



1 Work out $(7 \times 10^4) \times (3 \times 10^5)$

Give your answer in standard form.

(2 marks)

Multiply the number parts

$$7 \times 3 = 21. \text{ Add the powers: } 10^4 \times 10^5 = 10^9$$

This gives 21×10^9 , which is not in standard form

$$21 = 2.1 \times 10, \text{ so the answer is } 2.1 \times 10^{10}$$

$$\boxed{2.1 \times 10^{10}}$$

2 Work out $(9 \times 10^8) \div (3 \times 10^{-2})$

Give your answer in standard form.

(2 marks)

Divide the number parts

$$9 / 3 = 3$$

Subtract the powers

$$10^8 / 10^{-2} = 10^{(8 - (-2))} = 10^{10}$$

So the answer is 3×10^{10}

$$\boxed{3 \times 10^{10}}$$

3 Work out $(6.5 \times 10^5) + (5.8 \times 10^5)$

Give your answer in standard form.

(2 marks)

$$= (6.5 \times 10^5) + (5.8 \times 10^5)$$

$$= (6.5 + 5.8) \times 10^5$$

$$= 12.3 \times 10^5$$

12.3 is bigger than 10, so move the point

$$= 1.23 \times 10^6$$

$$\boxed{1.23 \times 10^6}$$

- 4 Work out $(3 \times 10^4)^2$
Give your answer in standard form.

(2 marks)

$$\begin{aligned} &= (3 \times 10^4)^2 \\ &= 3^2 \times (10^4)^2 \\ &= 9 \times 10^8 \end{aligned}$$

$$\boxed{9 \times 10^8}$$

- 5 $8w = 2 \times 10^5$
Find the value of w .
Give your answer in standard form.

(2 marks)

$$w = (2 \times 10^5) / 8 = 0.25 \times 10^5$$

0.25×10^5 is not in standard form

$$0.25 = 2.5 \times 10^{-1}$$

$$\text{So } w = 2.5 \times 10^4 (= 25,000)$$

$$\boxed{2.5 \times 10^4}$$

- 6 Work out $(4.6 \times 10^5) + (3.1 \times 10^4)$
Give your answer in standard form.

(3 marks)

Write both as ordinary numbers

$$4.6 \times 10^5 = 460,000 \text{ and } 3.1 \times 10^4 = 31,000$$

Add them

$$460,000 + 31,000 = 491,000$$

In standard form

$$491,000 = 4.91 \times 10^5$$

$$\boxed{4.91 \times 10^5}$$

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

(2 marks)

$$\begin{aligned} &= (2 \times 10^{-3})^3 \\ &= 2^3 \times (10^{-3})^3 \end{aligned}$$

multiply the powers: $-3 \times 3 = -9$

$$= 8 \times 10^{-9}$$

$$\boxed{8 \times 10^{-9}}$$

8

A red blood cell has a diameter of 7×10^{-6} metres.

3 000 000 red blood cells are placed in a straight line, touching end to end.

Work out the length of the line. Give your answer in metres, in standard form.

(4 marks)

$$3\,000\,000 = 3 \times 10^6$$

$$\text{length} = (3 \times 10^6) \times (7 \times 10^{-6})$$

multiply the numbers, add the powers

$$= 21 \times 10^0$$

21 is bigger than 10

$$= 2.1 \times 10^1$$

$$\boxed{2.1 \times 10^1 \text{ m}}$$

9

The mass of the Earth is 5.97×10^{24} kg.

The mass of the Moon is 7.35×10^{22} kg.

Work out the mass of the Moon as a percentage of the mass of the Earth. Give your answer correct to 3 significant figures.

(3 marks)

$$\text{Moon} \div \text{Earth} = (7.35 \times 10^{22}) \div (5.97 \times 10^{24})$$

divide the numbers, subtract the powers

$$= 1.2312... \times 10^{-2}$$

$$= 0.012312...$$

$\times 100$ for a percentage

$$= 1.2312...\%$$

$$\boxed{1.23\%}$$

- 10 The kinetic energy, E joules, of a moving object is given by

$$E = \frac{1}{2}mv^2$$

where m is the mass in kg and v is the speed in metres per second.

$$m = 4 \times 10^{-3} \text{ and } v = 6 \times 10^2$$

Work out the value of E . Give your answer in standard form.

(3 marks)

$$v^2 = (6 \times 10^2)^2$$

$$= 36 \times 10^4$$

$$= 3.6 \times 10^5$$

$$\frac{1}{2}m = \frac{1}{2} \times 4 \times 10^{-3} = 2 \times 10^{-3}$$

$$E = (2 \times 10^{-3}) \times (3.6 \times 10^5)$$

$$= 7.2 \times 10^2$$

$$E = 7.2 \times 10^2$$

- 11 Work out $(6.4 \times 10^6) - (5.9 \times 10^5)$

Give your answer in standard form.

(3 marks)

Write both as ordinary numbers

$$6.4 \times 10^6 = 6,400,000 \text{ and } 5.9 \times 10^5 = 590,000$$

Subtract

$$6,400,000 - 590,000 = 5,810,000$$

In standard form

$$5,810,000 = 5.81 \times 10^6$$

$$5.81 \times 10^6$$

- 12 The population of country A is 6.85×10^7
The population of country B is 928,000
Work out the total population of the two countries.
Give your answer in standard form.

(4 marks)

Write country A's population as an ordinary number

$$6.85 \times 10^7 = 68,500,000$$

Add country B's population

$$68,500,000 + 928,000 = 69,428,000$$

In standard form

$$69,428,000 = 6.9428 \times 10^7$$

$$\boxed{6.9428 \times 10^7}$$

- 13 A phone network handles 3.2×10^5 text messages every hour.
Work out an estimate for the number of text messages handled in 30 days. Give your answer in standard form, correct to 2 significant figures.

(3 marks)

$$30 \text{ days} = 30 \times 24 = 720 \text{ hours}$$

$$720 = 7.2 \times 10^2$$

$$\text{texts} = (3.2 \times 10^5) \times (7.2 \times 10^2)$$

$$= 23.04 \times 10^7$$

$$= 2.304 \times 10^8$$

2 significant figures

$$\boxed{2.3 \times 10^8}$$

- 14 A grain of sand has a mass of 0.0032 grams.
A bag contains 5×10^6 grains of sand.
Work out the total mass of the sand in the bag.
Give your answer in grams, in standard form.

(4 marks)

Write 0.0032 in standard form: 3.2×10^{-3}

Multiply

$$(3.2 \times 10^{-3}) \times (5 \times 10^6) = (3.2 \times 5) \times 10^{(-3+6)} = 16 \times 10^3$$

16×10^3 is not in standard form

$$16 = 1.6 \times 10, \text{ so the answer is } 1.6 \times 10^4 \text{ grams}$$

$$\boxed{1.6 \times 10^4 \text{ g}}$$

15

Data travels along an undersea fibre-optic cable at a speed of 2×10^5 kilometres per second.

The cable is 1.3×10^4 kilometres long.

a. Work out the time taken for data to travel the full length of the cable.

Give your answer in seconds, in standard form.

b. Write your answer to part (a) in milliseconds.

(4 marks)

$$\text{a) Time} = \text{distance} / \text{speed} = (1.3 \times 10^4) / (2 \times 10^5)$$

$$\text{a) } 1.3 / 2 = 0.65 \text{ and } 10^4 / 10^5 = 10^{-1}, \text{ giving } 0.65 \times 10^{-1} = 6.5 \times 10^{-2} \text{ seconds}$$

$$\text{b) } 1 \text{ second} = 1000 \text{ milliseconds, so } 6.5 \times 10^{-2} \text{ s} = 0.065 \times 1000 = 65 \text{ milliseconds}$$