mathematical argument, using the graph that the students in Group A could use.

**Key:** *Full credit:* One valid argument is given. Valid arguments could relate to the number of students passing, the disproportionate influence of the outlier, or the number of students with scores in the highest level; *no credit:* Other responses, including responses with no mathematical reasons, or wrong mathematical reasons, or responses that simply describe differences but are not valid arguments, missing.

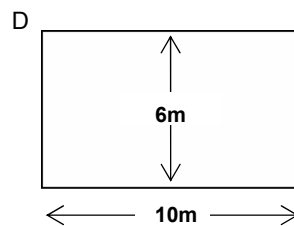
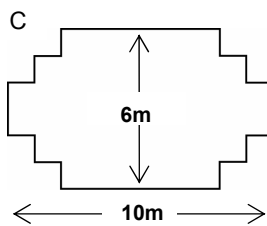
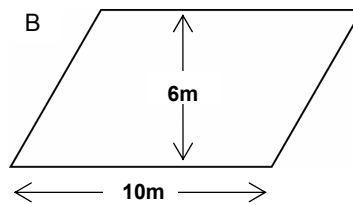
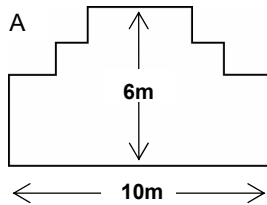
**Process:** *Connections.* Apply statistical knowledge in a problem situation where the mathematical representation is partially apparent, interpret and analyse given information, and communicate reasons and arguments.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	32.2	40.8
619.5	Incorrect	32.8	38.6
Level	Missing	35.0	20.6
5	Total	100	100

# UNIT: CARPENTER (2000)

Context: Educational.

A carpenter has 32 metres of timber and wants to make a border around a vegetable patch. He is considering the following designs for the vegetable patch.



## CARPENTER QUESTION 1 (Item code: M266Q01)

Domain: Space and shape. Item type: Complex multiple choice.

Circle either "Yes" or "No" for each design to indicate whether the vegetable patch can be made with 32 metres of timber.

Vegetable patch design	Using this design, can the vegetable patch be made with 32
Design A	<input checked="" type="radio"/> Yes / <input type="radio"/> No
Design B	<input type="radio"/> Yes / <input checked="" type="radio"/> No
Design C	<input checked="" type="radio"/> Yes / <input type="radio"/> No
Design D	<input checked="" type="radio"/> Yes / <input type="radio"/> No

**Key:** Full credit: Exactly four correct (circled in table); partial credit: Exactly three correct; no credit: Two or fewer correct, missing.

**Process:** Connections. Use geometrical insight and argumentation skills, and possibly some technical geometrical knowledge.

PISA Item Difficulty
Scale score
687.3
Level
6

Item statistics	% OECD	% Ireland
Fully correct	20.0	13.0
Partially correct	30.8	30.9
Incorrect	46.8	54.6
Missing	2.5	1.6
Total	100	100

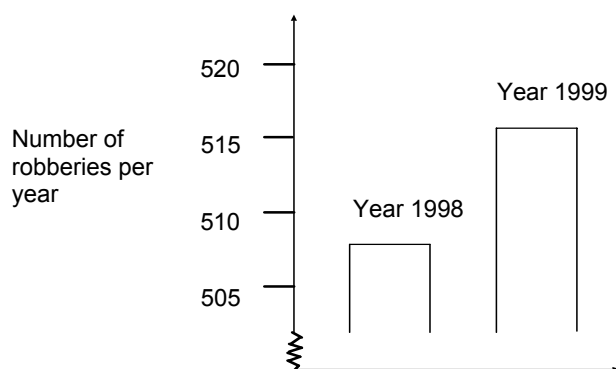
## UNIT: ROBBERIES

(2000)

**Context:** *Public.*

A TV reporter showed this graph to the viewers and said:

“The graph shows that there is a huge increase in the number of robberies from 1998 to 1999.”



### ROBBERIES QUESTION 1

(Item code: M179Q01)

**Domain:** *Uncertainty.* **Item type:** *Open constructed response.*

Do you consider the reporter’s statement to be a reasonable interpretation of the graph? Give an explanation to support your answer.

**Key:** *Full credit:* “No, not reasonable”. Focuses on the fact that only a small part of the graph is shown; *partial credit:* “No, not reasonable”, but explanation lacks detail, or “No, not reasonable”, with correct method but with minor computational errors; *no credit:* No, with no, insufficient or incorrect explanation, yes, other responses, missing.

**Process:** *Connections.* Focus on an increase given by an exact number of robberies in absolute and relative terms; argumentation based on interpretation of data.

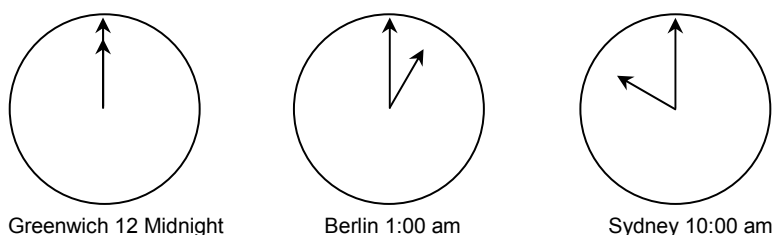
PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Fully correct	15.4	13.3
576.7 (PC); 694.3 (FC)	Partially correct	28.1	36.7
Level	Incorrect	41.5	38.1
4 (PC); 6 (FC)	Missing	15.0	11.9
	Total	100	100

## UNIT: INTERNET RELAY CHAT (2003)

**Context:** *Personal.*

Mark (from Sydney, Australia) and Hans (from Berlin, Germany) often communicate with each other using “chat” on the Internet. They have to log on to the Internet at the same time to be able to chat.

To find a suitable time to chat, Mark looked up a chart of world times and found the following:



### INTERNET RELAY CHAT QUESTION 1 (Item code: M402Q01)

**Domain:** *Change and relationships.* **Item type:** *Short response.*

At 7:00 pm in Sydney, what time is it in Berlin?

Answer: \_\_\_\_\_.

**Key:** *Full credit:* 10 am or 10:00; *no credit:* Other responses, missing.

**Process:** *Connections.*

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	53.7	50.1
533.1	Incorrect	42.7	48.1
Level	Missing	3.5	1.8
3	Total	100	100

### INTERNET RELAY CHAT QUESTION 2 (Item code: M402Q02)

**Domain:** *Change and relationships.* **Item type:** *Short response.*

Mark and Hans are not able to chat between 9:00 am and 4:30 pm their local time, as they have to go to school. Also, from 11:00 pm till 7:00 am their local time they won't be able to chat because they will be sleeping.

When would be a good time for Mark and Hans to chat? Write the local times in the table.

Place	Time
Sydney	
Berlin	

**Key:** *Full credit:* Any time or interval of time satisfying the 9 hours time difference and taken from one of these intervals: Sydney: 4:30 pm – 6:00 pm; Berlin: 7:30 am – 9:00 am, or: Sydney: 7:00 am – 8:00 am; Berlin: 10:00 pm – 11:00 pm, Sydney 17:00, Berlin 8:00 (if an interval is given, the entire interval must

satisfy the constraints. Also, if morning (am) or evening (pm) is not specified, but the times could otherwise be regarded as correct, the response should be given the benefit of the doubt, and coded as correct); *no credit*: Other responses, including one time correct, but corresponding time incorrect, missing.

**Process:** *Reflection*.

<b>PISA Item Difficulty</b>	<b>Item statistics</b>	<b>% OECD</b>	<b>% Ireland</b>
Scale score	Correct	28.8	37.2
635.9	Incorrect	52.1	53.5
Level	Missing	19.2	9.3
5	Total	100	100



## UNIT: EARTHQUAKE (2003)

**Context:** *Scientific.*

A documentary was broadcast about earthquakes and how often earthquakes occur. It included a discussion about the predictability of earthquakes.

A geologist stated: "In the next twenty years, the chance that an earthquake will occur in Zed City is two out of three".

### EARTHQUAKE QUESTION 1 (Item code: M509Q01)

**Domain:** *Uncertainty.* **Item type:** *Multiple choice.*

Which of the following best reflects the meaning of the geologist's statement?

- A  $2/3 \times 20 = 13.3$ , so between 13 and 14 years from now there will be an earthquake in Zed City.
- B  $2/3$  is more than  $1/2$ , so you can be sure there will be an earthquake in Zed City at some time during the next 20 years.
- C The likelihood that there will be an earthquake in Zed City at some time during the next 20 years is higher than the likelihood of no earthquake.
- D You cannot tell what will happen, because nobody can be sure when an earthquake will occur.

**Key:** *Full credit:* C; *no credit:* Other responses, missing.

**Process:** *Reflection.*

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	46.5	51.4
557.2	Incorrect	44.2	41.2
Level	Missing	9.3	7.4
4	Total	100	100

**READING LITERACY**  
**UNIT: THE GIFT (2000)**

**Context:** *Personal.* **Text format:** *Continuous, narrative.*

How many days, she wondered, had she sat like this, watching the cold brown water inch up the dissolving bluff. She could just faintly remember the beginning of the rain, driving in across the swamp from the south and beating against the shell of her house. Then the river itself started rising, slowly at first until at last it paused to turn back. From hour to hour it  
5 slithered up creeks and ditches and poured over low places. In the night, while she slept, it claimed the road and surrounded her so that she sat alone, her boat gone, the house like a piece of drift lodged on its bluff. Now even against the tarred planks of the supports the waters touched. And still they rose.

As far as she could see, to the treetops where the opposite banks had been, the swamp was  
10 an empty sea, awash with sheets of rain, the river lost somewhere in its vastness. Her house with its boat bottom had been built to ride just such a flood, if one ever came, but now it was old. Maybe the boards underneath were partly rotted away. Maybe the cable mooring the house to the great live oak would snap loose and let her go turning downstream, the way her boat had gone.

No one could come now. She could cry out but it would be no use, no one would hear. Down the length and breadth of the swamp others were fighting to save what little they could, maybe even their lives. She had seen a whole house go floating by, so quiet she was reminded of sitting at a funeral. She thought when she saw it she knew whose house it was. It had been bad seeing it drift by, but the owners must have escaped to higher ground. Later,  
20 with the rain and darkness pressing in, she had heard a panther scream upriver.

Now the house seemed to shudder around her like something alive. She reached out to catch a lamp as it tilted off the table by her bed and put it between her feet to hold it steady. Then creaking and groaning with effort the house struggled up from the clay, floated free, bobbing like a cork and swung out slowly with the pull of the river. She gripped the edge of the bed.

Swaying from side to side, the house moved to the length of its mooring. There was a jolt and a complaining of old timbers and then a pause. Slowly the current released it and let it swing back, rasping across its resting place. She caught her breath and sat for a long time feeling the slow pendulous sweeps. The dark sifted down through the incessant rain, and, head on arm, she slept holding on to the bed.

Sometime in the night the cry awoke her, a sound so anguished she was on her feet before she was awake. In the dark she stumbled against the bed. It came from out there, from the river. She could hear something moving, something large that made a dredging, sweeping sound. It could be another house. Then it hit, not head on but glancing and sliding down the length of her house. It was a tree. She listened as the branches and leaves cleared themselves  
35 and went on downstream, leaving only the rain and the lappings of the flood, sounds so constant now that they seemed a part of the silence. Huddled on the bed, she was almost asleep again when another cry sounded, this time so close it could have been in the room. Staring into the dark, she eased back on the bed until her hand caught the cold shape of the rifle. Then crouched on the pillow, she cradled the gun across her knees. "Who's there?" she called.

The answer was a repeated cry, but less shrill, tired sounding, then the empty silence closing in. She drew back against the bed. Whatever was there she could hear it moving about on the porch. Planks creaked and she could distinguish the sounds of objects being knocked over. There was a scratching on the wall as if it would tear its way in. She knew now what it was, a  
45 big cat, deposited by the uprooted tree that had passed her. It had come with the flood, a gift. Unconsciously she pressed her hand against her face and along her tightened throat. The rifle rocked across her knees. She had never seen a panther in her life. She had heard about

them from others and heard their cries, like suffering, in the distance. The cat was scratching on the wall again, rattling the window by the door. As long as she guarded the window and kept the cat hemmed in by the wall and water, caged, she would be all right. Outside, the animal paused to rake his claws across the rusted outer screen. Now and then, it whined and growled.

When the light filtered down through the rain at last, coming like another kind of dark, she was still sitting on the bed, stiff and cold. Her arms, used to rowing on the river, ached from the stillness of holding the rifle. She had hardly allowed herself to move for fear any sound might give strength to the cat. Rigid, she swayed with the movement of the house. The rain still fell as if it would never stop. Through the grey light, finally, she could see the rain-pitted flood and far away the cloudy shape of drowned treetops. The cat was not moving now. Maybe he had gone away. Laying the gun aside she slipped off the bed and moved without a sound to the window. It was still there, crouched at the edge of the porch, staring up at the live oak, the mooring of her house, as if gauging its chances of leaping to an overhanging branch. It did not seem so frightening now that she could see it, its coarse fur napped into twigs, its sides pinched and ribs showing. It would be easy to shoot it where it sat, its long tail whipping back and forth. She was moving back to get the gun when it turned around. With no warning, no crouch or tensing of muscles, it sprang at the window, shattering a pane of glass. She fell back, stifling a scream, and taking up the rifle, she fired through the window. She could not see the panther now, but she had missed. It began to pace again. She could glimpse its head and the arch of its back as it passed the window.

Shivering, she pulled back on the bed and lay down. The lulling constant sound of the river and the rain, the penetrating chill, drained away her purpose. She watched the window and kept the gun ready. After waiting a long while she moved again to look. The panther had fallen asleep, its head on its paws, like a housecat. For the first time since the rains began she wanted to cry, for herself, for all the people, for everything in the flood. Sliding down on the bed, she pulled the quilt around her shoulders. She should have got out when she could, while the roads were still open or before her boat was washed away. As she rocked back and forth with the sway of the house a deep ache in her stomach reminded her she hadn't eaten. She couldn't remember for how long. Like the cat, she was starving. Easing into the kitchen, she made a fire with the few remaining sticks of wood. If the flood lasted she would have to burn the chair, maybe even the table itself. Taking down the remains of a smoked ham from the ceiling, she cut thick slices of the brownish red meat and placed them in a skillet. The smell of the frying meat made her dizzy. There were stale biscuits from the last time she had cooked and she could make some coffee. There was plenty of water.

While she was cooking her food, she almost forgot about the cat until it whined. It was hungry too. "Let me eat," she called to it, "and then I'll see to you." And she laughed under her breath. As she hung the rest of the ham back on its nail the cat growled a deep throaty rumble that made her hand shake.

After she had eaten, she went to the bed again and took up the rifle. The house had risen so high now it no longer scraped across the bluff when it swung back from the river. The food had warmed her. She could get rid of the cat while light still hung in the rain. She crept slowly to the window. It was still there, mewling, beginning to move about the porch. She stared at it a long time, unafraid. Then without thinking what she was doing, she laid the gun aside and started around the edge of the bed to the kitchen. Behind her the cat was moving, fretting. She took down what was left of the ham and making her way back across the swaying floor to the window she shoved it through the broken pane. On the other side there was a hungry snarl and something like a shock passed from the animal to her. Stunned by what she had done, she drew back to the bed. She could hear the sounds of the panther tearing at the meat. The house rocked around her.

The next time she awoke she knew at once that everything had changed. The rain had stopped. She felt for the movement of the house but it no longer swayed on the flood. Drawing her door open, she saw through the torn screen a different world. The house was resting on the bluff where it always had. A few feet down, the river still raced on in a torrent, but it no longer covered the few feet between the house and the live oak. And the cat was gone. Leading from the porch to the live oak and doubtless on into the swamp were tracks, indistinct and already disappearing into the soft mud. And there on the porch, gnawed to whiteness, was what was left of the ham.

### THE GIFT QUESTION 1 (Item code: R119Q09)

**Item type:** *Open constructed response.*

Here is part of a conversation between two people who read “The Gift”:

Speaker 1: I think the woman in the story is heartless and cruel.

Speaker 2: How can you say that? I think she’s a very compassionate person.

Give evidence from the story to show how each of these speakers could justify their point of view.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Fully correct	55.2	65.4
480.2 (PC); 537.5 (FC)	Partially correct	18.0	19.2
Level	Incorrect	11.5	9.2
3 (PC; FC)	Missing	15.2	6.2
	Total	100	100

**Key:** *Full credit:* Gives evidence for both speakers (speaker 1: Evidence from the story that supports the idea that the woman is heartless and cruel; speaker 2: Evidence from the story that supports the idea that the woman is compassionate); *partial credit:* Gives evidence for one speaker; *no credit:* Other responses, missing.

**Process:** *Reflect and evaluate.* Connect own concepts of compassion and cruelty with behaviour of a character and use evidence identified in the text to justify opposing points of view.

### THE GIFT QUESTION 2 (Item code: R119Q01)

**Item type:** *Multiple choice.*

What is the woman’s situation at the beginning of the story?

- A She is too weak to leave the house after days without food.
- B She is defending herself against a wild animal.
- C Her house has been surrounded by flood waters.
- D A flooded river has swept her house away.

**Key:** C.

**Process:** *Interpretation of text.* Understand the setting of a story from information given in a single paragraph.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	73.5	80.7
447.5	Incorrect	23.4	18.5
Level	Missing	3.1	0.8
2	Total	100	100

### THE GIFT QUESTION 3 (Item code: R119Q07)

**Item type:** *Open constructed response.*

Here are some of the early references to the panther in the story.

“the cry awoke her, a sound so anguished...” (line 30)

“The answer was a repeated cry, but less shrill, tired sounding...” (line 41)

“She had...heard their cries, like suffering, in the distance.” (lines 47-48)

Considering what happens in the rest of the story, why do you think the writer chooses to introduce the panther with these descriptions?

**Key:** *Full credit:* Recognises that the quotations are intended to evoke pity; *partial credit:* Recognises that descriptions create mystery or suspense, or that the panther is presented from the woman’s point of view, or literal interpretation (e.g., the panther was hungry); *no credit:* other responses, missing.

**Process:** *Interpretation of text.* Detect nuances of language in short quotations from a story and relate them to the main theme. There are conflicting ideas in the immediate vicinity of the quotations.

PISA Difficulty	Item statistics	% OECD	% Ireland
Scale score	Fully correct	28.3	38.0
539 (PC); 645 (FC)	Partially correct	29.5	26.2
Level	Incorrect	24.2	27.5
3 (PC); 5 (FC)	Missing	18.1	8.4
	Total	100	100

### THE GIFT QUESTION 4 (Item code: R119Q06)

**Item type:** *Multiple choice.*

“Then creaking and groaning with effort the house struggled up ...” (lines 22-24)

What happened to the house in this part of the story?

- A It fell apart.
- B It began to float.
- C It crashed into the oak tree.
- D It sank to the bottom of the river.

**Key:** *Full credit:* B; *no credit:* Other responses, missing.

**Process:** *Retrieval of information.* Locate an explicitly stated piece of information in with little competing information.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	85.2	86.8
366.6	Incorrect	12.2	12.3
Level	Missing	2.6	0.9
1	Total	100	100

### THE GIFT QUESTION 5 (Item code: R119Q08)

**Item type:** *Open constructed response.*

What does the story suggest was the woman's reason for feeding the panther?

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	56.6	60.8
529.3	Incorrect	30.8	32.8
Level	Missing	12.5	6.4
3	Total	100	100

**Key:** *Full credit:* Recognises that there is an implication that the woman is motivated by pity or empathy, that the story does not explicitly mention the woman's motivation, or that the panther has a physical need for food or help; *no credit:* Other responses, missing.

**Process:** *Interpretation of text.* Explain a character's motivation by linking a chain of events dispersed throughout a long narrative text.

### THE GIFT QUESTION 6 (Item code: R119Q04)

**Item type:** *Multiple choice.*

When the woman says, "and then I'll see to *you*" (line 84) she means that she is

- A sure that the cat won't hurt her.
- B trying to frighten the cat.
- C intending to shoot the cat.
- D planning to feed the cat.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	40.9	48.7
602.9	Incorrect	56.1	50.0
Level	Missing	3.0	1.3
4	Total	100	100

**Key:** *Full credit:* C; *no credit:* Other responses, missing.

**Process:** *Interpretation of text.* Construe meaning of a sentence in context by taking information in a large section of text into account. In isolation the sentence is ambiguous and there are alternative meanings (if context is not taken into account).

### THE GIFT QUESTION 7 (Item code: R119Q05)

**Item type:** *Open constructed response.*

Do you think that the last sentence of “The Gift” is an appropriate ending? Explain your answer, demonstrating your understanding of how the last sentence relates to the story’s meaning.

**Key:** *Full credit:* Evaluates the story by going beyond a literal interpretation, in terms of thematic completeness, or in terms of style or mood; *partial credit:* Responds at a literal level, in terms of narrative sequence; *no credit:* other responses, missing.

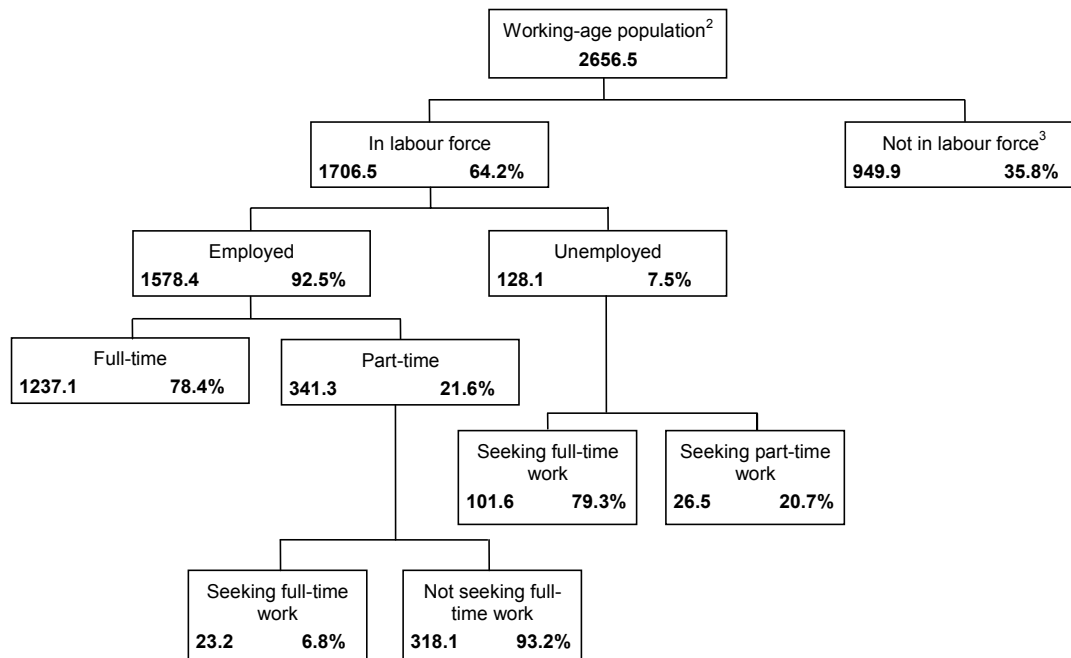
**Process:** *Reflect and evaluate.* Evaluate the appropriateness of a story ending by commenting on its consistency with the plot as a whole and/or by commenting on its connection with the general theme or mood of the text.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Fully correct	20.5	28.1
567.5 (PC); 652.0 (FC)	Partially correct	28.8	28.8
Level	Incorrect	30.0	31.3
4 (PC); 5 (FC)	Missing	20.8	11.8
	Total	100	100

## UNIT: LABOUR FORCE (2000)

**Context:** Educational. **Text format:** Non-continuous, schematic.

### *The Labour Force Structure year ended 31 March 1995 (000s)<sup>1</sup>*



#### Notes

1. Numbers of people are given in thousands (000s).
2. The working-age population is defined as people between the ages of 15 and 65.
3. People "Not in labour force" are those not actively seeking work and/or not available for work.

## LABOUR FORCE QUESTION 1 (Item code: R088Q01)

**Item type:** Multiple choice.

What are the two main groups into which the working-age population is divided?

- A Employed and unemployed.
- B Of working age and not of working age.
- C Full-time workers and part-time workers.
- D In the labour force and not in the labour force.

**Key:** D.

**Process:** Interpretation of text. Understand the relationship between two categories of information presented.



PISA Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	62.9	58.7
476.6	Incorrect	31.7	37.4
Level	Missing	5.4	3.8
2	Total	100	100

## LABOUR FORCE QUESTION 2 (Item code: R088Q03)

**Item type:** *Short response.*

How many people of working age were not in the labour force? (Write the number of people, not the percentage.)

**Key:** *Full credit:* 949.9 thousand (or equivalent, allowing rounding); *partial credit:* 949.9 (or equivalent, allowing rounding); *no credit:* Other responses, missing.

**Process:** *Retrieval of information.*

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Fully correct	27.9	28.5
485.7 (PC); 631.1 (FC)	Partially correct	37.0	43.8
Level	Incorrect	24.6	21.8
3 (PC); 5 (FC)	Missing	10.5	5.9
	Total	100	100

### LABOUR FORCE QUESTION 3 (Item code: R088Q04)

**Item type:** *Complex multiple choice*

In which part of the tree diagram, if any, would each of the people listed in the table below be included? Show your answer by placing a cross in the correct box in the table. The first one has been done for you.

	"In labour force: employed"	"In labour force: unemployed"	"Not in labour force"	Not included in any category
A part-time waiter, aged 35	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A business woman, aged 43, who works a sixty-hour week	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A full-time student, aged 21	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
A man, aged 28, who recently sold his shop and is looking for work	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A woman, aged 55, who has never worked or wanted to work outside the home	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
A grandmother, aged 80, who still works a few hours a day at the family's market stall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**Key:** *Full credit:* Marked in table; *partial credit:* one or two errors are permitted; *no credit:* Other responses, missing.

**Process:** *Interpretation of text.* Analyse and match several cases to categories where some of the necessary information is in footnotes.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Fully correct	13.4	14.5
473.0 (PC); 727.5 (FC)	Partially correct	52.0	54.0
Level	Incorrect	30.3	30.1
2 (PC); 5 (FC)	Missing	4.3	1.5
	Total	100	100

### LABOUR FORCE QUESTION 4 (Item code: R088Q05)

**Item type:** *Complex multiple choice*

Suppose that information about the labour force was presented in a tree diagram like this every year. Listed below are four features of the tree diagram. Show whether or not you would expect these features to change from year to year, by circling either 'Change' or 'No change'. The first one has been done for you.

<i>Features of Tree Diagram</i>	<i>Answer</i>
The labels in each box (e.g. "In labour force")	Change / No change
The percentages (e.g. "64.2%")	Change / No change
The numbers (e.g. "2656.5")	Change / No change
The footnotes under the tree diagram	Change / No change

**Key:** *Full Credit:* No change, change, change, no change, in this order, all responses must be correct; *no credit:* Other responses, missing.

**Process:** *Reflect and evaluate.* Draw on knowledge on the form and content of a tree diagram about the labour force to distinguish between variables and structural features.

<b>PISA Item Difficulty</b>	<b>Item statistics</b>	<b>% OECD</b>	<b>% Ireland</b>
Scale score	Correct	68.8	74.1
444.8	Incorrect	21.5	20.5
Level	Missing	9.7	5.4
2	Total	100	100

### LABOUR FORCE QUESTION 5 (Item code: R088Q07)

**Item type:** *Multiple choice.*

The information about the labour force structure is presented as a tree diagram, but it could have been presented in a number of other ways, such as a written description, a pie chart, a graph or a table. The tree diagram was probably chosen because it is especially useful for showing:

- A changes over time
- B the size of the country's total population
- C categories within each group
- D the size of each group

**Key:** C.

**Process:** *Reflect and evaluate.* Evaluate structure of a tree diagram and recognise that its structure is appropriate for showing categories within each group.

<b>PISA Item Difficulty</b>	<b>Item statistics</b>	<b>% OECD</b>	<b>% Ireland</b>
Scale score	Correct	62.4	70.0
485.7	Incorrect	31.2	26.2
Level	Missing	6.5	3.9
3	Total	100	100

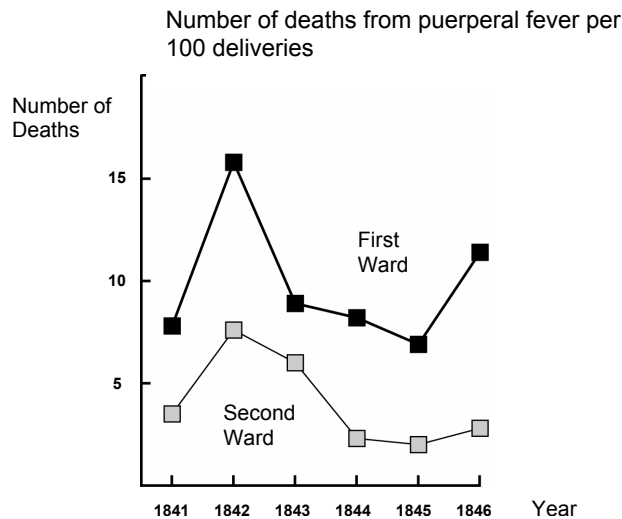
## SCIENCE

### UNIT: SEMMELWEIS (2000)

**Context:** *Historical.*

"July 1846. Next week I will take up a position as 'Herr Doktor' at the First Ward of the maternity clinic of the Vienna General Hospital. I was frightened when I heard about the percentage of patients who die in this clinic. This month not less than 36 of the 208 mothers died there, all from puerperal fever. Giving birth to a child is as dangerous as first-degree pneumonia."

These lines from the diary of Ignaz Semmelweis (1818-1865) illustrate the devastating effects of puerperal fever, a contagious disease that killed many women after childbirth. Semmelweis collected data about the number of deaths from puerperal fever in both the First and the Second Wards (see graph).



Graph

Physicians, among them Semmelweis, were completely in the dark about the cause of puerperal fever. Semmelweis continues:

"December 1846. Why do so many women die from this fever after giving birth without any problems? For centuries science has told us that it is an invisible epidemic that kills mothers. Causes may be changes in the air or some extraterrestrial influence or a movement of the earth itself, an earthquake."

Nowadays not many people would consider extraterrestrial influence or an earthquake as possible causes of fever. But in the time Semmelweis lived, many people, even scientists, did! We now know it has to do with hygienic conditions. Semmelweis knew that it was unlikely that fever could be caused by extraterrestrial influence or an earthquake. He pointed at the data he collected (see graph) and used these to try to persuade his colleagues.

### SEMMELWEIS QUESTION 1 (Item code: S195Q02)

**Scientific area:** *Life and health.* **Topic:** *Biological sciences.*

**Item type:** *Open constructed response.*

Suppose you were Semmelweis. Give a reason (based on the data Semmelweis collected) why puerperal fever is unlikely to be caused by earthquakes.

**Key:** *Full credit:* Refer to difference between number of deaths in the two wards; *partial credit:* Earthquakes infrequent; effect people outside wards; not always associated with fever; *no credit:* Other responses, missing.

**Process:** *Critically evaluating.*

PISA Item Difficulty
Scale score
625.7 (PC); 650.9 (FC)

Item statistics	% OECD	% Ireland
Fully correct	21.6	21.3
Partially correct	7.3	9.9
Incorrect	43.5	51.0
Missing	27.7	17.8
Total	100	100

## SEMMELWEIS QUESTION 2 (Item code: S195Q04)

**Scientific area:** *Life and health.* **Topic:** *Biological sciences.*

**Item type:** *Multiple choice.*

Part of the research in the hospital was dissection. The body of a deceased person was cut open to find the cause of death. Semmelweis recorded that the students working on the First ward usually took part in dissections on women who died the previous day, before they examined women who had just given birth. They did not pay much attention to cleaning themselves after the dissections. Some were even proud of the fact that you could tell by their smell that they had been working in the mortuary, as this showed how industrious they were!

One of Semmelweis' friends died after having cut himself during such a dissection. Dissection of his body showed he had the same symptoms as mothers who died from puerperal fever. This gave Semmelweis a new idea.

Semmelweis' new idea had to do with the high percentage of women dying in the maternity wards and the students' behaviour. What was this idea?

- A Having students clean themselves after dissections should lead to a decrease in puerperal fever.
- B Students should not take part in dissections because they may cut themselves.
- C Students smell because they do not clean themselves after a dissection.
- D Students want to show that they are industrious, which makes them careless when they examine the women.

**Key:** A.

**Process:** *Recognising questions.*

PISA Item Difficulty
Scale score
494.9

Item statistics	% OECD	% Ireland
Correct	63.8	69.8
Incorrect	28.0	25.4
Missing	8.2	4.9
Total	100	100

Response	% OECD	% Ireland
A*	63.8	69.8
B	7.5	6.1
C	6.0	6.6
D	14.5	12.7
Missing	8.2	4.9
Total	100	100

\*Key.

### SEMMELWEIS QUESTION 3 (Item code: S195Q05)

**Scientific area:** *Life and health.* **Topic:** *Biological sciences.*

**Item type:** *Open constructed response.*

Semmelweis succeeded in his attempts to reduce the number of deaths due to puerperal fever. But puerperal fever even today remains a disease that is difficult to eliminate. Fevers that are difficult to cure are still a problem in hospitals. Many routine measures serve to control this problem. Among these measures is washing sheets at high temperatures. Explain why high temperature (while washing sheets) helps to reduce the risk that patients will contract a fever.

**Key:** *Full credit:* Killing/removal of bacteria; micro organisms; sterilisation; *no credit:* Refers to killing the disease, other incorrect answer, missing.

**Process:** *Apply scientific knowledge.*

PISA Item Difficulty
Scale score
471.4

Item statistics	% OECD	% Ireland
Correct	67.6	69.8
Incorrect	13.9	17.1
Missing	18.5	13.1
Total	100	100

# **SEMMELOWIS QUESTION 4** (Item code: S195Q06)

**Scientific area:** *Life and health. Topic: Biological sciences.*

**Item type:** *Multiple choice.*

Nowadays, many diseases may be cured by using antibiotics. However, the success of some antibiotics against puerperal fever has diminished in recent years.

What is the reason for this?

- A Once produced, antibiotics gradually lose their activity.
- B Bacteria become resistant to antibiotics.
- C These antibiotics only help against puerperal fever, but not against other diseases.
- D The need for these antibiotics has been reduced because public health conditions have improved considerably in recent years.

**Key:** B.

**Process:** *Apply scientific knowledge.*

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	60.4	51.0
508.4	Incorrect	30.9	43.1
	Missing	8.7	5.9
	Total	100	100

Response	% OECD	% Ireland
A	6.0	6.5
B*	60.4	51.0
C	7.4	6.7
D	17.5	29.9
Missing	8.7	5.9
Total	100	100

\*Key.

## UNIT: OZONE (2000)

**Context:** *Global.*

Read the following section of an article about the ozone layer.

The atmosphere is an ocean of air and a precious natural resource for sustaining life on the Earth. Unfortunately, human activities based on national/personal interests are causing harm to this common resource, notably by depleting the fragile ozone layer, which acts as a protective shield for life on the Earth.

- 5 Ozone molecules consist of three oxygen atoms, as opposed to oxygen molecules which consist of two oxygen atoms. Ozone molecules are exceedingly rare: fewer than ten in every million molecules of air. However, for nearly a billion years, their presence in the atmosphere has played a vital role in safeguarding life on Earth. Depending on where it is located, ozone can either protect or harm life on Earth. The ozone in the troposphere (up to 10 kilometres above the Earth's surface) is 'bad' ozone which can damage lung tissues and plants. But about 90 percent of ozone found in the stratosphere (between 10 and 40 kilometres above the Earth's surface) is 'good' ozone which plays a beneficial role by absorbing dangerous ultraviolet (UV-B) radiation from the Sun.
- 10 Without this beneficial ozone layer, humans would be more susceptible to certain diseases due to the increased incidence of ultra-violet rays from the Sun. In the last decades the amount of ozone has decreased. In 1974 it was hypothesised that chlorofluorocarbons (CFCs) could be a cause for this. Until 1987, scientific assessment of the cause-effect relationship was not convincing enough to implicate CFCs. However, in September 1987, diplomats from around the world met in Montreal (Canada) and agreed to set sharp limits to the use of
- 15 CFCs.
- 20

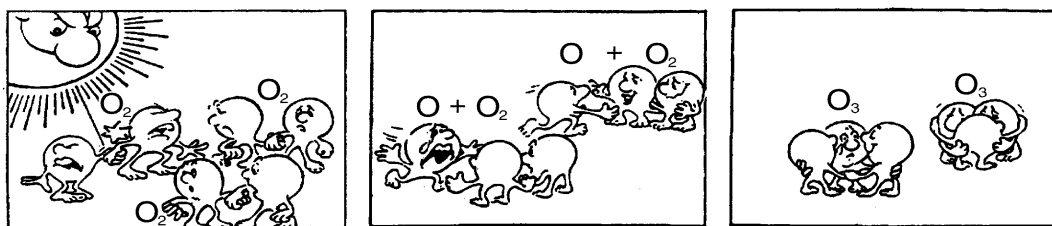


## OZONE QUESTION 5 (Item code: S253Q01)

**Scientific area:** Earth and environment. **Topic:** Earth and space sciences.

**Item type:** Open constructed response.

In the text (part 2 of text) above nothing is mentioned about the way ozone is formed in the atmosphere. In fact each day some ozone is formed and some other ozone disappears. The way ozone is formed is illustrated in the following comic strip.



Suppose you have an uncle who tries to understand the meaning of this strip. However, he did not get any science education at school and he doesn't understand what the author of the strip is explaining. He knows that there are no little creatures in the atmosphere but he wonders what those little creatures in the strip stand for, what those strange notations O, O<sub>2</sub> and O<sub>3</sub> mean and which processes the strip represents. He asks you to explain the strip. Assume that your uncle knows:

- that O is the symbol for oxygen;
- what atoms and molecules are.

Write an explanation of the comic strip for your uncle. In your explanation, use the words atoms and molecules in the way they are used in lines 6 and 7.

**Key:** *Full credit:* Answers with three aspects (1. Oxygen molecules split, 2. this splitting occurs by sunlight, 3. these combine with others to form ozone); *partial credit:* Answers with one or two aspects; *no credit:* Answers without any aspect, missing.

**Process:** *Communicating conclusion.*

PISA Item Difficulty
Scale score
615.8 (PC); 665.4 (FC)

Item statistics	% OECD	% Ireland
Fully correct	11.4	9.0
Partially correct	24.3	26.6
Incorrect	35.9	40.8
Missing	28.4	23.5
Total	100	100

### OZONE QUESTION 6 (Item code: S253Q02)

**Scientific area:** *Earth and environment.* **Topic:** *Earth and space sciences.*

**Item type:** *Closed constructed response.*

In terms of the article, is the ozone that is formed during thunderstorms ‘bad ozone’ or ‘good ozone’? Choose the answer and the explanation that is supported by the text.

	Bad ozone or good ozone?	Explanation
A	Bad	It is formed during bad weather.
B*	Bad	It is formed in the troposphere.
C	Good	It is formed in the stratosphere.
D	Good	It smells good.

\*=Key

**Process:** *Apply knowledge.*

PISA Item Difficulty	Response	% OECD	% Ireland
Scale score	A	7.5	10.5
629.3	B*	35.4	39.0
	C	22.6	22.0
	D	1.7	2.2
	Missing	32.8	26.4
	Total	100	100

Item statistics	% OECD	% Ireland
Correct	35.4	39.0
Incorrect	31.5	34.7
Missing	32.8	26.4
Total	100	100

### OZONE QUESTION 7 (Item code: S253Q05)

**Scientific area:** *Life and health.* **Topic:** *Biological sciences.*

**Item type:** *Short response.*

Lines 17 and 18 state: “Without this beneficial ozone layer, humans would be more susceptible to certain diseases due to the increased incidence of ultra-violet rays from the Sun.” Name one of these specific diseases.

**Key:** *Full credit:* Skin cancer, Melanoma, Cataracts; *no credit:* Other responses, missing.

**Process:** *Apply knowledge.*

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	54.6	55.8
542.7	Incorrect	32.6	37.4
	Missing	12.8	6.8
	Total	100	100

## PROBLEM SOLVING

### UNIT: CINEMA OUTING (2003)

**Problem type:** *Decision making.*

This problem is about finding a suitable time and date to go to the cinema.

Jason, a 15-year-old, wants to organise a cinema outing with two of his friends, who are of the same age, during the one-week school holiday. The holidays begin on Saturday, 24th March and end on Sunday, 1st April. Jason asks his friends for suitable dates and times for the outing. The following information is what he received.

**Fred:** "I've to stay home on Monday and Wednesday afternoons for music practice between 2:30 and 3:30."

**Simon:** "I've to visit my grandmother on Sundays, so it can't be Sundays. I have seen Pokamin and don't want to see it again."

Jason's parents insist that he only goes to films suitable for his age and does not walk home. They will fetch the boys home at any time up to 10 p.m.

Jason checks the film times for that week. This is the information that he finds.

TIVOLI CINEMA			
Advance Booking Number: 1850 2003545			
24 hour phone number: 1850 2020200			
Bargain Day Tuesdays: All films €5			
Films showing from Fri 23rd March for two weeks:			
<b>Children in the Net</b>		<b>Pokamin</b>	
113 mins	Suitable only for	105 mins	Parental Guidance.
14:00 (Mon-Fri only)	persons of 12 years	13:40 (Daily)	General viewing, but
21:35 (Sat/Sun only)	and over	16:35 (Daily)	some scenes may be
			unsuitable for young
			children
<b>Monsters from the Deep</b>		<b>Enigma</b>	
164 mins	Suitable only for	144 mins	Suitable only for
19:55 (Fri/Sat only)	persons of 18 years	15:00 (Mon-Fri only)	persons of 12 years
	and over	18:00 (Sat/Sun only)	and over
<b>Carnivore</b>		<b>King of the Wild</b>	
148 mins	Suitable only for	117 mins	Suitable for persons of
18:30 (Daily)	persons of 18 years	14:35 (Mon-Fri only)	all ages
	and over	18:50 (Sat/Sun only)	

### CINEMA OUTING QUESTION 1 (Item code: X601Q01)

**Item type:** *Multiple choice.*

Taking into account the information Jason found on the films, and the information he got from his friends, which of the six films should Jason and the boys consider watching?

Circle "Yes" or "No" for each film.

Film	Should the three boys consider watching the film?
Children in the Net	Yes / No
Monsters from the Deep	Yes / No
Carnivore	Yes / No
Pokamin	Yes / No
Enigma	Yes / No
King of the Wild	Yes / No

**Key:** *Full credit:* Yes, no, no, no, yes, yes, in that order; *partial credit:* One incorrect answer; *no credit:* Other responses, missing.

**Process:** Not classified by process.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Fully correct	55.5	64.3
441.9 (PC); 521.9 (FC)	Partially correct	23.4	18.5
Level	Incorrect	19.1	16.0
1 (PC); 2 (FC)	Missing	2.0	1.2
	Total	100	100

Note. Fully correct and partially correct are combined in the PISA International Report.

## CINEMA OUTING QUESTION 2

(Item code: X601Q02)

**Item type:** *Multiple choice.*

If the three boys decided on going to “Children in the Net”, which one of the following dates is suitable for them?

- A Monday, 26th March
- B Wednesday, 28th March
- C Friday, 30th March
- D Saturday, 31st March
- E Sunday, 1st April

**Key:** *Full credit:* C; *no credit:* Other responses, missing.

**Process:** Not classified by process.

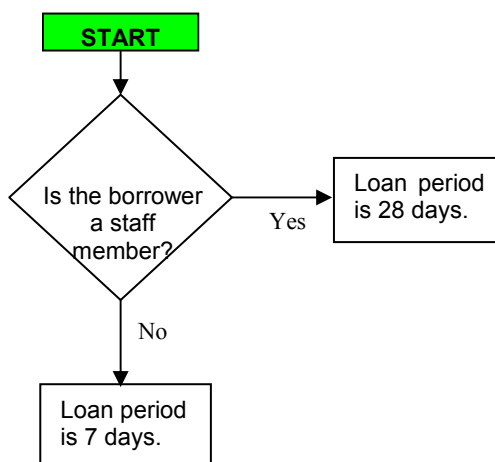
PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	68.1	77.8
468.3	Incorrect	19.1	15.3
Level	Missing	12.8	6.9
1	Total	100	100

## UNIT: LIBRARY SYSTEM

(2003)

**Problem type:** *System analysis and design.*

The **Moatstown Community School** library has a simple system for lending books: for staff members the loan period is 28 days, and for students the loan period is 7 days. The following is a flow chart showing this simple system:



The **Dunbeg Secondary School** library has a similar, but more complicated, lending system:

- All publications classified as “Reserved” have a loan period of 2 days.
- For books (not including magazines) that are **not** on the reserved list, the loan period is 28 days for staff, and 14 days for students.
- For magazines that are **not** on the reserved list, the loan period is 7 days for everyone.
- Persons with any overdue items are not allowed to borrow anything.

### LIBRARY SYSTEM QUESTION 1

(Item code: X402Q01)

**Item type:** *Closed constructed response.*

You are a student at **Dunbeg Secondary School**, and you do not have any overdue items from the library. You want to borrow a book that is **not** on the reserved list. How long can you borrow the book for? Answer: \_\_\_\_\_ days.

**Key:** *Full credit:* 14 days; *no credit:* Other responses, missing.

**Process:** Not classified by process.

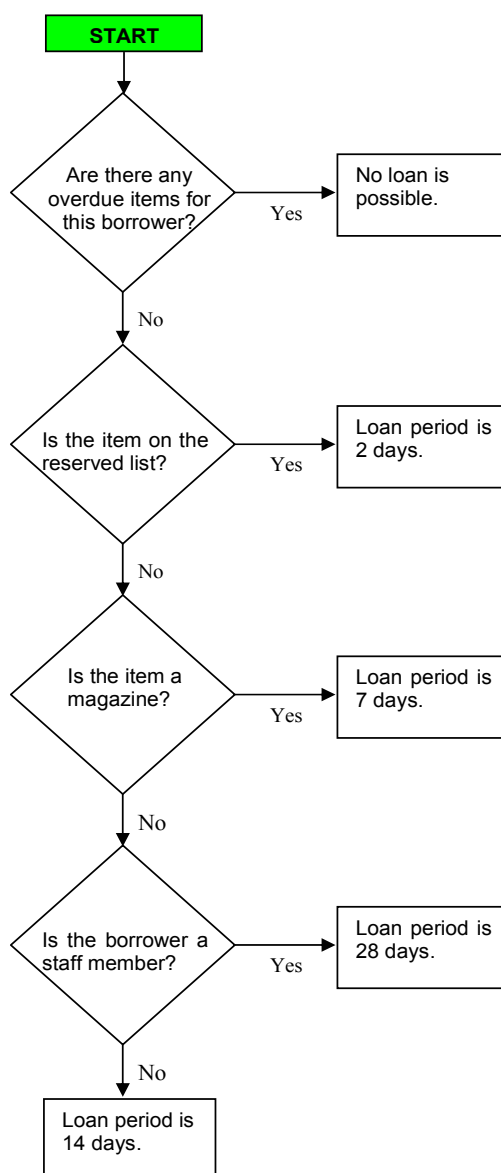
PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	74.8	86.8
436.8	Incorrect	19.5	10.9
Level	Missing	5.7	2.3
1	Total	100	100

## LIBRARY SYSYEM QUESTION 2

(Item code: X402Q02)

**Item type:** *Open constructed response.*

Develop a flow chart for the **Dunbeg Secondary School** Library system so that an automated checking system can be designed to deal with book and magazine loans at the library. Your checking system should be as efficient as possible (i.e. it should have the least number of checking steps). Note that each checking step should have only **two** outcomes and the outcomes should be labelled appropriately (e.g. “Yes” and “No”).



**Key:** *Full credit:* The most efficient system is the 4-step check system as above; equivalent statements can be accepted:

*Partial Credit (1):*

The diagram is correct except that the first three check steps are out of order in one (but not both) of the following two ways: The checks for “reserved list” and “magazine” are interchanged. The checks for “overdue items” and “reserved list” are interchanged.

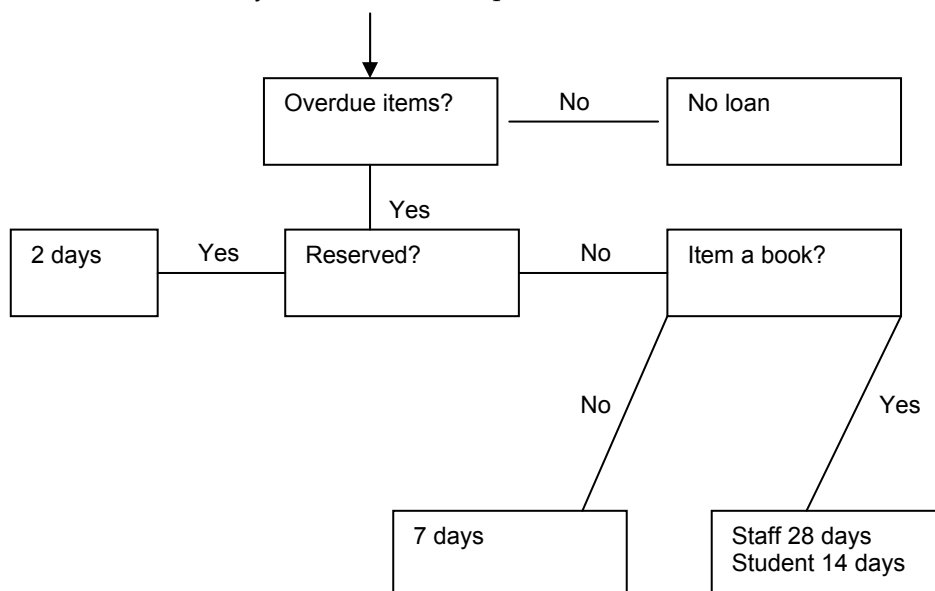
The check for “overdue items” is written as a statement outside the flow chart.

The other three check steps are in the right sequence, but with a “minor error”.

The check for “overdue items” is missing, but the other three check steps are completely correct and in the right sequence.

*Partial Credit (2):*

The four check steps are in the right sequence, but there is a “minor error”. For example: One loan period is incorrect; one loan period is missing; one or more Yes/No missing; one Yes/No incorrectly labelled. For example:



Or: The check for “overdue items” is written as a statement outside the flow chart, but the other three check steps are completely correct and in the right sequence.

Two check steps are out of order, resulting in 5 steps, as one extra check step is required.

The system is still “complete”, but less efficient. By “complete” we mean that the checking system will produce the correct loan periods in all cases.

*No credit:* The system is “complete”, but has more than 5 check steps; other responses, missing.

**Process:** Not classified by process.

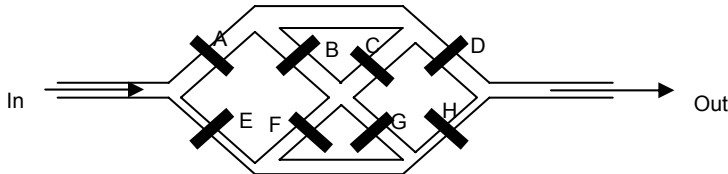
PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Fully correct	9.8	3.3
658.1 (PC1); 677.8 (PC2);	Part. correct (2)	3.5	3.4
693.0 (FC)	Part. correct (1)	6.8	4.5
Level	Incorrect	56.8	74.2
3 (PC1, PC2, FC)	Missing	23.2	14.7
	Total	100	100

## UNIT: IRRIGATION (2003)

**Problem type:** *Trouble shooting.*

Below is a diagram of a system of irrigation channels for watering sections of crops. The gates A to H can be opened and closed to let the water go where it is needed. When a gate is closed no water can pass through it. This is a problem about finding a gate which is stuck closed, preventing water from flowing through the system of channels.

Figure 1: A system of irrigation channels



Michael notices that the water is not always going where it is supposed to. He thinks that one of the gates is stuck closed, so that when it is switched to “open”, it does not open.

### IRRIGATION QUESTION 1 (Item code: X603Q01)

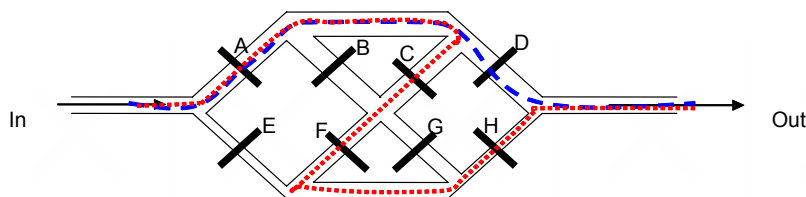
**Item type:** *Open constructed response.*

Michael uses the settings given in Table 1 to test the gates.

Table 1: Gate Settings

A	B	C	D	E	F	G	H
Open	Closed	Open	Open	Closed	Open	Closed	Open

With the gate settings as given in Table 1, on the diagram below draw all the possible paths for the flow of water. Assume that all gates are working according to the settings.



**Key:** *Full credit:* Flow paths as shown above: Ignore any indications of the directions of flow; the response could be shown in the diagram provided, or in figure 1, or in words, or with arrows; *no credit:* Other responses, missing.

**Process:** Not classified by process.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	47.1	45.9
497.2	Incorrect	50.2	52.3
Level	Missing	2.7	1.8
1	Total	100	100



## IRRIGATION QUESTION 2 (Item code: X603Q02)

**Item type:** *Multiple choice.*

Michael finds that, when the gates are set as shown in Table 1, no water flows through, indicating that at least one of the gates set to “open” is stuck closed.

Decide for each problem case below whether the water will flow through all the way. Circle “Yes” or “No” in each case.

Problem Case	Will water flow through all the way?
Gate A is stuck closed. All other gates are working properly as set in Table 1.	Yes/No
Gate D is stuck closed. All other gates are working properly as set in Table 1.	Yes/No
Gate F is stuck closed. All other gates are working properly as set in Table 1.	Yes/No

**Key:** *Full credit:* No, yes, yes, in that order; *no credit:* Other responses, missing.

**Process:** Not classified by process.

PISA Item Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	36.1	35.6
543.2	Incorrect	25.1	32.5
Level	Missing	38.8	31.9
2	Total	100	100

## IRRIGATION QUESTION 3 (Item code: X603Q03)

**Item type:** *Open constructed response.*

Michael wants to be able to test whether **gate D** is stuck closed.

In the following table, show settings for the gates to test whether **gate D** is stuck closed when it is set to “open”.

Settings for gates (each one “open” or “closed”):

A	B	C	D	E	F	G	H

**Key:** *Full credit:* A and E are not both closed. D must be open. H can only be open if water cannot get to it (e.g., other gates are closed preventing water from reaching H). Otherwise H must be closed (H closed, all other gates open); *no credit:* Other responses, missing.

**Process:** Not classified by process.

PISA Difficulty	Item statistics	% OECD	% Ireland
Scale score	Correct	54.4	55.8
531.3	Incorrect	32.9	35.1
Level	Missing	12.7	9.1
2	Total	100	100