STANDARD FORM OPERATIONS

Task 1 – Complete the following operations. Give your answers in standard form.

1) $(3.2 \times 10^5) + (4.5 \times 10^5) = \mathbf{7.7 \times 10^5}$
2) $(7.1 \times 10^6) - (3.9 \times 10^6) = \mathbf{3.2 \times 10^6}$
3) $(5.6 \times 10^4) + (2.3 \times 10^3) = \mathbf{5.83 \times 10^4}$
4) $(8.9 \times 10^{-3}) + (1.2 \times 10^{-3}) = \mathbf{1.01 \times 10^{-2}}$
5) $(4.7 \times 10^{-2}) - (2.8 \times 10^{-2}) = \mathbf{1.9 \times 10^{-2}}$
6) $(3 \times 10^4) \times (2 \times 10^3) = \mathbf{6 \times 10^7}$
7) $(5.2 \times 10^5) \times (4 \times 10^{-2}) = \mathbf{2.08 \times 10^4}$
8) $(6 \times 10^{-3}) \times (7 \times 10^{-6}) = \mathbf{4.2 \times 10^{-8}}$
9) $(8.5 \times 10^2) \times (3.2 \times 10^4) = \mathbf{2.72 \times 10^7}$
10) $(9 \times 10^{-5}) \times (2.1 \times 10^3) = \mathbf{1.89 \times 10^{-1}}$
11) $(4.8 \times 10^7) \div (1.2 \times 10^3) = \mathbf{4 \times 10^4}$
12) $(6 \times 10^{-2}) \div (3 \times 10^4) = \mathbf{2 \times 10^{-6}}$
13) $(9 \times 10^6) \div (3 \times 10^2) = \mathbf{3 \times 10^4}$
14) $(2.1 \times 10^{-3}) \div (7 \times 10^{-7}) = \mathbf{3 \times 10^3}$
15) $(5 \times 10^3) \div (2 \times 10^5) = \mathbf{2.5 \times 10^{-2}}$

Task 2 – Give your answers in standard form.

16) The population of Country A is 3.5×10^7. The population of Country B is 2.2×10^7. Find the total population of the countries.
$3.5 \times 10^7 + 2.2 \times 10^7 = \mathbf{5.7 \times 10^7}$

17) A city has 8.1×10^6 people in 2020. By 2025, the population increased by 4.9×10^5. What is the population in 2025?
$8.1 \times 10^6 + 4.9 \times 10^5 = \mathbf{8.59 \times 10^6}$

18) A scientist measures the mass of a rock as 6.2×10^3 g and the mass of another rock as 4.8×10^3 g. Find their total mass.
$6.2 \times 10^3 + 4.8 \times 10^3 = \mathbf{1.1 \times 10^4}$

19) The Sun's diameter is 1.39×10^6 km and Earth's diameter is 1.28×10^4 km. How much bigger is the Sun's diameter?
$1.39 \times 10^6 - 1.28 \times 10^4 = \mathbf{1.3772 \times 10^6}$

20) A microbe is 5×10^{-6} m long. Another microbe is 3×10^{-6} m long. What is their combined length?

$5 \times 10^{-6} + 3 \times 10^{-6} = \mathbf{8 \times 10^{-6}}$

21) The speed of light is 3×10^8 m/s. How far does light travel in 2×10^2 seconds?
$(3 \times 10^8) \times (2 \times 10^2) = \mathbf{6 \times 10^{10}\ m}$

22) A machine produces 4.5×10^3 screws each hour. How many screws does it produce in 3×10^2 hours?
$(4.5 \times 10^3) \times (3 \times 10^2) = \mathbf{1.35 \times 10^6\ screws}$

23) A grain of sand has a mass of 3×10^{-5} g. Find the total mass of 2×10^3 grains of sand.
$(3 \times 10^{-5}) \times (2 \times 10^3) = \mathbf{6 \times 10^{-2}\ g}$

24) A spacecraft travels 7.2×10^6 kilometres in 1.8×10^3 seconds. What is the speed of the spacecraft in km/s?
$(7.2 \times 10^6) \div (1.8 \times 10^3) = \mathbf{4 \times 10^3\ km/s}$

25) A car's engine produces 4×10^5 watts of power. A train's engine produces 1.2×10^7 watts of power. How many times more powerful is the train's engine than the car's?
$(1.2 \times 10^7) \div (4 \times 10^5) = 3 \times 10^1$
The train's engine is 30 times more powerful

26) Work out the value of $\frac{0.04 \times 0.008}{0.002}$. Give your answer in standard form.

$$\frac{(4 \times 10^{-2}) \times (8 \times 10^{-3})}{2 \times 10^{-3}}$$

$$= \frac{32 \times 10^{-5}}{2 \times 10^{-3}}$$

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

$$= \mathbf{1.6 \times 10^{-1}}$$

27) Work out the value of $\frac{4.587 \times 10^{-11}}{3.4 \times 10^4}$. Give your answer in standard form to 4 significant figures.

$$1.3491\ldots \times 10^{-15}$$

$$= \mathbf{1.349 \times 10^{-15}}$$

28) A sphere has a radius of 3.5×10^4 mm. Work out the volume of the sphere. Give your answer in standard form to 3 decimal places.

$$V = \frac{4}{3}\pi r^3$$

$$V = \frac{4}{3} \times \pi \times (3.5 \times 10^4)^3$$

$$= 1.79594 \ldots \times 10^{14}$$

$$= \mathbf{1.796 \times 10^{14}}$$

Challenge

29) The mass of a neutron is 1.675×10^{-27} kg. The mass of a helium nucleus is 6.646×10^{-27} kg. How many neutrons would have the same mass as 50 helium nuclei? Give your answer to the nearest unit.

Total mass of 50 helium nuclei:

$$50 \times (6.646 \times 10^{-27})$$
$$= 3.323 \times 10^{-25}\ kg$$

Number of neutrons:

$$(3.323 \times 10^{-25}) \div (1.675 \times 10^{-27})$$
$$= 198.388 \ldots$$

$$\mathbf{199\ nuetrons}$$

30) Given that, $a = 2.5 \times 10^7$ and $b = 4 \times 10^{-3}$, calculate $\frac{a^2 \times b^3}{5 \times 10^5}$. Give your answer in standard form.

$$\frac{(2.5 \times 10^7) \times (2.5 \times 10^7) \times (4 \times 10^{-3}) \times (4 \times 10^{-3}) \times (4 \times 10^{-3})}{5 \times 10^5}$$

$$= \frac{400 \times 10^5}{5 \times 10^5}$$

$$= 80$$

$$= \mathbf{8 \times 10^1}$$

31) The speed of light is 3×10^8 m/s. A particle travels at 6×10^{-4} times the speed of light for 2.5×10^6 s. How far does it travel? Give your answer in standard form in kilometres.

Speed:

$$(6 \times 10^{-4}) \times (3 \times 10^8) = 1.8 \times 10^5\ m/s$$

Distance:

$$(1.8 \times 10^5) \times (2.5 \times 10^6) = 4.5 \times 10^{11}\ m$$

$$\mathbf{4.5 \times 10^8\ km}$$

32) The product of two quantities is:

1.728×10^5

If one quantity is 4.5×10^2, work out the other in standard form. Then check your answer using ordinary numbers.

Other quantity:

$$\frac{(1.728 \times 10^5)}{(4.5 \times 10^2)}$$

$$= \left(\frac{1.728}{4.5}\right) \times 10^3$$

$$= 0.384 \times 10^3$$

$$= \mathbf{3.84 \times 10^2}$$

Check:

$$1.728 \times 10^5 = 172800$$
$$4.5 \times 10^2 = 450$$
$$3.84 \times 10^2 = 384$$

$$450 \times 384 = 172800\ \checkmark$$