

## Session 3: Universal Maths - Standard Form

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1 a) Write the number 340 000 in standard form.

b) Write  $7.2 \times 10^{-4}$  as an ordinary number

**(Total 2 marks)**

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2 The distance between Venus and the Sun is 108 800 000 km.

a) Write the number 108 800 000 km in standard form.

Uranus is 27 times as far from the Sun as Venus.

b) Calculate the distance between Uranus and the Sun.  
Give your answer in standard form.

**(Total 3 marks)**

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3 Work out the value of  $(7.4 \times 10^4) + (5.2 \times 10^3)$   
Give your answer in standard form.

**(Total 2 marks)**

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- 4 The mass of a proton is 0.000 000 000 000 000 000 000 001 67 kg
- a) Write the number 0.000 000 000 000 000 000 000 001 67 in standard form

The mass of a proton is roughly 1840 times greater than the mass of an electron.

- b) Calculate the mass, in kg, of an electron.  
Give your answer in standard form correct to 2 significant figures.

**(Total 3 marks)**

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- 5 The Earth has a radius of 6400 km.  
Assuming it is a perfect sphere, calculate the surface area, in km<sup>2</sup> of the Earth.  
Give your answer in standard form correct to 2 significant figures.

**(Total 3 marks)**

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- 6 A supercomputer can perform 56, 800 000 000 000 calculation per second.
- a) Write the number 56, 800 000 000 000 in standard form.
- b) Work out the number of calculations this computer can perform in 5 hours.  
Give your answer in standard form correct to 2 significant figures.

1 nanosecond =  $10^{-9}$  seconds.

- c) Work out the time, in nanoseconds, this computer takes to perform one calculation.  
Give your answer in standard form correct to 2 significant figures.

**(Total 5 marks)**

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- 7** Proxima Centauri is the closest star to Earth, other than the Sun.  
The distance from the Proxima Centauri to Earth is  $4.014 \times 10^{13}$  km.  
Light travels  $9.46 \times 10^{12}$  km in a year.
- a)** Calculate the time, in years, light takes to travel from the Proxima Centauri to Earth.  
Give your answer in standard form correct to two significant figures.

The fastest spacecraft humans have created travelled at 390,000 km/h.

- b)** Calculate how many years it would take this spacecraft to reach Proxima Centauri.

**(Total 5 marks)**

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- 8** 1 litre of paint covers an area of  $8 \text{ m}^2$ . Work out the thickness, in centimetres, of the coat of paint. Give your answer in standard form correct to two significant figures.

**(Total 4 marks)**

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- 9** The mass of an atom can be expressed in atomic mass units.  
1 atomic mass unit (amu) =  $1.66 \times 10^{-27}$  kg. The weight of 1 atom of oxygen 16 is 16 amu.
- a)** Express 16 amu in kg. Give your answer in standard form.

The weight of 1 atom of iron is  $9.27 \times 10^{-26}$  kg.

- b)** Express  $9.27 \times 10^{-26}$  in amu. Give your answer correct to the nearest whole number.

**(Total 4 marks)**

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- 10** Muons and taus are subatomic particles.  
The lifetime of a tau is  $2.9 \times 10^{-13}$  seconds.  
The lifetime of a muon is  $7.59 \times 10^6$  times greater than the lifetime of a tau.  
**b)** Calculate the lifetime, in seconds, of a muon.  
Give your answer in standard form correct to three significant figures.

(Total 3 marks)

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- 11**  $x = 2 \times 10^v$  and  $y = 4 \times 10^w$  where  $v$  and  $w$  are integers.  
Find an expression in standard form for  $xy$ .

(Total 2 marks)

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- 12**  $x = 5 \times 10^c$  and  $y = 3 \times 10^d$  where  $c$  and  $d$  are integers.  
Find an expression in standard form for:

- a)  $xy$                       b)  $\frac{x}{y}$

(Total 3 marks)

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- 13**  $x = 6 \times 10^w$  where  $w$  is an integer.  
Find an expression in standard form for  $x^2$ .  
Give your expression as simply as possible.

(Total 3 marks)

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- 14**  $x = 6 \times 10^v$  and  $y = 4 \times 10^w$  where  $v$  and  $w$  are integers.

Find an expression, in standard form, for  $\frac{x}{y}$

**(Total 3 marks)**

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- 15**  $3.6 \times 10^7 + h \times 10^8 = 4.96 \times 10^8$   
Find the value of  $h$ .

**(Total 3 marks)**

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- 16**  $(8 \times 10^4) \times (h \times 10^w) = 4.8 \times 10^{-7}$  where  $1 < h < 10$  and  $w$  is an integer.  
Find the value of  $h$  and the value of  $w$ .

**(Total 3 marks)**

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**17**  $\frac{6 \times 10^7}{h \times 10^w} = 1.5 \times 10^{16}$  where  $1 < h < 10$  and  $w$  is an integer.

Find the value of  $h$  and the value of  $w$ .

**(Total 3 marks)**

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**18**  $a = 4 \times 10^v$  and  $b = 2 \times 10^w$  where  $v$  and  $w$  are integers.

$$ab = 8 \times 10^2 \quad \text{and} \quad \frac{a}{b} = 2 \times 10^8$$

Find:

**a)** the value of  $v$                       **b)** the value of  $w$ .

**(Total 3 marks)**

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