

## LARGE POWERS OF 10

**Task 1 – For each of the following, give your answers in standard form.**

1)  $(7.2 \times 10^{68}) \times (4.5 \times 10^{93})$

2)  $(3.9 \times 10^{144}) \times (2.4 \times 10^{-37})$

3)  $(1.6 \times 10^{182}) \div (4 \times 10^{29})$

4)  $(9.5 \times 10^{211}) \div (3.8 \times 10^{-19})$

5)  $(5.2 \times 10^{125}) \times (6.8 \times 10^{77})$

6)  $(2.4 \times 10^{101}) \times (7 \times 10^{56})$

7)  $(4.3 \times 10^{88}) \div (1.1 \times 10^{12})$

8)  $\frac{(2.7 \times 10^{64})^3}{(9 \times 10^{58})^2}$

9) An observatory records photon readings from a telescope. The size of each uncompressed reading is  $4.6 \times 10^{173}$  units of data. Each reading is compressed by a factor of  $2.3 \times 10^{-7}$ . A storage block can hold  $5 \times 10^{168}$  units of data. Work out how many compressed readings fit into one block.

10) A data centre processes  $3.2 \times 10^{152}$  bytes per second for 45 minutes. Work out the total number of bytes of data that was processed.

**Task 2 – For each of the following, give your answers in standard form.**

11)  $(8 \times 10^{137}) + (3.4 \times 10^{137})$

12)  $(6.1 \times 10^{159}) - (2.9 \times 10^{159})$

13)  $(9.3 \times 10^{120}) + (1.7 \times 10^{121})$

14)  $(4.8 \times 10^{-188}) + (7 \times 10^{-189})$

15)  $(5.6 \times 10^{134}) - (4.2 \times 10^{133})$

16)  $(3.1 \times 10^{76}) + (2.49 \times 10^{78})$

17)  $(7.5 \times 10^{-162}) - (2.3 \times 10^{-163})$

18)  $(2.2 \times 10^{92})^2 + (4.4 \times 10^{184})$

19) A rare-event simulation logs  $6.02 \times 10^{146}$  events in Phase 1 and  $8.1 \times 10^{145}$  events in Phase 2. During validation,  $3.5 \times 10^{145}$  events are discarded. What is the final count in standard form?

20) A deep-sky survey estimates the mass of a cluster as  $2.7 \times 10^{45}$  kg with a correction of  $1.2 \times 10^{44}$  kg added for unseen matter, then subtracts  $8 \times 10^{43}$  kg for instrument bias. Find the corrected mass. Give your answer in standard form.

## Challenge

21) Given that,

$$(a \times 10^p) \times (b \times 10^q) = 3.15 \times 10^{210}$$

with,  $a = 4.5$ ,  $b = 7$ , and  $p - q = 19$

Work out the values of  $p$  and  $q$ .

22) The numbers

$$X = k \times 10^{190} \text{ and } Y = 8.0 \times 10^{188} \text{ satisfy}$$

$$X + Y = 8.56 \times 10^{190}.$$

Work out the value of  $k$ .

23) A student writes:

$$\begin{aligned}(4.0 \times 10^{172}) + (5.0 \times 10^{170}) \\ = 9.0 \times 10^{172}\end{aligned}$$

a) Explain the error.

b) Give the correct result in standard form.

24) Without completing a full calculation, order these numbers from least to greatest, justifying briefly:

$$A = (2.9 \times 10^{155}) \times (4 \times 10^{77})$$

$$B = (1.1 \times 10^{233})$$

$$C = (6 \times 10^{78})^3$$

25) Construct two different pairs  $(U, V)$  in standard form with  $U > V$  such that  $U + V = 1 \times 10^{161}$  and  $U \times V = 9 \times 10^{320}$