ICSE ML Aggarwal Solutions Class 8 Mathematics Chapter 2 Exponents and Powers

Ex 2.1

Question 1.

Evaluate:

(i) $\left(\dfrac{3}{5}\right)^{-2}$

(ii) $(-3)^{-3}$

(iii) $\left(\dfrac{2}{7}\right)^{-4}$

Solution:

(i) $\left(\dfrac{3}{5}\right)^{-2}$

$$= \left(\frac{5}{3}\right)^{2} \left\{ \because a^{-n} = \frac{1}{a^{n}} \right\}$$

$$= \frac{5}{3} \times \frac{5}{3}$$

$$= \frac{25}{9}$$

(ii) $(-3)^{-3}$

$$= \left(\frac{-1}{3}\right)^{3}$$

$$= \frac{-1}{3} \times \frac{-1}{3} \times \frac{-1}{3}$$

$$= -\frac{1}{27}$$

(iii) $\left(\dfrac{2}{7}\right)^{-4}$

$$= \left(\frac{7}{2}\right)^{-4}$$

$$= \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2}$$

$$= \frac{2401}{16}$$

Question 2.

Simplify:

(i) $\left[(2)^{-1} + (4)^{-1} + (3)^{-1}\right]^{-1}$

(ii) $\left[(4)^{-1} - (5)^{-1}\right]^2 \times \left(\dfrac{5}{8}\right)^{-1}$

(iii) $\left[4^0 + 4^2 - 2^3\right] \times 3^{-2}$

(iv) $\left[(5)^2 - \left(\dfrac{1}{4}\right)^{-2}\right] \times \left(\dfrac{3}{4}\right)^{-2}$

Solution:

(i) $\left[(2)^{-1} + (4)^{-1} + (3)^{-1}\right]^{-1}$

$\quad = \left(\dfrac{1}{2} + \dfrac{1}{4} + \dfrac{1}{3}\right)^{-1}$

$\quad = \left(\dfrac{6+3+4}{12}\right)^{-1}$

$\quad = \left(\dfrac{13}{12}\right)^{-1}$

$\quad = \dfrac{12}{13}$

(ii) $\left[(4)^{-1} - (5)^{-1}\right]^2 \times \left(\dfrac{5}{8}\right)^{-1}$

$\quad = \left(\dfrac{1}{4} - \dfrac{1}{5}\right)^2 \times \left(\dfrac{8}{5}\right)^1$

$\quad = \dfrac{5-4}{20} \times \left(\dfrac{8}{5}\right)^1$

$\quad = \left(\dfrac{1}{20}\right)^2 \times \dfrac{8}{5}$

$\quad = \dfrac{1}{20} \times \dfrac{1}{20} \times \dfrac{8}{5}$

$\quad = \dfrac{1}{250}$

(iii) $\left[4^0 + 4^2 - 2^3\right] \times 3^{-2}$

$\quad = (1 + 16 - 8) \times \dfrac{1}{3^2}$

$\quad = 9 \times \dfrac{1}{9} = 1$

(iv) $\left[(5)^2 - \left(\dfrac{1}{4}\right)^{-2}\right] \times \left(\dfrac{3}{4}\right)^{-2}$

$\quad = \left[25 - (4)^2\right] \times \left(\dfrac{4}{3}\right)^2$

$$= (25 - 16) \times \frac{16}{9}$$

$$= 9 \times \frac{16}{9} = 16$$

Question 3.

Find the multiplicative inverse of the following:

(i) $\left(\frac{81}{16} \right)^{\frac{-3}{4}}$

(ii) $\left\{ \left(\frac{-3}{2} \right)^{-4} \right\}^{\frac{1}{2}}$

(iii) $\left(\frac{5}{7} \right)^{-2} \times \left(\frac{5}{7} \right)^{4} \div \left(\frac{5}{7} \right)^{3}$

Solution:

(i) $\left(\frac{81}{16} \right)^{\frac{-3}{4}}$

$$= \left(\frac{16}{81} \right)^{\frac{3}{4}}$$

$$= \left(\frac{2^4}{3^4} \right)^{\frac{3}{4}}$$

$$= \left(\frac{2}{3} \right)^{4 \times \frac{3}{4}}$$

$$= \left(\frac{2}{3} \right)^{3}$$

$$= \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3}$$

$$= \frac{8}{27}$$

Multiplicative inverse of $\frac{8}{27} = \frac{27}{8}$

(ii) $\left\{ \left(\frac{-3}{2} \right)^{-4} \right\}^{\frac{1}{2}}$

$$= \left(\frac{-3}{2} \right)^{-4 \times \frac{1}{2}}$$

$$= \left(\frac{-3}{2} \right)^{-2}$$

$$= \left(\frac{2}{-3} \right)^{2}$$

$$= \frac{2 \times 2}{(-3) \times (-3)}$$

$$= \frac{4}{9}$$

Multiplicative inverse $= \dfrac{9}{4}$

(iii) $\left(\dfrac{5}{7}\right)^{-2} \times \left(\dfrac{5}{7}\right)^{4} \div \left(\dfrac{5}{7}\right)^{3}$

$\qquad = \left(\dfrac{7}{5}\right)^{2} \times \left(\dfrac{5}{7}\right)^{4} \div \left(\dfrac{5}{7}\right)^{3}$

$\qquad = \left(\dfrac{7}{5}\right)^{2} \times \left(\dfrac{5}{7}\right)^{4-3}$

$\qquad = \left(\dfrac{7}{5}\right)^{2} \times \left(\dfrac{5}{7}\right)^{1}$

$\qquad = \dfrac{7}{5} \times \dfrac{7}{5} \times \dfrac{5}{7}$

$\qquad = \dfrac{7}{5}$

Multiplicative inverse of $\dfrac{7}{5} = \dfrac{5}{7}$

ICSE ML Aggarwal Solutions Class 8 Mathematics Chapter 2 Exponents and Powers Part 2

Question 4.

(i) Express 16^{-2} as a power with base 2.

(ii) Express 125^{-4} as a power with base 5.

Solution:

(i) 16^{-2}

$$= \left(2^4\right)^{-2}$$

$$= 2^{4\times(-2)}$$

$$= 2^{-8}$$

$$= \frac{1}{2^8}$$

(ii) 125^{-4}

$$= \left(5^3\right)^{-4}$$

$$= (5)^{-3\times4}$$

$$= 5^{-12}$$

$$= \frac{1}{5^{12}}$$

Question 5.

Write the following numbers in expanded form using exponents:

(i) 2789.453

(ii) 3007.805

Solution:

(i) 2789.453

$$= 2\times10^3 + 7\times10^2 + 8\times10^1 + 9\times10^0 + 4\times10^{-1} + 5\times10^{-2} + 3\times10^{-3}$$

(ii) 3007.805

$$= 3\times10^3 + 7\times10^0 + 8\times10^{-1} + 5\times10^{-3}$$

Question 6.

Simplify and write in exponential form with positive exponent:

(i) $\left[\left\{\left(\dfrac{5}{7}\right)^2\right\}^{-1}\right]^{-3}$

(ii) $\left(\dfrac{2}{7}\right)^2 \times \left(\dfrac{7}{2}\right)^{-3} \div \left\{\left(\dfrac{7}{5}\right)^{-2}\right\}^{-4}$

(iii) $\left(\dfrac{4}{5}\right)^2 \times 5^4 \times \left(\dfrac{2}{5}\right)^{-2} \div \left(\dfrac{5}{2}\right)^{-3}$

(iv) $\dfrac{8^{-1} \times 5^3}{2^{-4}}$

Solution:

(i) $\left[\left\{\left(\dfrac{5}{7}\right)^2\right\}^{-1}\right]^{-3}$

$= \left\{\left(\dfrac{5}{7}\right)^2\right\}^{-1 \times (-3)}$

$= \left(\dfrac{5}{7}\right)^{2 \times 3}$

$= \left(\dfrac{5}{7}\right)^6$

(ii) $\left(\dfrac{2}{7}\right)^2 \times \left(\dfrac{7}{2}\right)^{-3} \div \left\{\left(\dfrac{7}{5}\right)^{-2}\right\}^{-4}$

$= \left(\dfrac{2}{7}\right)^2 \times \left(\dfrac{2}{7}\right)^3 \div \left(\dfrac{7}{5}\right)^{-2 \times (-4)}$

$= \left(\dfrac{2}{7}\right)^2 \times \left(\dfrac{2}{7}\right)^3 \div \left(\dfrac{7}{5}\right)^8$

$= \left(\dfrac{2}{7}\right)^2 \times \left(\dfrac{2}{7}\right)^3 \times \left(\dfrac{5}{7}\right)^8$

$= \dfrac{2^2}{7^2} \times \dfrac{2^3}{7^3} \times \dfrac{5^8}{7^8}$

$= \dfrac{2^{2+3}}{7^{2+3}} \times \dfrac{5^8}{7^8}$

$= \dfrac{2^5}{7^5} \times \dfrac{5^8}{7^8}$

$= \dfrac{2^5 \times 5^8}{7^{5+8}}$

$= \dfrac{2^5 \times 5^8}{7^{13}}$

(iii) $\left(\dfrac{4}{5}\right)^2 \times 5^4 \times \left(\dfrac{2}{5}\right)^{-2} \div \left(\dfrac{5}{2}\right)^{-3}$

$$= \frac{4^2}{5^2} \times 5^4 \times \frac{2^{-2}}{5^{-2}} \div \frac{5^{-3}}{2^{-3}}$$

$$= \frac{\left(2^2\right)^2 \times 5^4 \times 2^{-2}}{5^2 \times 5^{-2}} \times \frac{2^{-3}}{5^{-3}}$$

$$= \frac{2^4 \times 5^4 \times 2^{-2} \times 2^{-3}}{5^2 \times 5^{-2} \times 5^{-3}}$$

$$= 2^{4-2-3} \times 5^{4-2+2+3} = 2^{-1} \times 5^7$$

$$= \frac{5^7}{2^1}$$

(iv) $\dfrac{8^{-1} \times 5^3}{2^{-4}}$

$$= \frac{\left(2^3\right)^{-1} \times 5^3}{2^{-4}}$$

$$= \frac{2^{-3} \times 5^3}{2^{-4}}$$

$$= 2^{-3+4} \times 5^3$$

$$= 2^1 \times 5^3$$

$$= 2 \times 5 \times 5 \times 5$$

$$= 250$$

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Question 7.

Simplify and write the following in exponential form:

(i) $\left((-2)^3\right)^2 + 5^{-3} \div 5^{-5} - \left(-\dfrac{1}{2}\right)^0$

(ii) $3^{-5} \times 3^2 \div 3^{-6} + \left(2^2 \times 3\right)^2 + \left(\dfrac{2}{3}\right)^{-1} + 2^{-1} + \left(\dfrac{1}{19}\right)^{-1}$

Solution:

(i) $\left((-2)^3\right)^2 + 5^{-3} \div 5^{-5} - \left(-\dfrac{1}{2}\right)^0$

$\quad = (-2)^{3\times2} + \dfrac{1}{5^3} + \dfrac{1}{5^5} - 1$

$\quad = (-2)^6 + \dfrac{1}{5^3} \times 5^5 - 1$

$\quad = 64 + 5^{5-3} - 1 = 64 + 5^2 - 1$

$\quad = 64 + 25 - 1 = 88$

(ii) $3^{-5} \times 3^2 \div 3^{-6} + \left(2^2 \times 3\right)^2 + \left(\dfrac{2}{3}\right)^{-1} + 2^{-1} + \left(\dfrac{1}{19}\right)^{-1}$

$\quad = 3^{-5+2+6} + \left(2^4 \times 3^2\right) + \dfrac{3}{2} + \dfrac{1}{2} + 19^1$

$\quad = 3^3 + (16 \times 9) + \dfrac{4}{2} + 19$

$\quad = 27 + 144 + 2 + 19 = 192$

Question 8.

Simplify and write in exponential form with negative exponent:

(i) $5^3 \times \left(\dfrac{4}{5}\right)^3$

(ii) $\left[\left(\dfrac{3}{7}\right)^{-2}\right]^{-3}$

(iii) $\left(\dfrac{5}{9}\right)^{-2} \times \left(\dfrac{5}{3}\right)^2 \div \left(\dfrac{1}{5}\right)^{-2}$

(iv) $2^{-1} \left[\left(\dfrac{5}{3} \right)^4 + \left(\dfrac{3}{5} \right)^{-2} \right] \div \dfrac{17}{9}$

(v) $(-7)^3 \times \left(\dfrac{1}{-7} \right)^{-9} \div (-7)^{10}$

Solution:

(i) $5^3 \times \left(\dfrac{4}{5} \right)^3$

$= 5^3 \times \dfrac{4^3}{5^3}$

$= 5^{3-3} \times 4^3$

$= 1 \times 4^3$

$= 4^3$

$= \left(\dfrac{1}{4} \right)^{-3}$

(ii) $\left[\left(\dfrac{3}{7} \right)^{-2} \right]^{-3}$

$= \left(\dfrac{3}{7} \right)^{-2 \times (-3)}$

$= \left(\dfrac{3}{7} \right)^6$

$= \left(\dfrac{7}{3} \right)^{-6}$

(iii) $\left(\dfrac{5}{9} \right)^{-2} \times \left(\dfrac{5}{3} \right)^2 \div \left(\dfrac{1}{5} \right)^{-2}$

$= \dfrac{5^{-2}}{9^{-2}} \times \dfrac{5^2}{3^2} \div \dfrac{1}{5^{-2}}$

$= \dfrac{5^{-2} \times 5^2 \times 5^{-2}}{\left(3^2 \right)^{-2} \times 3^2}$

$= \dfrac{5^{-2+2-2}}{3^{-4} \times 3^2}$

$= \dfrac{5^{-2}}{3^{-4+2}}$

$= \dfrac{5^{-2}}{3^{-2}}$

$= \left(\dfrac{5}{3} \right)^{-2}$

(iv) $2^{-1} \left[\left(\dfrac{5}{3} \right)^4 + \left(\dfrac{3}{5} \right)^{-2} \right] \div \dfrac{17}{9}$

$$= 2^{-1} \left[\frac{5^4}{3^4} + \frac{3^{-2}}{5^{-2}} \right] \div \frac{17}{9}$$

$$= 2^{-1} \left[\frac{5^4}{3^4} + \frac{5^2}{3^2} \right] \div \frac{17}{9}$$

$$= 2^{-1} \left[\frac{625}{81} + \frac{25}{9} \right] \div \frac{17}{9}$$

$$= \frac{1}{2} \left[\frac{625 + 225}{81} \right] \times \frac{9}{17}$$

$$= \frac{1}{2} \times \frac{850}{81} \times \frac{9}{17} = \frac{25}{9}$$

$$= \frac{5^2}{3^2} = \left(\frac{5}{3} \right)^2 = \left(\frac{3}{5} \right)^{-2}$$

(v) $\ (-7)^3 \times \left(\dfrac{1}{-7} \right)^{-9} \div (-7)^{10}$

$$= (-7)^3 \times (-7)^9 \div (-7)^{10}$$

$$= (-7)^{3+9-10}$$

$$= (-7)^2$$

$$= \left(\frac{1}{-7} \right)^{-2}$$

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Question 9.

Simplify:

(i) $\dfrac{49 \times z^{-3}}{7^{-3} \times 10 \times z^{-5}} (z \neq 0)$

(ii) $\dfrac{9^3 \times 27 \times t^4}{(3)^2 \times (3)^4 \times t^2}$

(iii) $\dfrac{\left(3^{-2}\right)^2 \times \left(5^2\right)^{-3} \times \left(t^{-3}\right)^2}{\left(3^{-2}\right)^5 \times \left(5^3\right)^{-2} \times \left(t^{-4}\right)^3}$

(iv) $\dfrac{2^{-5} \times 15^{-5} \times 500}{5^{-6} \times 6^{-5}}$

Solution:

(i) $\dfrac{49 \times z^{-3}}{7^{-3} \times 10 \times z^{-5}} (z \neq 0)$

$= \dfrac{7^2 \times z^{-3}}{7^{-3} \times 10 \times z^{-5}}$

$= \dfrac{7^{2+3} \times z^{-3+5}}{10}$

$= \dfrac{7^5 \times z^2}{10}$

(ii) $\dfrac{9^3 \times 27 \times t^4}{(3)^2 \times (3)^4 \times t^2} = \dfrac{\left(3^2\right)^3 \times 3^3 \times t^4}{3^2 \times 3^4 \times t^2}$

$= \dfrac{3^6 \times 3^3 \times t^4}{3^2 \times 3^4 \times t^2}$

$= 3^{6+3-2-4} \times t^{4-2}$

$= 3^3 \times t^2$

$= 27t^2$

(iii) $\dfrac{\left(3^{-2}\right)^2 \times \left(5^2\right)^{-3} \times \left(t^{-3}\right)^2}{\left(3^{-2}\right)^5 \times \left(5^3\right)^{-2} \times \left(t^{-4}\right)^3}$

$$= \frac{3^{-2 \times 2} \times 5^{2 \times (-3)} \times t^{(-3) \times 2}}{(3)^{-2 \times 5} \times 5^{3 \times (-2)} \times t^{-4 \times 3}}$$

$$= \frac{3^{-4} \times 5^{-6} \times t^{-6}}{3^{-10} \times 5^{-6} \times t^{-12}}$$

$$= 3^{-4+10} \times 5^{-6+6} \times t^{-6+12}$$

$$= 3^6 \times 5^0 \times t^6$$

$$= 3^6 \times 1 \times t^6$$

$$= (3t)^6$$

(iv) $\dfrac{2^{-5} \times 15^{-5} \times 500}{5^{-6} \times 6^{-5}}$

$$= \frac{2^{-5} \times (3 \times 5)^{-5} \times 2^2 \times 5^3}{5^{-6} \times (2 \times 3)^{-5}}$$

$$= \frac{2^{-5} \times 3^{-5} \times 5^{-5} \times 2^2 \times 5^3}{5^{-6} \times 2^{-5} \times 3^{-5}}$$

$$= 2^{-5+2+5} \times 3^{-5+5} \times 5^{-5+3+6}$$

$$= 2^2 \times 3^0 \times 5^4$$

$$= 4 \times 1 \times 625$$

$$= 2500$$

Question 10.

By what number should $\left(\dfrac{3}{-2}\right)^{-3}$ be divided to get $\left(\dfrac{2}{3}\right)^2$?

Solution:

Required number $= \left(\dfrac{3}{-2}\right)^{-3} \div \left(\dfrac{2}{3}\right)^2$

$$= \frac{3^{-3}}{(-2)^{-3}} \div \frac{2^2}{3^2}$$

$$= \frac{3^{-3}}{(-2)^{-3}} \times \frac{3^2}{2^2}$$

$$= \frac{3^{-3} \times 3^2}{(-2)^{-3} \times (-2)^2}$$

$$= \frac{3^{-3+2}}{(-2)^{-3+2}}$$

$$= \frac{3^{-1}}{(-2)^{-1}}$$

$$= \frac{(-2)^1}{(3)^1}$$

$$= \frac{-2}{3}$$

Question 11.

Find the value of m for which $9^m \div 3^{-2} = 9^4$.

Solution:

$$9^m \div 3^{-2} = 9^4$$

$$\Rightarrow \left(3^2\right)^m \div 3^{-2} = \left(3^2\right)^4$$

$$\Rightarrow 3^{2m} \div 3^{-2} = 3^8$$

$$\Rightarrow 3^{2m+2} = 3^8$$

Comparing, we get

$$2m + 2 = 8$$

$$\Rightarrow 2m = 8 - 2 = 6$$

$$\Rightarrow m = \frac{6}{2} = 3$$

Question 12.

If $\left(\frac{-5}{7}\right)^{-4} \times \left(\frac{-5}{7}\right)^{12} = \left\{\left(\frac{-5}{7}\right)^3\right\}^x \times \left(\frac{-5}{7}\right)^{-1}$ find the value of x.

Solution:

$$\left(\frac{-5}{7}\right)^{-4} \times \left(\frac{-5}{7}\right)^{12} = \left\{\left(\frac{-5}{7}\right)^3\right\}^x \times \left(\frac{-5}{7}\right)^{-1}$$

$$\left(\frac{-5}{7}\right)^{-4} \times \left(\frac{-5}{7}\right)^{12} = \left(\frac{-5}{7}\right)^{3x} \times \left(\frac{-5}{7}\right)^{-1}$$

$$\Rightarrow \left(\frac{-5}{7}\right)^{-4+12} = \left(\frac{-5}{7}\right)^{3x-1}$$

$$\Rightarrow \left(\frac{-5}{7}\right)^{8} = \left(\frac{-5}{7}\right)^{3x-1}$$

Comparing, we get

$$\Rightarrow 8 = 3x - 1 \Rightarrow 3x = 8 + 1 = 9$$

$$x = \frac{9}{3} = 3$$

$$\therefore x = 3$$

Question 13.

Find x if $\left(\frac{-2}{3}\right)^{-13} \times \left(\frac{3}{-2}\right)^{8} = \left(\frac{-2}{3}\right)^{-2x+1}$

Solution:

$$\left(\frac{-2}{3}\right)^{-13} \times \left(\frac{3}{-2}\right)^{8} = \left(\frac{-2}{3}\right)^{-2x+1}$$

$$\Rightarrow \left(\frac{-2}{3}\right)^{-13} \times \left(\frac{-2}{3}\right)^{-8} = \left(\frac{-2}{3}\right)^{-2x+1}$$

$$\Rightarrow \left(\frac{-2}{3}\right)^{-13-8} = \left(\frac{-2}{3}\right)^{-2x+1}$$

$$\Rightarrow \left(\frac{-2}{3}\right)^{-21} = \left(\frac{-2}{3}\right)^{-2x+1}$$

Comparing, we get

$$-2x + 1 = -21 \Rightarrow 2x - 1 = 21$$

$$\Rightarrow 2x = 21 + 1 = 22$$

$$x = \frac{22}{2} = 11$$

Hence, x = 11

ICSE ML Aggarwal Solutions Class 8 Mathematics Chapter 2 Exponents and Powers Part 5

Question 14.

(i) If $5^{2x-1} = \dfrac{1}{(125)^{x-3}}$, find x.

(ii) If $\dfrac{9^n \times 3^5 \times (27)^3}{3 \times (81)^4} = 27$, find n.

Solution:

(i) $5^{2x-1} = \dfrac{1}{(125)^{x-3}}$

$\Rightarrow 5^{2x-1} = \dfrac{1}{\left(5^3\right)^{x-3}}$

$\Rightarrow 5^{2x-1} = \dfrac{1}{5^{3x-9}}$

$\Rightarrow 5^{2x-1} = 5^{-3x+9}$

Comparing, we get

$2x - 1 = -3x + 9$

$2x + 3x = 9 + 1 \Rightarrow 5x = 10$

$\Rightarrow x = \dfrac{10}{5} = 2$

$\therefore x = 2$

(ii) $\dfrac{9^n \times 3^5 \times (27)^3}{3 \times (81)^4} = 27$

$\Rightarrow \dfrac{9^n \times 3^5 \times (27)^3}{3 \times (81)^4} = 3^3$

$\Rightarrow \dfrac{\left(3^2\right)^n \times 3^5 \times \left(3^3\right)^3}{3 \times \left(3^4\right)^4} = 3^3$

$\Rightarrow \dfrac{3^{2n} \times 3^5 \times 3^9}{3 \times 3^{16}} = 3^3$

$\Rightarrow 3^{2n+5+9-1-16} = 3^3$

$\Rightarrow 3^{2n-3} = 3^3$

Comparing, we get

$$2n - 3 = 3 \Rightarrow 2n = 3 + 3 = 6$$

$$n = \frac{6}{2} = 3$$

$$\therefore n = 3$$

Ex 2.2

Question 1.

Express the following numbers in standard form:

(i) 0.0000000000085

(ii) 0.000000000000942

(iii) 6020000000000000

(iv) 0.00000000837

Solution:

(i) $0.0000000000085 = 8.5 \times 10^{-12}$

(ii) $0.000000000000942 = 9.42 \times 10^{-13}$

(iii) $6020000000000000 = 6.02 \times 10^{15}$

(iv) $0.00000000837 = 8.37 \times 10^{-9}$

Question 2.

Express the following numbers in the usual form:

(i) 3.02×10^{-6}

(ii) $1 - 007 \times 10^{11}$

(iii) 5.375×10^{14}

(iv) 7.579×10^{-14}

Solution:

(i) $3.02 \times 10^{-6} = 0.00000302$

(ii) $1 - 007 \times 10^{11} = 100700000000$

(iii) $5.375 \times 10^{14} = 537500000000000$

(iv) $7.579 \times 10^{-14} = 0.00000000000007579$

ICSE ML Aggarwal Solutions Class 8 Mathematics Chapter 2 Exponents and Powers Part 6

Question 3.

Express the number appearing in the following statements in standard form:

(i) The mass of a proton is 0.00000000000000000000001673 gram.

(ii) The thickness of a piece of paper is 0.0016 cm.

(iii) The diameter of a wire on a computer chip is 0.000003 m.

(iv) A helium atom has a diameter of $\dfrac{22}{100000000000} m$

(v) Mass of a molecule of hydrogen gas is about 0.00000000000000000000334 tons.

(vi) The human body has 1 trillion cells which vary in shapes and sizes.

(vii) The distance from the Earth of the Sun is 149, 600,000, 000 m.

(viii) The speed of light is 300,000, 000 m/sec.

(ix) Mass of the Earth is 5, 970, 000, 000, 000, 000, 000,000, 000 kg.

(x) Express 3 years in seconds.

(xi) Express 7 hectares in cm^2 .

(xii) A sugar factory has annual sales of 3 billion 720 million kilograms of sugar.

Solution:

(i) The mass of a proton is 0.00000000000000000000001673 gram $= 1.673 \times 10^{-24} gram$.

(ii) Thickness of a piece of paper is 0.0016 cm $= 1.6 \times 10^{-3}$

(iii) Diameter of a wire on a computer chip is $0.000003 m = 3.0 \times 10^{-6} m$

(iv) A helium atom has a diameter of $\dfrac{22}{100000000000}$ m $= 22 \times 10^{12} = 2.2 \times 10^{-10}$

(v) Mass of a molecule of hydrogen gas is about 0.00000000000000000000334 tons $= 3.34 \times 10^{-21}$ tons

(vi) Human body has 1 trillion of cells which vary in shapes and sizes

$= 1,000,000,000,000 = 10^{12}$

(vii) The distance from the Earth of the Sun is 149, 600,000, 000 m $= 1.496 \times 10^{11}$

(viii) The speed of light is 300,000, 000 m/sec $= 3.0 \times 10^8$ m/sec

(ix) Mass of the Earth is 5,970, 000.000, 000, 000, 000,000, 000 kg $= 5.97 \times 10^{24} kg$

(x) Express 3 years in seconds 3 years $= 3 \times 365 \, days$

$= 3 \times 365 \times 24 \text{hours}$

$= 3 \times 365 \times 24 \times 3600 \text{seconds}$

$= 1040688000 \text{seconds}$

$= 1.040688 \times 10^9 \text{seconds}$

(xi) Express 7 hectares in cm^2

7 hectares $= 7 \times 10000 m^2$

$= 7 \times 10000 \times 100 \times 100 cm^2$

$= 700000000 cm^2$

$= 7.0 \times 10^8 \, cm^2$

(xii) A sugar factory has annual sales of

3 billion 720 million kilograms of sugar >

Annual sale of a sugar factory = 3 billion

720 million kilograms sugar $= 3,720,000,000 \, kg = 3.72 \times 10^9 kg$

Question 4.

Compare the following:

(i) Size of a plant cell to the thickness of a piece of paper.

(ii) Size of a plant cell to the diameter of a wire on a computer chip.

(iii) The thickness of a piece of paper to the diameter of a wire on a computer chip.

Given size of plant cell = 0.00001275 m

Thickness of a piece of paper = 0.0016 cm

Diameter of a wire on a computer chip = 0.000003 m

Solution:

(i) Size of plant cell $= 0.00001275m = 1.275 \times 10^{-5} m$

Thickness of a piece of paper $= 0.0016 \, cm = 1.6 \times 10^{-3} cm$

Diameter of a wire on a computer chip $= 0.000003m = 3.0 \times 10^{-6} m$

(i) Size of plant cell: thickness of a piece of paper

$= 1.275 \times 10^{-5} : 1.6 \times 10^{-3}$

Size of plant cell = $\frac{1.2}{1.6}$ = $\frac{3}{4}$ times of thickness of paper

(ii) Comparison between size of plant cell: diameter of wire on a computer chip

$$= 1.275 \times 10^{-5} : 3.0 \times 10^{-6}$$

$$= 12.75 : 3.00$$

Size of plant cell is 4 times of diameter of wire.

(iii) Thickness of a piece of paper: diameter of a wire on a computer chip

$$= 1.6 \times 10^{-3} : 3.0 \times 10^{-6} \times 100 \ cm$$

$$= 1.6 \times 1000 : 300$$

$$= 16.1 : 3$$

Approximately 5 times is the thickness of paper to diameter of wire.

Question 5.

The number of red blood cells per cubic millimetre of blood is approximately 5.5 million. If the average body contains 5 litres of blood, what is the total number of red cells in the body? (1 litre = $1,00,000 \ mm^3$)

Solution:

Red blood per cubic millimeter = 5.5 million $= 5.5 \times 10^6$

Red blood in 5 litres of blood

$$= 5.5 \times 10^6 \times 5 \times 10^5 \ (1 \ \text{litre} = 10^5 \ \text{mm})$$

$$= 27.5 \times 10^{6+5}$$

$$= 27.5 \times 10^{11}$$

$$= 2.75 \times 10 \times 10^{11}$$

$$= 2.75 \times 10^{12}$$

Question 6.

Mass of Mars is 6.42×10^{29} kg and the mass of the sun is 1.99×10^{30} kg. What is the total mass?
Solution:

Mass of Mars = 6.42×10^{29} kg and mass of sun = 1.99×10^{30}

Total mass $= 6.42 \times 10^{29} + 1.99 \times 10^{30}$

$$= 10^{29} (6.42 + 1.99 \times 10)$$

$$= 10^{29} (6.42 + 19.9)$$

$$= 26.32 \times 10^{29}$$

Question 7.

A particular star is at a distance of about 8.1×10^{13} km from the Earth. Assuming that the light travels at 3×10^8 m/sec, find how long does light take from that star to reach the Earth. Solution:

Distance between earth and a particular star = 8.1×10^{13} km

Speed of light = 3×10^8 m/sec.

Time is taken to reach the earth

$$= \frac{8.1 \times 10^{13} \times 1000}{3 \times 10^8}$$

$$= 2.7 \times 10^{16-8}$$

$$= 2.7 \times 10^8 \text{ sec.}$$