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EXPONENTS AND POWERS

Exercise 13.1

Q.1. Find the value of :

- (i) 2^6 (ii) 9^3 (iii) 11^2 (iv) 5^4

Ans. (i) $2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$

(ii) $9^3 = 9 \times 9 \times 9 = 729$

(iii) $11^2 = 11 \times 11 = 121$

(iv) $5^4 = 5 \times 5 \times 5 \times 5 = 625$

Q.2. Express the following in exponential form :

- (i) $6 \times 6 \times 6 \times 6$ (ii) $t \times t$ (iii) $b \times b \times b \times b$
 (iv) $5 \times 5 \times 7 \times 7 \times 7$ (v) $2 \times 2 \times a \times a$
 (vi) $a \times a \times a \times c \times c \times c \times c \times d$

Ans. (i) $6 \times 6 \times 6 \times 6 = 6^4$

(ii) $t \times t = t^2$

(iii) $b \times b \times b \times b = b^4$

(iv) $5 \times 5 \times 7 \times 7 \times 7 = 5^2 \times 7^3$

(v) $2 \times 2 \times a \times a = 2^2 \times a^2$

(vi) $a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d$

Q.3. Express each of the following numbers using exponential notation :

- (i) 512 (ii) 343 (iii) 729 (iv) 3125

Ans. (i) $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^9$

(ii) $343 = 7 \times 7 \times 7 = 7^3$

(iii) $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

$$(iv) 3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^5$$

Q.4. Identify the greater number, wherever possible, in each of the following?

- (i) 4^3 or 3^4 (ii) 5^3 or 3^5 (iii) 2^8 or 8^2
 (iv) 100^2 or 2^{100} (v) 2^{10} or 10^2

Ans. (i) $4^3 = 4 \times 4 \times 4 = 64$
 $3^4 = 3 \times 3 \times 3 \times 3 = 81$
 $\Rightarrow 3^4 > 4^3$

(ii) $5^3 = 5 \times 5 \times 5 = 125$
 $3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243$
 $\Rightarrow 3^5 > 5^3$

(iii) $2^8 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 256$
 $8^2 = 8 \times 8 = 64$
 $\Rightarrow 2^8 > 8^2$

(iv) 100^2 or 2^{100}
 $100^2 = 100 \times 100 = 10000$
 $2^{100} = 2 \times 2 \times 2 \times 2 \dots \times 2 \times 2 = 2^{100}$
 $\Rightarrow 2^{100} > 100^2$

(v) 2^{10} or 10^2
 $2^{10} = 2 \times 2 \times \dots \times 2 = 1024$
 $10^2 = 10 \times 10 = 100$
 $\Rightarrow 2^{10} > 10^2$

Q.5. Express each of the following as product of powers of their prime factors :

- (i) 648 (ii) 405 (iii) 540 (iv) 3,600

Ans. (i) $648 = 2 \times 324 = 2 \times 2 \times 162$
 $= 2 \times 2 \times 2 \times 81 = 2 \times 2 \times 2 \times 9 \times 9$

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

$$(ii) \quad 405 = 3 \times 135 = 3 \times 3 \times 45$$

$$= 3 \times 3 \times 3 \times 3 \times 15$$

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

$$(iii) \quad 540 = 2 \times 270 = 2 \times 2 \times 135$$

$$= 2 \times 2 \times 3 \times 45 = 2 \times 2 \times 3 \times 3 \times 15$$

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

$$(iv) \quad 3600 = 2 \times 1800 = 2 \times 2 \times 900$$

$$= 2 \times 2 \times 2 \times 450 = 2 \times 2 \times 2 \times 2 \times 225$$

$$= 2 \times 2 \times 2 \times 2 \times 3 \times 75$$

$$= 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 25$$

$$= 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 5$$

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

Q.6. Simplify :

$$(i) \quad 2 \times 10^3 \quad (ii) \quad 7^2 \times 2^2 \quad (iii) \quad 2^3 \times 5 \quad (iv) \quad 3 \times 4^4$$

$$(v) \quad 0 \times 10^2 \quad (vi) \quad 5^2 \times 3^3 \quad (vii) \quad 2^4 \times 3^2 \quad (viii) \quad 3^2 \times 10^4$$

Ans. (i) $2 \times 10^3 = 2 \times 10 \times 10 \times 10$

$$= 2 \times 1000 = 2000$$

(ii) $7^2 \times 2^2 = 7 \times 7 \times 2 \times 2 = 49 \times 4 = 196$

(iii) $2^3 \times 5 = 2 \times 2 \times 2 \times 5 = 8 \times 5 = 40$

(iv) $3 \times 4^4 = 3 \times 4 \times 4 \times 4 \times 4 = 768$

(v) $0 \times 10^2 = 0 \times 10 \times 10 = 0$

(vi) $5^2 \times 3^3 = 5 \times 5 \times 3 \times 3 \times 3 = 25 \times 27 = 675$

(vii) $2^4 \times 3^2 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$

$$= 16 \times 9 = 144$$

(viii) $3^2 \times 10^4 = 3 \times 3 \times 10 \times 10 \times 10 \times 10$

$$= 9 \times 10000 = 90000$$

Q.7. Simplify :

- (i) $(-4)^3$ (ii) $(-3) \times (-2)^3$ (iii) $(-3)^2 \times (-5)^2$
 (iv) $(-2)^3 \times (-10)^3$

Ans. (i) $(-4)^3 = -4 \times -4 \times -4 = -64$
 (ii) $-3 \times (-2)^3 = -3 \times -2 \times -2 \times -2$
 $= -3 \times -8 = 24$
 (iii) $(-3)^2 \times (-5)^2 = -3 \times -3 \times -5 \times -5$
 $= 9 \times 25 = 225$
 (iv) $(-2)^3 \times (-10)^3 = -2 \times -2 \times -2 \times -10 \times -10 \times -10$
 $= -8 \times -1000$
 $= -8000$

Q.8. Compare the following numbers :

- (i) 2.7×10^{12} ; 1.5×10^8 (ii) 4×10^{14} ; 3×10^{17}

Ans. (i) $2.7 \times 10^{12} = \frac{27}{10} \times 10 \times 10^{11}$
 $= 27 \times 10^{11}$
 $= 3 \times 3 \times 3 \times 10^{11}$
 $= 3^3 \times 10^{11}$
 $1.5 \times 10^8 = \frac{15}{10} \times 10 \times 10^7$
 $= 15 \times 10^7$
 $= 3 \times 5 \times 10^7$
 $3^3 \times 10^{11} > 3 \times 5 \times 10^7$
 So, $2.7 \times 10^{12} > 1.5 \times 10^8$
 (ii) $\therefore 10^{17} > 10^{14}$
 So, $3 \times 10^{17} > 4 \times 10^{14}$

Exercise 13.2

Q.1. Using laws of exponents, simplify and write the answer in exponential form :

- | | | |
|---------------------------------|---------------------------|--|
| (i) $3^2 \times 3^4 \times 3^8$ | (ii) $6^{15} \div 6^{10}$ | (iii) $a^3 \times a^2$ |
| (iv) $7^x \times 7^2$ | (v) $(5^2)^3 \div 5^3$ | (vi) $2^5 \times 5^5$ |
| (vii) $a^4 \times b^4$ | (viii) $(3^4)^3$ | (ix) $(2^{20} \div 2^{15}) \times 2^3$ |
| (x) $8^t \div 8^2$ | | |

Ans. (i) $3^2 \times 3^4 \times 3^8 = 3^{2+4+8} = 3^{14} \quad (a^m \times a^n = a^{m+n})$

(ii) $3^{15} \div 6^{10} = \frac{6^{15}}{6^{10}} = 6^{15-10} = 6^5 \quad (a^m \div a^n = a^{m-n})$

(iii) $a^3 \times a^2 = a^{3+2} = a^5$

(iv) $7^x \times 7^2 = 7^{x+2}$

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

(vi) $2^5 \times 5^5 = (2 \times 5)^5 = 10^5$

(vii) $a^4 \times b^4 = (ab)^4$

(viii) $(3^4)^3 = 3^{4 \times 3} = 3^{12}$

(ix) $(2^{20} \div 2^{15}) \times 2^3 = \frac{2^{20}}{2^{15}} \times 2^3 = 2^{20-15} \times 2^3$
 $= 2^5 \times 2^3 = 2^{5+3} = 2^8$

(x) $8^t \div 8^2 = \frac{8^t}{8^2} = 8^{t-2}$

Q.2. Simplify and express each of the following in exponential form :

- | | | |
|---|--------------------------------------|-----------------------|
| (i) $\frac{2^3 \times 3^4 \times 4}{3 \times 32}$ | (ii) $[(5^2)^3 \times 5^4] \div 5^7$ | (iii) $25^4 \div 5^3$ |
|---|--------------------------------------|-----------------------|

$$(iv) \frac{3 \times 7^2 \times 11^8}{21 \times 11^3} \quad (v) \frac{3^7}{3^4 \times 3^3} \quad (vi) 2^0 + 3^0 + 4^0$$

$$(vii) 2^0 \times 3^0 \times 4^0 \quad (viii) (3^0 + 2^0) \times 5^0 \quad (ix) \frac{2^8 \times a^5}{4^3 \times a^3}$$

$$(x) \left(\frac{a^5}{a^3} \right) \times a^8 \quad (xi) \frac{4^5 \times a^8 b^3}{4^5 \times a^5 b^2} \quad (xii) (2^3 \times 2)^2$$

Ans. (i)
$$\frac{2^3 \times 3^4 \times 4}{3 \times 32} = \frac{2^3 \times 3^4 \times 4}{3 \times 2 \times 2 \times 2 \times 4}$$

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

$$= 3^3$$

(ii)
$$[(5^2)^3 \times 5^4] \div 5^7 = (5^6 \times 5^4) \div 5^7 \quad (a^m \times a^n = a^{m+n})$$

$$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7} \quad [a^m \div a^n = a^{m-n}]$$

$$= 5^{10-7} = 5^3$$

(iii)
$$25^4 \div 5^3 = \frac{25^4}{5^3} = \frac{(5^2)^4}{5^3} = \frac{5^8}{5^3}$$

$$= 5^{8-3} = 5^5$$

(iv)
$$\frac{3 \times 7^2 \times 11^8}{21 \times 11^3} = \frac{3 \times 7^2 \times 11^8}{7 \times 3 \times 11^3}$$

$$= \frac{3 \times 7 \times 7 \times 11^3 \times 11^5}{7 \times 3 \times 11^3} = 7 \times 11^5$$

(v)
$$\frac{3^7}{3^4 \times 3^3} = \frac{3^7}{3^{4+3}} \quad (a^m \div a^n = a^0 = 1)$$

$$= \frac{3^7}{3^7} = 3^0 \text{ or } 1$$

$$(vi) \quad 2^0 + 3^0 + 4^0 = 1 + 1 + 1 = 3 \quad (\text{where } a^0 = 1)$$

$$(vii) \quad 2^0 \times 3^0 \times 4^0 = 1 \times 1 \times 1 = 1 \quad \text{where } (a^0 = 1)$$

$$(viii) \quad (3^0 + 2^0) \times 5^0 = (1 + 1) \times 1 = 2 \times 1 = 2$$

$$(ix) \quad \frac{2^8 \times a^5}{4^3 \times a^3} = \frac{2^8 \times a^5}{(2^2)^3 \times a^3} = \frac{2^2 \times 2^6 \times a^2 \times a^3}{2^6 \times a^3}$$

$$= 2^2 \times a^2 = (2a)^2$$

$$(x) \quad \left(\frac{a^5}{a^3} \right) \times a^8 = \frac{a^{5+8}}{a^3} = \frac{a^{13}}{a^3}$$

$$= \frac{a^{10} \times a^3}{a^3} = a^{10}$$

$$(xi) \quad \frac{4^5 \times a^8 b^3}{4^5 \times a^5 b^2} = \frac{4^5 \times a^5 \times a^3 \times b^2 \times b}{4^5 \times a^5 \times b^2} = a^3 b$$

$$(xii) \quad (2^3 \times 2)^2 = 2^{3 \times 2} \times 2^2 = 2^6 \times 2^2 = 2^{6+2} = 2^8$$

Q.3. Say true or false and justify your answer :

$$(i) \quad 10 \times 10^{11} = 100^{11} \quad (ii) \quad 2^3 > 5^2$$

$$(iii) \quad 2^3 \times 3^2 = 6^5 \quad (iv) \quad 3^0 = (1000)^0$$

Ans. (i) $10 \times 10^{11} = 100^{11}$

L.H.S. $(10)^{11+1} = (10)^{12}$

R.H.S. $= (100)^{11} = (10^2)^{11} = 10^{22}$

Hence, L.H.S. $\neq$ R.H.S.

So, $10 \times 11^{11} = 100^{11}$ (False)

(ii) $2^3 > 5^2$ L.H.S. $2^3 = 8$

R.H.S. $5^2 = 25$

$\therefore 5^2 > 2^3$

So, $2^3 > 5^2$ (False)

(iii) $2^3 \times 3^2 = 6^5$

$$\text{L.H.S.} = 2^3 \times 3^2$$

$$\text{R.H.S.} = 6^5 = (2 \times 3)^5 = 2^5 \times 3^5$$

$$\therefore \text{L.H.S.} \neq \text{R.H.S.}$$

$$\text{So, } 2^3 \times 3^2 = 6^5 \quad (\text{False})$$

$$(iv) \quad 3^0 = (1000)^0$$

$$\text{L.H.S.} = 3^0 = 1 \quad (\text{where, } a^0 = 1)$$

$$\text{R.H.S.} = 1000^0 = 1$$

$$\therefore \text{L.H.S.} = \text{R.H.S.} \quad (\text{True})$$

Q.4. Express each of the following as a product of prime factors only in exponential form :

(i) 108×192

(ii) 270

(iii) 729×64

(iv) 768

$$\begin{aligned} \text{Ans. (i) } 108 \times 192 &= (2 \times 2 \times 3 \times 3 \times 3) \times (2 \times 2 \\ &\quad \times 2 \times 2 \times 2 \times 2 \times 3) \\ &= 2^8 \times 3^4 \end{aligned}$$

$$(ii) \quad 270 = 2 \times 5 \times 3 \times 3 \times 3 = 2 \times 5 \times 3^3$$

$$\begin{aligned} (iii) \quad 729 \times 64 &= (3 \times 3 \times 3 \times 3 \times 3 \times 3) \times (2 \times 2 \\ &\quad \times 2 \times 2 \times 2 \times 2) \\ &= 3^6 \times 2^6 \end{aligned}$$

$$\begin{aligned} (iv) \quad 768 &= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \\ &= 2^8 \times 3 \end{aligned}$$

Q.5. Simplify :

$$(i) \quad \frac{(2^5)^2 \times 7^3}{8^3 \times 7}$$

$$(ii) \quad \frac{25 \times 5^2 \times t^8}{10^3 \times t^4}$$

$$(iii) \quad \frac{3^5 \times 10^5 \times 25}{5^7 \times 6^5}$$

$$\text{Ans. (i)} \quad \frac{(2^5)^2 \times 7^3}{8^3 \times 7} = \frac{2^{10} \times 7^3}{(2 \times 2 \times 2)^3 \times 7}$$

$$= \frac{2^{10} \times 7^3}{(2^3)^3 \times 7}$$

$$= \frac{2^{10} \times 7^3}{2^9 \times 7}$$

$$= 2 \times 7^2$$

$$= 2 \times 49 = 98$$

$$\text{(ii)} \quad \frac{25 \times 5^2 \times t^8}{10^3 \times t^4} = \frac{5 \times 5 \times 5^2 \times t^8}{(5 \times 2)^3 \times t^4} = \frac{5^2 \times 5^2 \times t^8}{5^3 \times 2^3 \times t^4}$$

$$= \frac{5^4 \times t^8}{5^3 \times 2^3 \times t^4}$$

$$= \frac{5^3 \times 5 \times t^8}{5^3 \times 2^3 \times t^4}$$

$$= \frac{5 \times t^4}{2^3} = \frac{5t^4}{8}$$

$$\text{(iii)} \quad \frac{3^5 \times 10^5 \times 25}{5^7 \times 6^5} = \frac{3^5 \times (5 \times 2)^5 \times 5 \times 5}{5^7 \times (3 \times 2)^5}$$

$$= \frac{3^5 \times 5^5 \times 2^5 \times 5^2}{5^7 \times 3^5 \times 2^5}$$

$$= \frac{3^5 \times 5^7 \times 2^5}{5^7 \times 3^5 \times 2^5} = 1$$

Exercise 13.3

**Q.1. Write the following numbers in the expanded forms :
279404, 3006194, 2806196, 120719, 20068**

Ans. $279404 = 2 \times 100000 + 7 \times 10000 + 9 \times 1000 + 4 \times 100$
 $\quad\quad\quad + 0 \times 10 + 4 \times 1 \times 1$
 $= 2 \times 10^5 + 7 \times 10^4 + 9 \times 10^3 + 4 \times 10^2$
 $\quad\quad\quad + 0 \times 10^1 + 4 \times 10^0$

$3006194 = 3 \times 1000000 + 0 \times 100000 + 0 \times 10000$
 $\quad\quad\quad + 6 \times 1000 + 1 \times 100 + 9 \times 10 + 4 \times 1$
 $= 3 \times 10^6 + 0 \times 10^5 + 0 \times 10^4 + 6 \times 10^3$
 $\quad\quad\quad + 1 \times 10^2 + 9 \times 10^1 + 4 \times 10^0$

$2806196 = 2 \times 1000000 + 8 \times 100000 + 0 \times 10000$
 $\quad\quad\quad + 6 \times 1000 + 1 \times 100 + 9 \times 10 + 6 \times 1$
 $= 2 \times 10^6 + 8 \times 10^5 + 0 \times 10^4 + 6 \times 10^3 + 1 \times 10^2$
 $\quad\quad\quad + 9 \times 10^1 + 6 \times 10^0$

$120719 = 1 \times 100000 + 2 \times 10000 + 0 \times 1000 + 7 \times 100$
 $\quad\quad\quad + 1 \times 10 + 9 \times 1$
 $= 1 \times 10^5 + 2 \times 10^4 + 0 \times 10^3 + 7 \times 10^2 + 1 \times 10^1$
 $\quad\quad\quad + 9 \times 10^0$

$20068 = 2 \times 10000 + 0 \times 1000 + 0 \times 100 + 6 \times 10$
 $\quad\quad\quad + 8 \times 1$
 $= 2 \times 10^4 + 0 \times 10^3 + 0 \times 10^2 + 6 \times 10^1 + 8 \times 10^0$

Q.2. Find the number from each of the following expanded forms :

(i) $8 \times 10^4 + 6 \times 10^3 + 0 \times 10^2 + 4 \times 10^1 + 5 \times 10^0$

(ii) $4 \times 10^5 + 5 \times 10^3 + 3 \times 10^2 + 2 \times 10^0$

(iii) $3 \times 10^4 + 7 \times 10^2 + 5 \times 10^0$

$$\text{(iv)} \quad 9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$$

$$\begin{aligned} \text{Ans. (i)} \quad & 8 \times 10^4 + 6 \times 10^3 + 0 \times 10^2 + 4 \times 10^1 + 5 \times 10^0 \\ &= 8 \times 10000 + 6 \times 1000 + 0 \times 100 \\ &\quad + 4 \times 10 + 5 \times 1 \\ &= 80000 + 6000 + 0 + 40 + 5 \\ &= 86045 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & 4 \times 10^5 + 5 \times 10^3 + 3 \times 10^2 + 2 \times 10^0 \\ &= 4 \times 100000 + 5 \times 1000 + 3 \times 100 + 2 \times 1 \\ &= 400000 + 5000 + 300 + 2 \\ &= 405302 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad & 3 \times 10^4 + 7 \times 10^2 + 5 \times 10^0 \\ &= 3 \times 10000 + 7 \times 100 + 5 \times 1 \\ &= 30000 + 700 + 5 \\ &= 30705 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad & 9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1 \\ &= 9 \times 100000 + 2 \times 100 + 3 \times 10 \\ &= 900000 + 200 + 30 \\ &= 900230 \end{aligned}$$

Q.3. Express the following numbers in standard form :

$$\begin{array}{lll} \text{(i)} \quad 5,00,00,000 & \text{(ii)} \quad 70,00,000 & \text{(iii)} \quad 3,18,65,00,000 \\ \text{(iv)} \quad 3,90,878 & \text{(v)} \quad 39087.8 & \text{(vi)} \quad 3908.78 \end{array}$$

$$\begin{aligned} \text{Ans. (i)} \quad & 5,00,00,000 = 5.0 \times 10000000 = 5.0 \times 10^7 \\ \text{(ii)} \quad & 70,00,000 = 7.0 \times 1000000 = 7.0 \times 10^6 \\ \text{(iii)} \quad & 3,18,65,00,000 = 3.1865 \times 1000000000 \\ &= 3.1865 \times 10^9 \\ \text{(iv)} \quad & 3,90,878 = 3.90878 \times 100000 = 3.90878 \times 10^5 \end{aligned}$$

$$(v) \quad 39087.8 = 3.90878 \times 10000 = 3.90878 \times 10^4$$

$$(vi) \quad 3908.78 = 3.90878 \times 1000 = 3.90878 \times 10^3$$

Q.4. Express the number appearing in the following statements in standard form.

- (a) The distance between Earth and Moon is 384,000,000 m.
- (b) Speed of light in vacuum is 300,000,000 m/s.
- (c) Diameter of the Earth is 1,27,56,000 m.
- (d) Diameter of the Sun is 1,400,000,000 m.
- (e) In a galaxy there are on an average 100,000,000,000 stars.
- (f) The universe is estimated to be about 12,000,000,000 years old.
- (g) The distance of the Sun from the centre of the Milky Way Galaxy is estimated to be 300,000,000,000,000,000 m.
- (h) 60,230,000,000,000,000,000 molecules are contained in a drop of water weighing 1.8 gm.
- (i) The earth has 1,353,000,000 cubic km of sea water.
- (j) The population of India was about 1,027,000,000 in March, 2001.

Ans. (a) $384,000,000 = 3.84 \times 100000000 = 3.84 \times 10^8 \text{ m.}$

(b) $300,000,000 = 3.0 \times 100000000 = 3.0 \times 10^8 \text{ m/s.}$

(c) $1,27,56,000 = 1.2756 \times 10000000 = 1.2756 \times 10^7 \text{ m.}$

(d) $1,400,000,000 = 1.4 \times 1000000000$
 $= 1.4 \times 10^9 \text{ m.}$

(e) $100,000,000,000 = 1.0 \times 100000000000$
 $= 1.0 \times 10^{11}$

(f) $12,000,000,000 = 1.2 \times 10000000000 = 1.2 \times 10^{10} \text{ year}$

(g) 300,000,000,000,000,000,000 m.

$$= 3.0 \times 100000000000000000000$$

$$= 3.0 \times 10^{20} \text{ m.}$$

(h) 60,230,000,000,000,000,000,000

$$= 6.023 \times 10000000000000000000000$$

$$= 6.023 \times 10^{22} \text{ molecules of water in 1.8 gm.}$$

(i) 1,353,000,000 = 1.353×1000000000

$$= 1.353 \times 10^9 \text{ km}^3$$

(j) 1,027,000,000 = 1.027×1000000000

$$= 1.027 \times 10^9$$