Standard Form

Practice Worksheet (Problem Solving)

I Do

(a) Write 3.4×10^{-4} as an ordinary number.

..... *(1 mark)*

(b) Work out $(4.5 \times 10^5) \times (6 \times 10^4)$. Give your answer in standard form.

..... *(2 marks)*

(Total for Question is 3 marks)

We Do

(a) Write 6.2×10^{-3} as an ordinary number.

..... *(1 mark)*

(b) Work out $(3.5 \times 10^6) \times (4 \times 10^3)$. Give your answer in standard form.

..... *(2 marks)*

(Total for Question is 3 marks)

You Do 1

(a) Write 0.000081 in standard form.

..... *(1 mark)*

(b) Work out $(2.5 \times 10^{-4}) \times (8 \times 10^{7})$. Give your answer in standard form.

..... *(2 marks)*

(Total for Question is 3 marks)

You Do 2

(a) Write 7.05×10^{5} as an ordinary number.

..... *(1 mark)*

(b) Work out $(1.8 \times 10^{8}) \div (4.5 \times 10^{3})$. Give your answer in standard form.

..... *(2 marks)*

(Total for Question is 3 marks)

You Do 3

(a) Work out $(5.4 \times 10^5) + (3.2 \times 10^4)$. Give your answer in standard form.

..... *(2 marks)*

(b) Work out $(7.2 \times 10^{-3}) - (4 \times 10^{-4})$. Give your answer in standard form.

..... *(2 marks)*

(Total for Question is 4 marks)

Challenge 1

Given that

$$p = 4 \times 10^5 \qquad \text{and} \qquad q = 1.25 \times 10^{-2}$$

Work out the value of $\frac{p^2}{q}$.
Give your answer in standard form.
Show all of your working clearly.

.....

(Total for Question is 3 marks)

Challenge 2

$A = 4 \times 10^n$ and $B = 5 \times 10^{n-1}$, where n is an integer.

(a) Find an expression, in standard form in terms of n, for $A \times B$.

..... *(2 marks)*

(b) Find an expression, in standard form in terms of n, for $A + B$.

..... *(2 marks)*

(Total for Question is 4 marks)

Extreme Challenge

$x = 4 \times 10^p$ and $y = 5 \times 10^q$, where p and q are integers.

(a) Express x^2y in standard form in terms of p and q.

..... *(2 marks)*

(b) Given that $x^2y = 8 \times 10^{17}$ and $\frac{y}{x} = 1.25 \times 10^{-5}$, find the value of p and the value of q.
You must show all of your algebraic working clearly.

$p =$ ..... $q =$ ..... *(3 marks)*

(Total for Question is 5 marks)

Worked Answers

I Do

(a) Move the decimal point 4 places to the left: **0**.**00034**.
(b) Multiply the numbers and add the powers of 10:
$(4.5 \times 6) \times 10^{5+4} = 27 \times 10^{9}$.
Adjust into standard form ($27 = 2.7 \times 10^{1}$):
$2.7 \times 10^{1} \times 10^{9} =$ **2**.**7** $\times$ **10**$^{\mathbf{10}}$.

We Do

(a) Move the decimal point 3 places to the left: **0**.**0062**.
(b) $(3.5 \times 4) \times 10^{6+3} = 14 \times 10^{9} =$ **1**.**4** $\times$ **10**$^{\mathbf{10}}$.

You Do 1

(a) Move the decimal point 5 places to the right to get 8.1: **8**.**1** $\times$ **10**$^{\mathbf{-5}}$.
(b) $(2.5 \times 8) \times 10^{-4+7} = 20 \times 10^{3} =$ **2** $\times$ **10**$^{\mathbf{4}}$.

You Do 2

(a) Move the decimal point 5 places to the right: **705 000**.
(b) Divide the numbers and subtract the powers of 10:
$(1.8 \div 4.5) \times 10^{8-3} = 0.4 \times 10^{5}$.
Adjust into standard form ($0.4 = 4 \times 10^{-1}$):
$4 \times 10^{-1} \times 10^{5} =$ **4** $\times$ **10**$^{\mathbf{4}}$.

You Do 3

(a) Convert to the same power of 10 (or ordinary numbers):
$5.4 \times 10^{5} + 0.32 \times 10^{5} =$ **5**.**72** $\times$ **10**$^{\mathbf{5}}$ *(or* $540\,000 + 32\,000 = 572\,000$*)*.
(b) Convert to the same power of 10 (or ordinary numbers):
$7.2 \times 10^{-3} - 0.4 \times 10^{-3} =$ **6**.**8** $\times$ **10**$^{\mathbf{-3}}$ *(or* $0.0072 - 0.0004 = 0.0068$*)*.

Challenge 1

1. Find p^2:
$p^2 = (4 \times 10^{5})^2 = 4^2 \times (10^{5})^2 = 16 \times 10^{10}$.
2. Divide by q:
$\dfrac{p^2}{q} = \dfrac{16 \times 10^{10}}{1.25 \times 10^{-2}} = (16 \div 1.25) \times 10^{10-(-2)} = 12.8 \times 10^{12}$.
3. Adjust into standard form:
$12.8 \times 10^{12} = 1.28 \times 10^{1} \times 10^{12} =$ **1**.**28** $\times$ **10**$^{\mathbf{13}}$.

Challenge 2

(a) Multiply A and B:
$A \times B = (4 \times 10^n) \times (5 \times 10^{n-1}) = (4 \times 5) \times 10^{n+(n-1)} = 20 \times 10^{2n-1}$.
Adjust $20 = 2 \times 10^1$:
$A \times B = 2 \times 10^1 \times 10^{2n-1} = \mathbf{2} \times \mathbf{10^{2n}}$.

(b) Rewrite B with power 10^n:
$B = 5 \times 10^{n-1} = 0.5 \times 10^n$.
Add A and B:
$A + B = 4 \times 10^n + 0.5 \times 10^n = \mathbf{4.5} \times \mathbf{10^n}$.

Extreme Challenge

(a) 1. Square x:
$x^2 = (4 \times 10^p)^2 = 16 \times 10^{2p}$.
2. Multiply by y:
$x^2y = (16 \times 10^{2p}) \times (5 \times 10^q) = 80 \times 10^{2p+q}$.
3. Adjust into standard form ($80 = 8 \times 10^1$):
$x^2y = \mathbf{8} \times \mathbf{10^{2p+q+1}}$.

(b) 1. Equate the powers of 10 from $x^2y = 8 \times 10^{17}$:
$2p + q + 1 = 17 \implies 2p + q = 16$.
2. Express $\frac{y}{x}$ in standard form:
$\frac{y}{x} = \frac{5 \times 10^q}{4 \times 10^p} = 1.25 \times 10^{q-p}$.
Equate the powers of 10 with 1.25×10^{-5}:
$q - p = -5 \implies q = p - 5$.
3. Substitute $q = p - 5$ into $2p + q = 16$:
$2p + (p - 5) = 16$
$3p - 5 = 16 \implies 3p = 21 \implies \mathbf{p = 7}$.
4. Find q:
$q = 7 - 5 = \mathbf{2}$.