

EXERCISE # 1

- Evaluate.
(i) 3^{-2} (ii) $(-4)^{-2}$ (iii) $\left(\frac{1}{2}\right)^{-5}$
- Simplify and express the result in power notation with positive exponent.
(i) $(-4)^5 \div (-4)^8$ (ii) $\left(\frac{1}{2^3}\right)^2$
(iii) $(-3)^4 \times \left(\frac{5}{3}\right)^4$ (iv) $(3^{-7} \div 3^{-10}) \times 3^{-5}$
(v) $2^{-3} \times (-7)^{-3}$
- Find the value of.
(i) $(3^0 + 4^{-1}) \times 2^2$
(ii) $(2^{-1} \times 4^{-1}) \div 2^{-2}$
(iii) $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2}$
(iv) $(3^{-1} + 4^{-1} + 5^{-1})^0$ (v) $\left\{\left(\frac{-2}{3}\right)^{-2}\right\}^2$
- Evaluate (i) $\frac{8^{-1} \times 5^3}{2^{-4}}$ (ii) $(5^{-1} \times 2^{-1}) \times 6^{-1}$
- Find the value of m for which $5^m \div 5^{-3} = 5^5$.
- Evaluate (i) $\left\{\left(\frac{1}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right\}^{-1}$
(ii) $\left(\frac{5}{8}\right)^{-7} \times \left(\frac{8}{5}\right)^{-4}$
- Simplify.
(i) $\frac{25 \times t^{-4}}{5^{-3} \times 10 \times t^{-8}}$ ($t \neq 0$)
(ii) $\frac{3^{-5} \times 10^{-5} \times 125}{5^{-7} \times 6^{-5}}$
- Express the following numbers in standard form.
(i) 0.0000000000085
(ii) 0.00000000000942
(iii) 6020000000000000
(iv) 0.00000000837
(v) 31860000000
- Express the following numbers in usual form.
(i) 3.02×10^{-6} (ii) 4.5×10^4
(iii) 3×10^{-8} (iv) 1.0001×10^9
(v) 5.8×10^{12} (vi) 3.61492×10^6
- Express the number appearing in the following statements in standard form.
(i) 1 micron is equal to $\frac{1}{1000000}$ m
(ii) Charge of an electron is 0.000,000,000,000,000,16 coulomb.
(iii) Size of a bacteria is 0.0000005 m
(iv) Size of a plant cell is 0.00001275 m
(v) Thickness of a thick paper is 0.07 mm
- In a stack there are 5 books each of thickness 20 mm and 5 paper sheets each of thickness 0.016 mm. What is the total thickness of the stack.
- Express each of the following as a rational number of the form $\frac{p}{q}$:
(i) 5^{-3} (ii) $(-2)^{-5}$
(iii) $\left(\frac{4}{3}\right)^{-3}$ (iv) $\left(\frac{-2}{5}\right)^{-4}$
(v) $\frac{1}{2^{-3}}$
- Express each of the following as a rational number of the form $\frac{p}{q}$:
(i) $\left(\frac{3}{8}\right)^{-2} \times \left(\frac{4}{5}\right)^{-3}$ (ii) $\left(\frac{-2}{7}\right)^{-4} \times \left(\frac{-7}{5}\right)^2$

- 14.** Express each of the following as power of a rational number with positive exponent :
- (i) $\left(\frac{1}{4}\right)^{-3}$ (ii) $5^{-3} \times 5^{-6}$
- (iii) $\left(\frac{-1}{4}\right)^{-5} \times \left(\frac{-1}{4}\right)^{-7}$
- 15.** Simplify:
- (i) $\left(2^{-1} \div 5^{-1}\right)^2 \times \left(\frac{-5}{8}\right)^{-1}$
- (ii) $\left(6^{-1} - 8^{-1}\right)^{-1} \div (2^{-1} - 3^{-1})^{-1}$
- (iii) $\left(5^{-1} \times 3^{-1}\right)^{-1} \div 6^{-1}$
- (iv) $\left(4^{-1} + 8^{-1}\right) \div \left(\frac{2}{3}\right)^{-1}$
- 16.** Simplify
- (i) $\left(\frac{1}{4}\right)^{-2} + \left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2}$
- (ii) $\left\{6^{-1} \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$
- 17.** Express each of the following as a rational number of the form $\frac{p}{q}$
- (i) $(2^{-1} + 3^{-1})^2$ (ii) $(2^{-1} - 4^{-1})^2$
- (iii) $\left\{\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right\}^{-1}$
- 18.** By what number should $(-8)^{-1}$ be multiplied so that the product may be equal to 10^{-1} ?
- 19.** Using the laws of exponents, simplify each of the following and express in exponential form:
- (i) $3^7 \times 3^{-2}$ (ii) $2^{-7} \div 2^{-3}$
- (iii) $(5^2)^{-3}$ (iv) $2^{-3} \times (-7)^{-3}$
- (v) $\frac{3^{-5}}{4^{-5}}$
- 20.** Using the laws of exponents simplify and express each of the following in exponential form with positive exponent:
- (i) $(-4)^4 \times (-4)^{-10}$ (ii) $2^{-5} \div 2^2$
- (iii) $3^{-4} \times 2^{-4}$ (iv) $\left(\frac{1}{2^3}\right)^2$
- (v) $(3^{-7} \div 3^{-10}) \times 3^{-5}$ (vi) $(-3)^4 \times \left(\frac{5}{3}\right)^4$
- 21.** Simplify and write the answer in the exponential form:
- (i) $(2^5 \div 2^8)^5 \times 2^{-5}$ (ii) $(-4)^3 \times (5)^{-3} \times (-5)^{-3}$
- (iii) $\frac{1}{8} \times 3^{-3}$
- 22.** Simplify :
- (i) $\left(\frac{5}{8}\right)^{-7} \times \left(\frac{8}{5}\right)^{-5}$ (ii) $\left(\frac{-2}{3}\right)^{-2} \times \left(\frac{4}{5}\right)^{-3}$
- (iii) $\left(\frac{3}{4}\right)^{-4} \div \left(\frac{3}{2}\right)^{-3}$ (iv) $\left(\frac{3}{7}\right)^{-2} \times \left(\frac{7}{6}\right)^{-3}$
- 23.** Evaluate: $\frac{8^{-1} \times 5^3}{2^{-4}}$
- 24.** Simplify:
- (i) $\frac{25 \times a^{-4}}{5^{-3} \times 10 \times a^{-8}}$ (ii) $\frac{3^{-5} \times 10^{-5} \times 125}{5^{-7} \times 6^{-5}}$
- 25.** By what number should $(-12)^{-1}$ be divided so that the quotient may be $\left(\frac{2}{3}\right)^{-1}$?
- 26.** Find x so that $\left(\frac{5}{3}\right)^{-5} \times \left(\frac{5}{3}\right)^{-11} = \left(\frac{5}{3}\right)^{8x}$
- 27.** Write the following numbers in standard form:
- (i) 0.4579 (ii) 0.000007
- (iii) 0.000000564 (iv) 0.0000021
- (v) 216000000 (vi) 0.0000529×10^4
- (vii) 9573×10^{-4}
- 28.** Express the following numbers in usual form:
- (i) 3.52×10^5 (ii) 7.54×10^{-4}
- (iii) 3×10^{-5}

ANSWER KEY

EXERCISE # 1

1. (i) $\frac{1}{9}$ (ii) $\frac{1}{16}$ (iii) 32
2. (i) $\frac{1}{(-4)^3}$ (ii) $\frac{1}{2^6}$ (iii) $(5)^4$ (iv) $\frac{1}{(3)^2}$ (v) $\frac{1}{(-14)^3}$
3. (i) 5 (ii) $\frac{1}{2}$ (iii) 29 (iv) 1 (v) $\frac{81}{16}$
4. (i) 250 (ii) $\frac{1}{60}$ 5. $m = 2$ 6. (i) -1 (ii) $\frac{512}{125}$
7. (i) $\frac{625t^4}{2}$ (ii) 5^5
8. (i) 8.5×10^{-12} (ii) 9.42×10^{-12} (iii) 6.02×10^{15} (iv) 8.37×10^{-9} (v) 3.186×10^{10}
9. (i) 0.00000302 (ii) 45000 (iii) 0.00000003 (iv) 1000100000 (v) 5800000000000
- (vi) 3614920
10. (i) 1×10^{-6} (ii) 1.6×10^{-19} (iii) 5×10^{-7} (iv) 1.275×10^{-5} (v) 7×10^{-2}
11. 1.0008×10^2
12. (i) $\frac{1}{125}$ (ii) $-\frac{1}{32}$ (iii) $\frac{27}{64}$ (iv) $\frac{625}{16}$ (v) 8
13. (i) $\frac{125}{9}$ (ii) $\frac{117649}{400}$ 14. (i) 4^3 (ii) $\left(\frac{1}{5}\right)^9$ (iii) 4^{12}
15. (i) -10 (ii) 30 (iii) 90 (iv) $\frac{1}{4}$
16. (i) 29 (ii) $\frac{6}{5}$ 17. (i) $\frac{25}{36}$ (ii) $\frac{1}{16}$ (iii) $-\frac{3}{8}$
18. $-\frac{4}{5}$
19. (i) 3^5 (ii) 2^{-4} (iii) 5^{-6} (vi) $(-14)^{-3}$ (v) $\left(\frac{3}{4}\right)^{-5}$
20. (i) $\left(-\frac{1}{4}\right)^6$ (ii) $\left(\frac{1}{2}\right)^7$ (iii) $\left(\frac{1}{6}\right)^4$ (iv) $\left(\frac{1}{2}\right)^6$ (v) $\left(\frac{1}{3}\right)^2$
- (vi) 5^4
21. (i) 2^{-20} (ii) 10^{-6} (iii) 6^{-3}
22. (i) $\frac{64}{25}$ (ii) $\frac{1125}{256}$ (iii) $\frac{32}{3}$ (iv) $\frac{24}{7}$
23. 250 24. (i) $\frac{625}{2}a^4$ (ii) 5^5
25. $-\frac{1}{18}$ 26. -2
27. (i) 4.579×10^{-1} (ii) 7×10^{-6} (iii) 5.64×10^{-7} (iv) 2.1×10^{-6} (v) 2.16×10^8
- (vi) 5.29×10^{-1} (vii) 9.573×10^{-1}
28. (i) 352000 (ii) 0.000754 (iii) 0.00003

EXERCISE # 2

1. Evaluate the following :

$$(i) \left(\frac{-7}{3}\right)^2 \quad (ii) \left(\frac{-4}{3}\right)^4$$

$$(iii) \left(\frac{-2}{-9}\right)^2 \quad (iv) \left(\frac{-3}{5}\right)^3$$

$$(v) \left(\frac{-2}{3}\right)^6 \quad (vi) \left(\frac{-2}{7}\right)^3$$

2. Express the following in exponential form.

$$(i) \frac{16}{625} \quad (ii) \frac{-1}{27}$$

$$(iii) \frac{-7}{9} \times \frac{-7}{9} \times \frac{-7}{9} \quad (iv) \frac{-16}{169}$$

$$(v) \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3}$$

3. Simplify :

$$(i) \left(\frac{-7}{2}\right)^5 \times \left(\frac{1}{14}\right)^2 \quad (ii) \left(\frac{-2}{3}\right)^3 \times \left(\frac{-3}{2}\right)^3$$

$$(iii) \left(\frac{-3}{4}\right)^3 \times \left[\frac{16}{27} - \left(\frac{2}{3}\right)^3\right]$$

$$(iv) \left[\left(\frac{-2}{3}\right)^3 + \left(\frac{4}{9}\right)\right] \times \left(\frac{5}{3}\right)^3$$

4. Find the reciprocal of the following -

$$(i) (-3)^5 \quad (ii) \left(\frac{-2}{5}\right)^3$$

$$(iii) \left(\frac{3}{5}\right)^3 \quad (iv) \left(\frac{3}{-7}\right)^4$$

5. Find the absolute value of-

$$(i) \left(\frac{-1}{4}\right)^3 \quad (ii) \left(\frac{3}{7}\right)^5$$

$$(iii) \left(\frac{-3}{5}\right)^4 \quad (iv) \left(\frac{-11}{14}\right)^2$$

$$(v) \left(\frac{-2}{3}\right)^4 \quad (vi) -\left(\frac{7}{8}\right)^2$$

6. Find the reciprocal and express the same in power notation.

$$(i) \frac{27}{8} \quad (ii) \frac{-125}{216} \quad (iii) \frac{675}{392}$$

7. Find the product of the following-

$$(i) 3^7 \times 3^{11} \quad (ii) 4^6 \times 4^4$$

$$(iii) a^9 \times a^3 \quad (iv) x^{12} \times x^7$$

$$(v) 2^{21} \times 2^7 \quad (vi) a^4 \times a^7 \times a^3$$

$$(vii) 3^5 \times 3^7 \times 3^2 \quad (viii) 5^{11} \times 5^3 \times 5$$

$$(ix) 3^5 \times 2^5 \times 3^7 \times 2^7$$

Note :- Exponential form is must useful in scientific calculations, in expressing distance the planets etc.

8. Simplify using the laws of exponents (answer in exponential form)

$$(i) 3^7 \div 3^5 \quad (ii) \frac{4^8}{4}$$

$$(iii) \frac{5^{12}}{5^7} \quad (iv) \frac{7^{18}}{7^{15}}$$

$$(v) \frac{6^{24}}{6^{21}} \quad (vi) \frac{36}{6}$$

$$(vii) \frac{125}{5^2} \quad (viii) \frac{108}{12}$$

$$(ix) \frac{625}{5}$$

9. Simplify and give your answer in exponential form.

$$(i) (5^2)^3 \quad (ii) (3^4)^3$$

$$(iii) (8^5)^4 \quad (iv) (7^3)^8$$

$$(v) (10^4)^2 \quad (vi) (11^3)^2$$

$$(vii) (6^5)^6 \quad (viii) (8)^6$$

$$(ix) (3^2 \times 2^2)^5$$

10. Simplify and give your answer in exponential form-

$$(i) 36 \times 6 \quad (ii) 48 \times 2$$

$$(iii) 5^3 \times 15^2 \quad (iv) \frac{8}{16}$$

$$(v) \frac{27}{81} \quad (vi) \frac{225}{30}$$

11. Express in exponential form-

(i) $\frac{3}{4} \times \frac{3}{4} \times \frac{3}{4}$

(ii) $\frac{-2}{5} \times \frac{-2}{5} \times \frac{-2}{5} \times \frac{-2}{5}$

(iii) $\frac{-1}{7} \times \frac{-1}{7} \times \frac{-1}{7}$

(iv) $\frac{4}{9} \times \frac{4}{9} \times \frac{4}{9} \times \frac{4}{9}$

(v) $\frac{7}{2} \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2}$

(vi) $\frac{-3}{8} \times \frac{-3}{8} \times \frac{-3}{8}$

12. Express in exponential form

(i) $\frac{81}{125}$

(ii) $\frac{16}{225}$

(iii) $\frac{243}{32}$

(iv) $\frac{-32}{243}$

(v) $\frac{-1}{216}$

(vi) $\frac{343}{128}$

13. Express as a rational number

(i) 3^{-1}

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

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

(vi) $\left(\frac{-4}{9}\right)^3$

(v) $\left(\frac{-5}{6}\right)^{-4}$

(vi) $\left(\frac{3}{8}\right)^{-3}$

(vii) $\left(\frac{-1}{7}\right)^{-4}$

(viii) $(-5)^{-2}$

(ix) $\left(\frac{5}{7}\right)^{-2}$

14. Evaluate :

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

(ii) $\left[\left(\frac{2}{5}\right)^3\right]^2$

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

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

(v) $\left[\left(\frac{1}{2}\right)^{-1} \times (-4)^{-1}\right]^2$

(vi) $\left(\frac{3}{2}\right)^{-1} \div \left(\frac{-2}{5}\right)^{-1}$

(vii) $\left(\frac{-4}{5}\right)^2 \times \left(\frac{15}{2}\right) \times \frac{1}{6} \times \left(\frac{125}{64}\right)$

(viii) $\left[\left(\frac{3}{7}\right)^2 \times \left(\frac{3}{7}\right)^3\right] \div \left(\frac{3}{7}\right)^8$

15. Find x, so that-

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

(ii) $\left(\frac{3}{2}\right)^3 \div \left(\frac{3}{2}\right)^4 = \left(\frac{3}{2}\right)^{2x+1}$

(iii) $3^{-9} \times 3^x = 3$

(iv) $4^x \times 4^{-8} = 4^{-3}$

(v) $\left(\frac{-3}{5}\right)^{-4} \times \left(\frac{-3}{5}\right)^6 = \left(\frac{5}{3}\right)^{2x}$

(vi) $5^x \times 5^{-2} \times 5^4 = 5^{-3}$

16. (i) By what number should 3^{-9} be multiplied, so that the product is equal to 3^{-4} ?
(ii) By what number should $(-28)^{-1}$ be divided, so that the quotient is 4^{-1} ?

(iii) By what number should $\left(\frac{-4}{5}\right)^2$ be multiplied, so that the product is $\left(\frac{2}{3}\right)^3$?

(iv) By what number should 13^{-2} be divided to get 13^5 ?

(v) By what number should we multiply 5^{-4} , so that the product is 5^2 ?

(vi) By what number should we multiply $(-7)^{-1}$ to get the product 4^{-1} ?

17. If $\frac{x}{y} = \left(\frac{2}{3}\right)^{-5} \div \left(\frac{2}{3}\right)^{-2}$, find $\left(\frac{x}{y}\right)^{-2}$ and $\left(\frac{x}{y}\right)^2$.

18. If $\frac{x}{y} = \left(\frac{5}{2}\right)^{-1} \times \left(\frac{8}{9}\right)^0$, find the value of $\left(\frac{x}{y}\right)^{-2}$.

19. Find the value of :
- (i) $(7^0 + 3^0) \times (8^0 - 5^0)$ (ii) $\frac{2^0 \times 5^0 \times 8^0}{2^0 + 5^0 + 8^0}$
- (iii) $\left(\frac{-5}{6}\right)^0$ (iv) $\frac{2}{5} \times \left(\frac{2}{5}\right)^3 \div \left(\frac{3}{5}\right)^4$
20. Simplify and write the answer with positive exponents
- (i) $(3 + 4)^{-1} \times (3^{-1} + 4^{-1})$
- (ii) $\left[\left(\frac{5}{4}\right)^{-1} \times \left(\frac{2}{5}\right)^{-1}\right]^{-1}$
- (iii) $(5^{-1} - 7^{-1})^{-1} + (3^{-1} - 5^{-1})^{-1}$
21. Verify that $\left(\frac{1}{3}\right)^{-3} + \left(\frac{1}{2}\right)^{-5} - \left(\frac{1}{2}\right)^{-5} = 27$
22. If $\frac{x}{y} = \left(\frac{-1}{3}\right)^{-2} \div \left(\frac{2}{3}\right)^{-3}$,
find the value of $\left(\frac{x}{y}\right)^{-3}$
23. Find x, so that $\left(\frac{2}{3}\right)^{-2} \times \left(\frac{2}{3}\right)^{-9} = \left(\frac{2}{3}\right)^{2x-1}$
24. By what number should $\left(\frac{5}{3}\right)^{-2}$ be multiplied,
so that the product may be $\left(\frac{7}{3}\right)^{-1}$?
25. By what number should $\left(\frac{-3}{2}\right)^{-3}$ be divided,
so that the quotient may be $\left(\frac{4}{27}\right)^{-2}$?
26. By what number should $\left(\frac{1}{2}\right)^{-1}$ be multiplied,
so that the product may be equal to $\left(\frac{-4}{7}\right)^{-1}$?
27. Solve $\frac{121 \times 343}{(7)^{-1} \times \left(\frac{1}{11}\right)^{-1}}$
28. If the diameters of the Sun and the Earth are 1.4×10^9 metres and 1.275×10^7 metre respectively. Compare these two.
29. The size of a red blood cell is 0.000007 m and the size of a plant cell is 0.00001275 m. Compare these two.
30. Express each of the following rational numbers with a negative exponent:
- (i) $\left(\frac{1}{4}\right)^3$ (ii) 3^5
- (iii) $\left(\frac{3}{5}\right)^4$ (iv) $\left\{\left(\frac{3}{2}\right)^4\right\}^{-3}$
- (v) $\left\{\left(\frac{7}{3}\right)^4\right\}^{-3}$
31. Express each of the following rational numbers with a positive exponent:
- (i) $\left(\frac{3}{4}\right)^{-2}$ (ii) $\left(\frac{5}{4}\right)^{-3}$
- (iii) $4^3 \times 4^{-9}$ (iv) $\left\{\left(\frac{4}{3}\right)^{-3}\right\}^{-4}$
- (v) $\left\{\left(\frac{3}{2}\right)^4\right\}^{-2}$
32. Simplify
- (i) $\left\{\left(\frac{3}{2}\right)^{-3} - \left(\frac{1}{2}\right)^{-3}\right\} \div \left(\frac{1}{4}\right)^{-3}$
- (ii) $(3^2 - 2^2) \times \left(\frac{2}{3}\right)^{-3}$
- (iii) $\left\{\left(\frac{1}{2}\right)^{-1} \times (4)^{-1}\right\}^{-1}$
- (iv) $\left[\left\{\left(\frac{-1}{4}\right)^2\right\}^{-2}\right]^{-1}$
- (v) $\left\{\left(\frac{2}{3}\right)^2\right\}^3 \times \left(\frac{1}{3}\right)^{-4} \times 3^{-1} \times 6^{-1}$

ANSWER KEY

EXERCISE # 2

1. (i) $\frac{49}{9}$ (ii) $\frac{256}{81}$ (iii) $\frac{4}{81}$ (iv) $\frac{-27}{125}$ (v) $\frac{64}{729}$
 (vi) $\frac{-8}{343}$
2. (i) $\left(\frac{2}{5}\right)^4$ (ii) $\left(\frac{-1}{3}\right)^3$ (iii) $\left(\frac{-7}{9}\right)^3$ (iv) $-\left(\frac{4}{13}\right)^2$ (v) $\left(\frac{2}{3}\right)^3$
3. (i) $\frac{-343}{128}$ (ii) 1 (iii) $\frac{-1}{8}$ (iv) $\frac{500}{729}$
4. (i) $\frac{-1}{243}$ (ii) $\frac{-125}{8}$ (iii) $\frac{125}{27}$ (iv) $\frac{2401}{81}$
5. (i) $\frac{1}{64}$ (ii) $\frac{243}{16807}$ (iii) $\frac{81}{625}$ (iv) $\frac{121}{196}$ (v) $\frac{16}{81}$
 (vi) $\frac{49}{64}$
6. (i) $\left(\frac{2}{3}\right)^3$ (ii) $\left(\frac{-6}{5}\right)^3$ (iii) $\left(\frac{2}{3}\right)^3 \times \left(\frac{7}{5}\right)^2$
7. (i) 3^{18} (ii) 4^{10} (iii) a^{12} (iv) x^{19} (v) 2^{28}
 (vi) a^{14} (vii) 3^{14} (viii) 5^{15} (ix) 6^{12}
8. (i) 3^2 (ii) 4^7 (iii) 5^5 (iv) 7^3 (v) 6^3
 (vi) 6^1 (vii) 5^1 (viii) 3^2 (ix) 5^3
9. (i) 5^6 (ii) 3^{12} (iii) 8^{20} (iv) 7^{24} (v) 10^8
 (vi) 11^6 (vii) 6^{30} (viii) 2^{18} (ix) 6^{10}
10. (i) 6^3 (ii) $2^5 \times 3$ (iii) $5^5 \times 3^2$ (iv) 2^{-1} (v) 3^{-1}
 (vi) $\frac{15}{2}$
11. (i) $\left(\frac{3}{4}\right)^3$ (ii) $\left(\frac{-2}{5}\right)^4$ (iii) $\left(\frac{-1}{7}\right)^3$ (iv) $\left(\frac{4}{9}\right)^4$ (v) $\left(\frac{7}{2}\right)^5$ (vi) $\left(\frac{-3}{8}\right)^3$
12. (i) $\frac{3^4}{5^3}$ (ii) $\left(\frac{4}{15}\right)^2$ (iii) $\left(\frac{3}{2}\right)^5$ (iv) $\left(\frac{-2}{3}\right)^5$ (v) $\left(-\frac{1}{6}\right)^3$ (vi) $\left(\frac{7}{4}\right)^3$
13. (i) $\frac{1}{3}$ (ii) $\frac{2^6}{5^6}$ (iii) $\frac{7}{2}$ (iv) $\frac{-64}{729}$ (v) $\frac{1296}{625}$
 (vi) $\frac{512}{27}$ (vii) 2401 (viii) $\frac{1}{25}$ (ix) $\frac{49}{25}$
14. (i) $\frac{625}{24}$ (ii) $\frac{64}{15625}$ (iii) $\frac{7}{2}$ (iv) $\frac{32}{243}$ (v) $\frac{1}{4}$
 (vi) $\frac{-4}{15}$ (vii) $\frac{+25}{16}$ (viii) $\frac{343}{27}$
15. (i) 4 (ii) -1 (iii) 10 (iv) 5 (v) -1
 (vi) -5
16. (i) 3^5 (ii) $\frac{-1}{7}$ (iii) $\frac{25}{54}$ (iv) 13^{-7} (v) 5^6 (vi) $\frac{-7}{4}$

17. (i) $\left(\frac{2}{3}\right)^6, \left(\frac{3}{2}\right)^6$

18. $\left(\frac{5}{2}\right)^2$

19. (i) 0 (ii) $\frac{1}{3}$

(iii) 1 (iv) $\left(\frac{2}{3}\right)^4$

20. (i) $\frac{1}{12}$ (ii) $\frac{1}{2}$

(iii) 25

22. $\frac{3^3}{2^3}$

23. -5

24. $\frac{25}{21}$ 25. $\frac{-2^7}{3^9}$

26. $\frac{-7}{8}$

27. 26411

28. 100

29. A red blood cell is approximately half of a plant cell is size

30. (i) 4^{-3} (ii) $\left(\frac{1}{3}\right)^{-5}$

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

(iv) $\left(\frac{3}{2}\right)^{-12}$

(v) $\left(\frac{7}{3}\right)^{-12}$

31. (i) $\left(\frac{4}{3}\right)^2$ (ii) $\left(\frac{4}{5}\right)^3$

(iii) $\left(\frac{1}{4}\right)^6$

(iv) $\left(\frac{4}{3}\right)^{12}$

(v) $\left(\frac{2}{3}\right)^8$

32. (i) $\frac{19}{64}$ (ii) $\frac{135}{8}$

(iii) -2

(iv) $\frac{1}{256}$

(v) $\frac{32}{81}$