


# Outcome 1 - Maximum & Minimum Values

## Bronze example

**Examples...**


A company making matches aims for them all to be 35 mm in length exactly.



As this is not always possible, they will accept each match within a tolerance of  $(35 \pm 4)$  mm.

What are the minimum and maximum length of matches that the company will accept?


Minimum Length =  $35 - 4 = 31$  mm  
Maximum Length =  $35 + 4 = 41$  mm



## Silver example


**Examples...**

A cutting from a piece of wood has a tolerance of  $(25 \pm 1.5)$  cm.



What are the minimum and maximum lengths of wood that are acceptable?


Minimum Length =  $25 - 1.5 = 23.5$  cm  
Maximum Length =  $25 + 1.5 = 26.5$  cm



## Gold example

**Examples...**


To cook a turkey in an oven, a recipe recommends a temperature of  $(190 \pm 10\%)^{\circ}\text{C}$ .



What are the minimum and maximum temperatures that are acceptable?









$10\% \text{ of } 190 = 190 \div 10 = 19$

Minimum Temp =  $190 - 19 = 171^{\circ}\text{C}$   
Maximum Temp =  $190 + 19 = 209^{\circ}\text{C}$











## Bronze Questions

For each of the following tolerances, write down the minimum (min) and maximum (max) allowable sizes...

- |  |  |
|--|--|
|  1 $(20 \pm 3)$ m     |  2 $(100 \pm 7)$ cm             |
|  3 $(82 \pm 6)$ mm    |  4 $(47 \pm 5)$ km              |
|  5 $(50 \pm 1)$ kg    |  6 $(69 \pm 9)$ ml              |
|  7 $(4 \pm 2)$ litres |  8 $(20 \pm 8)^{\circ}\text{C}$ |









## Silver Questions

For each of the following tolerances, write down the minimum (min) and maximum (max) allowable sizes...

- |   |   |
|---|---|
|  1 $(12 \pm 2.5)$ m    |  2 $(33 \pm 2.7)$ cm                 |
|  3 $(54 \pm 4.8)$ mm   |  4 $(66 \pm 6.6)$ km                 |
|  5 $(8.5 \pm 1.9)$ kg  |  6 $(18.4 \pm 0.8)$ ml               |
|  7 $(3.75 \pm 0.05)$ g |  8 $(7.23 \pm 0.04)^{\circ}\text{C}$ |

## Gold Questions

For each of the following tolerances, write down the minimum (min) and maximum (max) allowable sizes...

- |  |   |
|--|---|
|  1 $(60 \pm 50\%)$ m  |  2 $(24 \pm 25\%)$ cm              |
|  3 $(40 \pm 20\%)$ mm |  4 $(20 \pm 1\%)$ km               |
|  5 $(90 \pm 70\%)$ kg |  6 $(125 \pm 80\%)$ ml             |
|  7 $(300 \pm 5\%)$ g  |  8 $(18 \pm 15\%)^{\circ}\text{C}$ |

## Bronze Answers

- |                                   |                              |
|-----------------------------------|------------------------------|
| 1. min = 17 m, max = 23 m         | 2. min = 93 cm, max = 107 cm |
| 3. min = 76 mm, max = 88 mm       | 4. min = 42 km, max = 52 km  |
| 5. min = 49 kg, max = 51 kg       | 6. min = 60 ml, max = 78 ml  |
| 7. min = 2 litres, max = 6 litres | 8. min = 12°C, max = 28°C    |

## Silver Answers

- |                                 |                                 |
|---------------------------------|---------------------------------|
| 1. min = 9.5 m, max = 14.5 m    | 2. min = 30.3 cm, max = 35.7 cm |
| 3. min = 49.2 mm, max = 58.8 mm | 4. min = 59.4 km, max = 72.6 km |
| 5. min = 6.6 kg, max = 10.4 kg  | 6. min = 17.6 ml, max = 19.2 ml |
| 7. min = 3.7 g, max = 3.8 g     | 8. min = 7.19 °C, max = 7.27 °C |

## Gold Answers

- |                              |                                 |
|------------------------------|---------------------------------|
| 1. min = 30 m, max = 90 m    | 2. min = 18 cm, max = 30 cm     |
| 3. min = 32 mm, max = 48 mm  | 4. min = 19.8 km, max = 20.2 km |
| 5. min = 27 kg, max = 153 kg | 6. min = 25 ml, max = 225 ml    |
| 7. min = 285 g, max = 315 g  | 8. min = 15.3°C, max = 20.7°C   |