(b) Write 0.000 003 06 in standard form.

3.06×10^{-6} [1]

8 Write in standard form.

(a) 3 706 000

3.706×10^{6} [1]

(b) 0.001 010

1.01×10^{-3} [1]

8 Calculate 0.3^2.
Give your answer in standard form.

0.3×0.3

two digits after dp.

$3 \times 3 = 9$

$0.3 \times 0.3 = 0.09$

two digits after d.p.

9×10^{-2} [2]

10 **(a)** Write 0.006 54 in standard form.

6.54×10^{-3} [1]

(b) The number 1.467×10^{102} is written as an ordinary number.

Write down the number of zeros that follow the digit 7.

1.467×10^{102}

take up three of the spaces

$102 - 3 = 99$

99 [1]

13 Calculate $0.04^2 + 0.03 \times 0.28$.
Give your answer in standard form.

$0.04 \times 0.04 = 0.0016$

$(4 \times 4 = 16)$

$0.03 \times 0.28 = 0.0084$

$(3 \times 28 = 84)$

$0.0016 + 0.0084 = 0.0100$

$= 0.01$

$= 1 \times 10^{-2}$ ..... [2]

7 **(a)** Write 0.003 08 in standard form.

3.08×10^{-3} ..... [1]

(b) Work out $(7 \times 10^6) \times (3 \times 10^{-8})$.

Give your answer in standard form.

$7 \times 3 \times 10^6 \times 10^{-8}$

$= 21 \times 10^{-2}$

$= 2.1 \times 10^1 \times 10^{-2}$

$= 2.1 \times 10^{-1}$

2.1×10^{-1} ..... [2]

9 **(a)** Write 0.007 09 in standard form.

7.09×10^{-3} ..... [1]

(b) Work out $(4 \times 10^4)^2$.
Give your answer in standard form.

$4^2 \times (10^4)^2$

$= 16 \times 10^8$

$= 1.6 \times 10^1 \times 10^8$

$= 1.6 \times 10^9$

1.6×10^9 ..... [2]

12 Simplify $(3 \times 10^{85}) \times (7 \times 10^{15})$.
Give your answer in standard form.

$3 \times 7 \times 10^{85} \times 10^{15}$

$= 21 \times 10^{100}$

$= 2.1 \times 10^{1} \times 10^{100}$

$= 2.1 \times 10^{101}$

2.1×10^{101} [2]

16 Calculate $(3 \times 10^{-3})^3$.
Give your answer in standard form.

$3^3 \times (10^{-3})^3$

$= 27 \times 10^{-9}$

$= 2.7 \times 10^{1} \times 10^{-9}$

$= 2.7 \times 10^{-8}$

2.7×10^{-8} [1]

7 $p = 5 \times 10^7$

Work out p^3.
Give your answer in standard form.

$5^3 \times (10^7)^3$

$= 125 \times 10^{21}$

$= 1{\cdot}25 \times 10^2 \times 10^{21}$

$= 1{\cdot}25 \times 10^{23}$

$1{\cdot}25 \times 10^{23}$ [2]

11 $10 < ab < 100$

Simplify $(a \times 10^7) \times (b \times 10^8)$.
Give your answer in standard form.

$a \times b \times 10^7 \times 10^8$

$= ab \times 10^{15}$ but ab needs to be between 1 and 10

$= \frac{ab}{10} \times 10^1 \times 10^{15}$

$= \frac{ab}{10} \times 10^{16}$

$\frac{ab}{10} \times 10^{16}$ [2]

8 $p = 2 \times 10^3$ $q = 8 \times 10^{-5}$

Work out the following, giving each answer in standard form.

(a) pq $2 \times 8 \times 10^3 \times 10^{-5}$

$= 16 \times 10^{-2}$

$= 1{\cdot}6 \times 10^1 \times 10^{-2} = 1{\cdot}6 \times 10^{-1}$

$1{\cdot}6 \times 10^{-1}$ [2]

(b) $\frac{p}{q}$

$\frac{2 \times 10^3}{8 \times 10^{-5}} = \frac{2}{8} \times \frac{10^3}{10^{-5}}$

$= 0{\cdot}25 \times 10^8$

$= 2{\cdot}5 \times 10^{-1} \times 10^8$

$= 2{\cdot}5 \times 10^7$

$2{\cdot}5 \times 10^7$ [2]

6 (a) Write 0.0000586 in standard form.

5.86×10^{-5} [1]

(b) $(2\times10^{a})\div(8\times10^{b}) = k\times10^{n}$ where $1 \leqslant k < 10$.

(i) Find the value of k.

$\frac{2}{8} \times \frac{10^{a}}{10^{b}} = 0.25 \times 10^{a-b}$

$= 2.5 \times 10^{-1} \times 10^{a-b}$

$k =$ 2.5 [1]

(ii) Write an expression for n in terms of a and b.

$2.5 \times 10^{-1} \times 10^{a-b}$

$= 2.5 \times 10^{a-b-1}$

$n =$ $a-b-1$ [1]

12 Work out, giving your answer in standard form,

(a) $(7.1\times10^{-15})\times(2\times10^{3})$

$7.1 \times 2 \times 10^{-15} \times 10^{3}$

$= 14.2 \times 10^{-12}$

$= 1.42 \times 10^{1} \times 10^{-12}$

$= 1.42 \times 10^{-11}$

1.42×10^{-11} [2]

(b) $(5.2\times10^{7})+(5.2\times10^{6})$. change both to highest base (in this case 10^{7}):

$5.2 \times 10^{7} + 0.52 \times 10^{1} \times 10^{6}$

$= 5.2 \times 10^{7} + 0.52 \times 10^{7}$ → $5.2 + 0.52 = 5.72$

$= 5.72 \times 10^{7}$

5.72×10^{7} [2]

9 Calculate $4.8\times10^{6}+3.7\times10^{7}$.
Give your answer in standard form.

$0.48 \times 10^{1} \times 10^{6} + 3.7 \times 10^{7}$

$= 0.48 \times 10^{7} + 3.7 \times 10^{7}$ → $3.7 + 0.48 = 4.18$

$= 4.18 \times 10^{7}$

4.18×10^{7} [1]

6 $p = 5 \times 10^{-8}$ $q = 6.8 \times 10^{-7}$

Find, giving your answers in standard form,

(a) pq $5 \times 6.8 \times 10^{-8} \times 10^{-7}$

$= 34 \times 10^{-15}$

$= 3.4 \times 10^{1} \times 10^{-15}$

$= 3.4 \times 10^{-14}$

3.4×10^{-14} [2]

$6.8 \times 5 = 34.0$

(b) $p+q$. change both to highest base (10^{-7})

$0.5 \times 10^{1} \times 10^{-8} + 6.8 \times 10^{-7}$

$= 0.5 \times 10^{-7} + 6.8 \times 10^{-7}$ → $0.5 + 6.8 = 7.3$

$= 7.3 \times 10^{-7}$

7.3×10^{-7} [2]

8 Calculate the value of $(2.3 \times 10^{-3}) + (6.8 \times 10^{-4})$.
Give your answer in standard form.

$2.3 \times 10^{-3} + 0.68 \times 10^{1} \times 10^{-4}$

$= 2.3 \times 10^{-3} + 0.68 \times 10^{-3}$ → $2.3 + 0.68 = 2.98$

$= 2.98 \times 10^{-3}$

2.98×10^{-3} [1]

6 (a) Work out $(1.5 \times 10^{1}) \times (7 \times 10^{-3})$.
Give your answer in standard form.

$1.5 \times 7 \times 10^{1} \times 10^{-3}$

$= 10.5 \times 10^{-2}$

$= 1.05 \times 10^{1} \times 10^{-2}$

1.05×10^{-1} [2]

(b) Work out $(6.5 \times 10^{-2}) + (7.8 \times 10^{-3})$.
Give your answer in standard form.

$6.5 \times 10^{-2} + 0.78 \times 10^{1} \times 10^{-3}$

$= 6.5 \times 10^{-2} + 0.78 \times 10^{-2}$ → $6.5 + 0.78 = 7.28$

$= 7.28 \times 10^{-2}$

7.28×10^{-2} [2]

14 Work out $(3\times10^{199})+(2\times10^{201})$.
Give your answer in standard form.

$3\times10^{199} + 2\times10^{201}$

$= 0{\cdot}03\times10^{2}\times10^{199} + 2\times10^{201}$

$= 0{\cdot}03\times10^{201} + 2\times10^{201}$

$= 2{\cdot}03\times10^{201}$

$2{\cdot}03\times10^{201}$ [2]

7 Work out the following, giving each answer in standard form.

(a) $(4.3\times10^{4})\times(3\times10^{-4})$

$4{\cdot}3\times3\times10^{4}\times10^{-4}$

$= 12{\cdot}9\times10^{0}$

$= 1{\cdot}29\times10^{1}\times10^{0}$

$1{\cdot}29\times10^{1}$ [2]

(b) $(6\times10^{-2})+(3\times10^{-3})$

$6\times10^{-2} + 0{\cdot}3\times10^{1}\times10^{-3}$

$= 6\times10^{-2} + 0{\cdot}3\times10^{-2}$

$= 6{\cdot}3\times10^{-2}$

$6{\cdot}3\times10^{-2}$ [2]

10 $c=4\times10^{7}$ $d=5.8\times10^{6}$

Work out, giving your answers in standard form,

(a) c^2, $4^2\times(10^{7})^{2}$

$= 16\times10^{14}$

$= 1{\cdot}6\times10^{1}\times10^{14}$

$1{\cdot}6\times10^{15}$ [2]

(b) $c-d$.

$4\times10^{7} - 0{\cdot}58\times10^{1}\times10^{6}$

$= 4\times10^{7} - 0{\cdot}58\times10^{7}$ → $3\ 9\ 1$ / $4{\cdot}00$ / $-\ 0{\cdot}58$ / $3{\cdot}42$

$= 3{\cdot}42\times10^{7}$

$3{\cdot}42\times10^{7}$ [2]

11 **(a)** Write 0.007 08 in standard form.

7.08×10^{-3} [1]

(b) Work out $(3.8 \times 10^{22}) + (3.8 \times 10^{23})$.
Give your answer in standard form.

$0.38 \times 10^{1} \times 10^{22} + 3.8 \times 10^{23}$

$= 0.38 \times 10^{23} + 3.8 \times 10^{23}$

$= 4.18 \times 10^{23}$

$\rightarrow \begin{array}{r} 3.8 \\ +\ 0.38 \\ \hline 4.18 \end{array}$

4.18×10^{23} [2]

13 Work out $2 \times 10^{100} - 2 \times 10^{98}$, giving your answer in standard form.

$2 \times 10^{100} - 0.02 \times 10^{2} \times 10^{98}$

$= 2 \times 10^{100} - 0.02 \times 10^{100}$

$= 1.98 \times 10^{100}$

$\rightarrow \begin{array}{r} 2.00 \\ -\ 0.02 \\ \hline 1.98 \end{array}$

1.98×10^{100} [2]

(d) Write 0.00701 in standard form.

7.01×10^{-3} [1]

(e) Simplify $1.5 \times 10^{x} + 1.5 \times 10^{x-1}$ giving your answer in standard form.

$1.5 \times 10^{x} + 0.15 \times 10^{1} \times 10^{x-1}$

$= 1.5 \times 10^{x} + 0.15 \times 10^{x}$

$= 1.65 \times 10^{x}$

$\rightarrow \begin{array}{r} 1.5 \\ +\ 0.15 \\ \hline 1.65 \end{array}$

1.65×10^{x} [2]

14 In this calculation, the three numbers are written in standard form.

$(4\times10^{p})\times(n\times10^{p+2})=3.2\times10^{t}$

n, p and t are integers.

Given n is an integer and the numbers are in standard form:

$4n = 32$

(disregard decimal point in 3·2)

(a) Find the value of n.

$4\times n\times10^{p}\times10^{p+2} = 3.2\times10^{t}$

$: \quad 4n\times10^{2p+2} = 3.2\times10^{t}$

$n =$ 8 [1]

(b) Find t in terms of p.

$4\times8\times10^{2p+2} = 3.2\times10^{t}$

$: \quad 32\times10^{2p+2} = 3.2\times10^{t}$

$: \quad 3.2\times10^{1}\times10^{2p+2} = 3.2\times10^{t}$

$: \quad 3.2\times10^{2p+3} = 3.2\times10^{t}$

$t =$ 2p + 3 [1]

20 Simplify $2.1\times10^{p}+2.1\times10^{p-1}$.
Give your answer in standard form.

$2.1\times10^{p} + 0.21\times10^{1}\times10^{p-1}$

$: \quad 2.1\times10^{p} + 0.21\times10^{p}$

$: \quad 2.31\times10^{p}$

$\begin{array}{r} 2.1 \\ +\,0.21 \\ \hline 2.31 \end{array}$

2.31×10^{p} [2]