

Standard Form

10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}
10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}

$$\begin{array}{ccccccc}
 3 & 5 & 0 & 0 & 0 & 0 & 0 \\
 4 & 7 & 5 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0
 \end{array}$$

$$35000 = 35000 \times 10^0$$

$$3500 \times 10^1$$

$$350 \times 10^2$$

$$35 \times 10^3$$

$$\text{Standard form} \Rightarrow 3.5 \times 10^4$$

$$4750 \quad 4.75 \times 10^3$$

$$0.038 = 38 \times 10^{-3}$$

$$\text{Standard form} \Rightarrow 3.8 \times 10^{-2}$$

$10^8 \times 10^2 = 10^{12}$	$\frac{10^8}{10^2} = 10^6$
$10^7 \times 10^{-3} = 10^4$	$\frac{10^7}{10^{-3}} = 10^{7-(-3)} = 10^{10}$
	$\frac{10^7}{10^{-3}} = 10^{10}$

1.

Find the value of $(9.2 \times 10^5) - (3 \times 10^4)$. Give your answer in standard form.

[2]

$$\begin{array}{r}
 10^6 \quad 10^5 \quad 10^4 \quad 10^3 \quad 10^2 \quad 10^1 \quad 10^0 \\
 \begin{array}{ccccccc}
 8 & 9 & 2 & 0 & 0 & 0 & 0 \\
 3 & 0 & 0 & 0 & 0 & 0 & 0 \\
 \hline
 8 & 9 & 0 & 0 & 0 & 0 & 0
 \end{array}
 \end{array}
 = 8.9 \times 10^5$$

2.

Evaluate the following, giving each of your answers in standard form.

[2]

(a) $(2.5 \times 10^6) \times (8 \times 10^3)$

$$2.5 \times 8 \times 10^6 \times 10^3$$

$$20 \times 10^9$$

$$2 \times 10^{10}$$

$$\begin{array}{r}
 2.5 \\
 \times 8 \\
 \hline
 20.0 \\
 4
 \end{array}$$

(b) $5 \times 10^8 + 6.8 \times 10^9$

[2]

$$\begin{array}{r}
 10^9 \quad 10^8 \quad 10^7 \quad 10^6 \quad 10^5 \quad 10^4 \quad 10^3 \quad 10^2 \quad 10^1 \quad 10^0 \\
 \begin{array}{cccccccccc}
 5 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 6 & 8 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 \hline
 7 & 3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
 \end{array}
 \end{array}$$

$$7.3 \times 10^9$$

3.

Evaluate each of the following giving all of your answers in **standard form**.

(a) $4.5 \times 10^8 + 9.4 \times 10^7$

[1]

$$\begin{array}{r}
 10^8 \quad 10^7 \quad 10^6 \quad 10^5 \quad 10^4 \quad 10^3 \quad 10^2 \quad 10^1 \quad 10^0 \\
 4 \quad 5 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \\
 + \quad 9 \quad 4 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \\
 \hline
 5 \quad 4 \quad 4 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0
 \end{array}$$

Answer in standard form:

5.44×10^8

(b) $\frac{6 \times 10^{12}}{3 \times 10^{-6}}$

[1]

$$\frac{6}{3} = 2 \quad \frac{10^{12}}{10^{-6}} = 10^{12-(-6)} = 10^{12+6} = 10^{18}$$

Answer in standard form:

2×10^{18}

(c) The product of 1000 and six million.

[2]

$$\begin{array}{r}
 10^3 \quad 10^2 \quad 10^1 \quad 10^0 \quad 10^{-1} \quad 10^{-2} \quad 10^{-3} \quad 10^{-4} \quad 10^{-5} \quad 10^{-6} \\
 1 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \\
 \times \quad 6 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \\
 \hline
 6 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0
 \end{array}$$

Answer in standard form:

$$\begin{aligned}
 &1 \times 10^3 \times 6 \times 10^6 \\
 &1 \times 6 = 6 \quad 10^{3+6} = 10^9 \\
 &\boxed{6 \times 10^9}
 \end{aligned}$$

4.

Evaluate the following, giving your answer in standard form.

(a) $\frac{6.3 \times 10^{12}}{12.6 \times 10^8}$

$\frac{6.3}{12.6} = 0.5$ $10^{12-8} = 10^4$ $0.5 \times 10^4 = 5 \times 10^3$

10^4 10^3 10^2 10^1 10^0

[2]

(b) $(8 \times 10^2) \times (3 \times 10^6)$

$24 \times 10^8 = 2.4 \times 10^9$

[2]

(c) $(3.24 \times 10^8) + (1.2 \times 10^7)$

10^8 10^7 10^6 10^5 10^4 10^3 10^2 10^1 10^0

$+ \begin{array}{r} 324000000 \\ 12000000 \\ \hline 336000000 \end{array}$

3.36×10^8

[2]

5.

Express 13 million in standard form.

[1]

$13\ 000\ 000$ 1.3×10^7

6.

CALC

Calculate $\frac{2.9 \times 10^{12}}{7.1 \times 10^4}$. Give your answer in standard form, correct to 2 significant figures. [3]

40845070.42

41000000

4.1×10^7

7.

CALC

The Millennium Stadium can seat 72500 people.
The population of Wales would fill the Millennium Stadium forty-two times.

Use this information to calculate the population of Wales.
Give your answer in standard form correct to 3 significant figures.

[3]

$$42 \times 72500 = 3045000$$

$$3045000 \text{ to 3 s.f.}$$

$$3.05 \times 10^6$$

8.

(a) Arrange the following numbers in ascending order.

2100 2.4×10^{-3} 2.4×10^3 10^3
 2.1×10^3 1×10^3 2.4×10^3 1×10^3
 Smallest 2.4×10^{-3} 1×10^3 2.1×10^3 2.4×10^3 Largest

[2]

(b) Evaluate $6 \times 10^{13} + 9 \times 10^{13}$, giving your answer in standard form.

$$15 \times 10^{13}$$

$$1.5 \times 10^{14}$$

[2]

9.

CALC

- (a) Find the value of $\frac{3.6 \times 10^7}{6 \times 10^4}$.

Give your answer in standard form.

[2]

$$600 \times 10^2$$

- (b) The mass of an atom of hydrogen is 1.66×10^{-24} g.
 The mass of an atom of oxygen is 2.66×10^{-23} g.
 A molecule of water consists of two atoms of hydrogen and one atom of oxygen.

Calculate the mass of a molecule of water.

Give your answer in standard form, correct to 3 significant figures.

[3]

$$(2 \times 1.66 \times 10^{-24}) + 2.66 \times 10^{-23}$$

$$2.99 \times 10^{-23}$$

10.

CALC

Evaluate $\frac{8.44 \times 10^{-8} \times 4.53 \times 10^{-4}}{2.34 \times 10^{16}}$.

Express your answer in standard form correct to 3 significant figures.

[2]

$$1.63 \times 10^{-27}$$

11.

The reciprocal of the speed of light squared is 2.22×10^{-18} .
Find the speed of light in standard form correct to two significant figures.

CALC

$$\frac{1}{s^2} = 2.22 \times 10^{-18}$$

$$1 = 2.22 \times 10^{-18} \times s^2$$

$$\frac{1}{2.22 \times 10^{-18}} = s^2$$

[3]

$$\sqrt{\frac{1}{2.22 \times 10^{-18}}} = s$$

$$6700000000$$

$$6.7 \times 10^8$$

Marking Scheme

1.

9. $920000 - 30000 (= 890000)$ $= 8.9 \times 10^5$	M1 A1	OR $9.2 \times 10^5 - 0.3 \times 10^5$ OR $92 \times 10^4 - 3 \times 10^4$ OR 89×10^4 OR 890×10^3
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2.

11.(a) 2×10^{10}	B2	B1 for 20×10^9 or 0.2×10^{11} or similar attempt at standard form B0 for 20 000 000 000
(b) 7.3×10^9	B2	B1 for $10^8(5 + 6.8 \times 10)$ or 73×10^8 or 0.73×10^{10} or similar attempt at standard form B0 for 7 300 000 000
	4	If no marks in (a) & (b) then SC1 for both answers correct but not in standard form

3.

10.(a) $5.4(4) \times 10^8$	B1	
(b) 2×10^{18}	B1	
(c) $1000 \times 6\,000\,000$ or $6\,000\,000\,000$ or $1000 \times 6 \times 10^6$ 6×10^9	M1 A1 4	

4.

14.(a) 5×10^3	B2	B1 for 0.5×10^4 or $\frac{1}{2} \times 10^4$ or 5000
(b) 2.4×10^9	B2	B1 for 24×10^8 or 2 400 000 000
(c) 3.36×10^8	B2	B1 for attempt to match addition of numbers, e.g. breaking down to $3.24 \times 10^7 \times 10$ or alternative strategy, or sight of 336 000 000
	6	

5.

2015 Summer Linear Paper 2 Higher Tier		Comments
9. 1.3×10^7	B1	CAO

6.

Unitised Unit 3 – Nov 2015 Higher Tier		FINAL MARK SCHEME Comments
10. 4.1×10^7	B3 3	B2 for $4(-084507042) \times 10^7$ B1 for 40845070.42 or equivalent, or 41000000.

7.

Unitised Unit 3 – June 2015 Higher Tier	✓		Comments
12. 3.05×10^6		B3	B2 for 3.045×10^6 OR 3.04×10^6 OR 3 050 000 or equivalent. B1 for 3 045 000 or equivalent. If no marks awarded, SC1 for 1.73×10^3 .

8.

8(a) 2.4×10^{-3} 10^3 2100 2.4×10^3 or equivalent	B2	Mark answer space, unless blank B1 for a run of 3 in the correct order ignoring the incorrect one (i.e. blank out 1 value to find 3 in the appropriate order ignoring the gap made by the incorrect value, placing on the answer spaces thus incorrect) For incorrect value written in answer space for 2400, 1000 or 0.0024 in the answer space penalise -1 only
8(b) 1.5×10^{14}	B2	B1 for 15×10^{13}

9.
10.

Methods in Mathematics June 2015 Unit 2 Higher Tier		Mark	Comment
10.	1.63×10^{-27}	B2 2	B1 $1.63(3897...) \times 10^{-27}$ or 16.3×10^{-29}

11.

11. Stages of working: evidence of understanding $1/x$ inverse of squaring being $\sqrt{\quad}$ 6.7×10^8	M1 M1 A1 3	In either order CAO
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