Exercise 3.1

Q.1 Express each of the following numbers in scientific notations.

(i) 5700

$= 5.7 \times 10^3$ **Ans**

(ii) 49,800,000

$= 4.98 \times 10^7$ **Ans**

(iii) 96000000

$= 9.6 \times 10^7$ **Ans**

(iv) 416.9

$= 4.169 \times 10^2$ **Ans**

(v) 83000

$= 8.3 \times 10^4$ **Ans**

(vi) 0.00643

$= 6.43 \times 10^{-3}$ **Ans**

(vii) 0.0074

$= 7.4 \times 10^{-3}$ **Ans**

(viii) 60,000,000

$= 6 \times 10^7$ Ans

(ix) 0.00000000395

$= 3.95 \times 10^{-9}$ **Ans**

(x) $\dfrac{275000}{0.0025}$

$= \dfrac{2.75 \times 10^5}{2.5 \times 10^{-3}}$ **Ans**

Q.2 Express the following number in ordinary notation.

(i) 6×10^{-4}

$= 0.0006$ **Ans**

(ii) 5.06×10^{10}

$= 50600000000$ **Ans**

(iii) 9.018×10^{-6}

$= 0.000009018$ Ans

(iv) 7.865×10^8

$= 786500000$ **Ans**

Exercise 3.2

Q.1 Find the common logarithms of each of the following numbers.

(i) 232.92

Solution: 232.92

Suppose $x = 232.92$

Taking log

$\log x = \log 232.92$

$Ch = 2$

Mantissa = 0.3672

$\log x = 2.3672$ **Ans**

(ii) 29.326

Solution: 29.326

Suppose $x = 29.326$

Taking log

$\log x = \log 29.326$

$Ch = 1$

Mantissa = 0.4672

$\log x = 1.4672$ **Ans**

(iii) 0.00032

Solution: 0.00032

Suppose $x = 0.00032$

Taking log

$\log x = \log 0.00032$

$Ch = \bar{4}$

Mantissa = 0.5051

$\log x = \bar{4}.5051$ **Ans**

(iv) 0.3206

Solution: 0.3206

Suppose $x = 0.3206$

Taking log:

$\log x = \log 0.3206$

$Ch = \bar{1}$

Mantissa = 0.5059

$\log x = \bar{1}.5059$ **Ans**

Q.2 If $\log 31.09 = 1.4926$, find the value of the following.

If

$\log 31.09 = 1.4926$

Then

(i) $\log 3.109 = 0.4926$

(ii) $\log 310.9 = 2.4926$

(iii) $\log 0.003109 = \bar{3}.4926$

(iv) $0.3109 = \bar{1}.4926$

Solution:

(i) $\log 3.109$

Characteristics = 0

Mantissa = 0.4926

$\log 3.109 = 0.4926$ **Ans**

(ii) $\log 310.9$

Characteristics = 2

Mantissa =0.4926

$\log 310.9 = 2.4926$ **Ans**

(iii) $\log 0.003109$

Characteristics = $\bar{3}$

Mantissa = 0.4926

$\log 0.003109 = \bar{3}.4926$ **Ans**

(iv) $\log 0.3109$

Characteristics = $\bar{1}$

Mantissa = 0.4926

$\log 0.3109 = \bar{1}.4926$ **Ans**

Q.3 Find the numbers whose common logarithms are

(i) 3.5621

Solution:

$\log x = 3.5621$

Ch=3(If ch is positive, then plus for reference point)

Mantissa = 0.5621

$x = \text{antilog}\, 3.5621$

$x = 3649.0$ **Ans**

(ii) $\bar{1}.7427$

Solution:

$\log x = \bar{1}.7427$

$\text{Ch} = \bar{1}$

Mantissa = 0.7427

$x = \text{anti}\log \bar{1}.7427$

$x = 0.5530$ **Ans**

Q.4 What replacement for the unknown in each of the following will make the true statements?

(i) $\log_3 81 = L$

Solution: $\log_3 81 = L$

Writing in exponential form.

$3^L = 81$

$3^L = 3^4$

$\because$ Bases are equal so

$L = 4$ **Ans**

(ii) $\log_a 6 = 0.5$

Solution: $\log_a 6 = 0.5$

$a^{0.5} = 6$

$a^{\frac{1}{2}} = 6$

$\sqrt{a} = 6$ Taking square on both sides

$\sqrt{(a)}^2 = (6)^2$

$a = 36$ **Ans**

(iii) $\log_5 n = 2$

Write in exponential form

$5^2 = n$

$25 = n$

Or $n = 25$ **Ans**

(iv) $10^P = 40$

Solution: $10^P = 40$

Changing into logarithmic form

$P = \log_{10} 40$

$= \log 40$

$= 1.6021$ **Ans**

Q.5 Evaluate.

(i) $\log_2 \frac{1}{128}$

Solution: $\log_2 \frac{1}{128}$

Suppose $\log_2 \frac{1}{128} = x$

Writing in exponential form.

$2^x = \frac{1}{128}$

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

$2^x = 2^{-7}$

$\because$ Bases are equal so

$x = -7$ **Ans**

(ii) log 512 to the base $2\sqrt{2}$

Solution: $\log_{2\sqrt{2}} 512 = x$

Writing in exponential form

$\left(2\sqrt{2}\right)^x = 512$

$\left(2^1.2^{\frac{1}{2}}\right)^x = 2^9$

$\left(2^{\frac{3}{2}}\right)^x = 2^9$

$2^{\frac{3}{2}x} = 2^9$

$\because$ Bases are equal so

$\frac{3}{2}x = 9$

$x = \frac{9 \times 2}{3}$

$x = \frac{\cancel{18}^{6}}{\cancel{3}}$

$x = 6$ **Ans**

Q.6 Find the value of x from the following statements.

(i) $\log_2 x = 5$

Solution: $\log_2 x = 5$

Write in exponential form.

$2^5 = x$

$32 = x$ **Ans**

(ii) $\log_{81} 9 = x$

Solution: $\log_{81} 9 = x$

Writing in the exponential form.

$81^x = 9$

$(9^2)^x = 9$

$9^{2x} = 9$

$2x = 1$

$x = \frac{1}{2}$ **Ans**

(iii) $\log_{64} 8 = \frac{x}{2}$

Solution: $\log_{64} 8 = \frac{x}{2}$

Writing in exponential form.

$64^{\frac{x}{2}} = 8$

$(8^{\cancel{2}})^{\frac{x}{\cancel{2}}} = 8$

$8^x = 8$

$x = 1$ **Ans**

(iv) $\log_x 64 = 2$

Solution: $\log_x 64 = 2$

Writing in exponential form

$x^2 = 64$

$x^2 = 8^2$

$x = 8$ **Ans**

(v) $\log_3 x = 4$

Solution: $\log_3 x = 4$

$3^4 = x$

$81 = x$

Or $x = 81$ **Ans**

Exercise 3.3

Q.1 Write the following into sum or difference $\log(A\times B)$

(i) $\log(A\times B)$

Solution: $\log(A\times B)$

$$\log A\times B=\log A+\log B \text{ **Ans**}$$

(ii) $\log\frac{15.2}{30.5}$

Solution: $\log\frac{15.2}{30.5}$

$$\log\frac{15.2}{30.5}=\log 15.2-\log 30.5 \text{ **Ans**}$$

(iii) $\log\frac{21\times 5}{8}$

Solution: $\log\frac{21\times 5}{8}$

$$\log\frac{21\times 5}{8}=\log(21\times 5)-\log 8$$

$$=\log 21+\log 5-\log 8 \text{ **Ans**}$$

(iv) $\log\sqrt[3]{\frac{7}{15}}$

Solution: $\log\sqrt[3]{\frac{7}{15}}$

$$\log\sqrt[3]{\frac{7}{15}}=\log\left(\frac{7}{15}\right)^{\frac{1}{3}}$$

$$=\frac{1}{3}\log\left(\frac{7}{15}\right)$$

$$=\frac{1}{3}(\log 7-\log 15)$$

$$=\frac{1}{3}\log 7-\frac{1}{3}\log 15 \text{ **Ans**}$$

(v) $\log\frac{(22)^{\frac{1}{3}}}{5^3}$

Solution: $\log\frac{(22)^{\frac{1}{3}}}{5^3}$

$$\log\frac{(22)^{\frac{1}{3}}}{5^3}=\log 22^{\frac{1}{3}}-\log 5^3$$

$$=\frac{1}{3}\log 22-3\log 5 \text{ **Ans**}$$

(vi) $\log\frac{25\times 97}{29}$

Solution: $\log\frac{25\times 97}{29}$

$$\log\frac{25\times 47}{29}=\log(25\times 47)-\log 29$$

$$=\log 25+\log 47-\log 29 \text{ **Ans**}$$

Q.2 Express
$\log x-2\log x+3\log(x+1)-\log(x^2-1)$ **as a single logarithm.**

Solution:

$$\log x-2\log x+3\log(x+1)-\log(x^2-1)$$

$$=\log x-\log x^2+\log(x+1)^3-\log(x^2-1)$$

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

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

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

$$=\log\frac{\cancel{x}(x+1)^2\ \cancel{(x+1)}}{x\times\cancel{x}(x-1)\ \cancel{(x+1)}}$$

$$=\log\frac{(x+1)^2}{x(x-1)} \text{ **Ans**}$$

Q.3 Write the following in the form of a single logarithm.

(i) $\log 21 + \log 5$

Solution: $\log 21 + \log 5$

$= \log(21 \times 5)$ **Ans**

(ii) $\log 25 - 2\log 3$

Solution: $\log 25 - 2\log 3$

$= \log 25 - 2\log 3$

$= \log 25 - \log 3^2$

$= \log \frac{25}{3^2}$ **Ans**

(iii) $2\log x - 3\log y$

Solution: $2\log x - 3\log y$

$= 2\log x - 3\log y$

$= \log x^2 - \log y^3$

$= \log \frac{x^2}{y^3}$ **Ans**

(iv) $\log 5 + \log 6 - \log 2$

Solution: $\log 5 + \log 6 - \log 2$

$= \log 5 + \log 6 - \log 2$

$= \log(5 \times 6) - \log 2$

$= \log \frac{5 \times 6}{2}$ **Ans**

Q.4 Calculate the following.

(i) $\log_3 2 \times \log_2 81$

Solution: $\log_3 2 \times \log_2 81$

$= \frac{\cancel{\log 2}}{\log 3} \times \frac{\log 81}{\cancel{\log 2}}$

$= \frac{\log 81}{\log 3}$

$= \frac{\log 3^4}{\log 3}$

$= \frac{4\cancel{\log 3}}{\cancel{\log 3}}$

$= 4$ **Ans**

(ii) $\log_3 \times \log_3 25$

Solution: $\log_3 \times \log_3 25$

$= \frac{\cancel{\log 3}}{\log 5} \times \frac{\log 25}{\cancel{\log 3}}$

$= \frac{\log 25}{\log 5}$

$= \frac{\log 5^2}{\log 5}$

$= \frac{2\cancel{\log 5}}{\cancel{\log 5}}$

$= 2$ **Ans**

Q.5 If $\log 2 = 0.3010, \log 3 = 0.4771$ **and** $\log 5 = 0.6990,$ **then find the values of the following.**

(i) $\log 32$

$= \log 2^5$

$\because$ using 3^{rd} law of logarithm

$= 5\log 2$

By putting the value of $\log 2$

$= 5(0.3010)$

$= 1.5050$ **Ans**

(ii) log 24

Solution: log 24

$= \log(2^3 \times 3)$

$= \log 2^3 + \log 3$

$= 3\log 2 + \log 3$

By putting the value of $\log 2$ and $\log 3$

$= 3(0.3010) + 0.4771$

$= 0.9030 + 0.4771$

$= 1.3801$ **Ans**

(iii) $\log \sqrt{3\frac{1}{3}}$

Solution: $\log \sqrt{3\frac{1}{3}}$

$= \log\left(\frac{10}{3}\right)^{\frac{1}{2}}$

$$=\frac{1}{2}\log\left[\frac{2\times 5}{3}\right]$$

$$=\frac{1}{2}(\log 2+\log 5-\log 3)$$

By putting the values of $\log 2, \log 3$ and $\log 5$

$$=\frac{1}{2}(0.3010+0.69900-0.4771)$$

$$=\frac{1}{2}(1-0.4771)$$

$$=\frac{1}{2}(0.5229)$$

$= 0.26145$ **Ans**

(iv) $\log\frac{8}{3}$

Solution: $\log\frac{8}{3}$

$$=\log\frac{2^3}{3}$$

$$=\log 2^3-\log 3$$

$$=3\log 2-\log 3$$

By putting the values of $\log 2$ and $\log 3$

$$=3(0.3010)-0.4771$$

$$=0.9030-0.4771$$

$= 0.4259$ **Ans**

(v) $\log 30$

Solution: $\log 30$

$$=\log(5\times 2\times 3)$$

$\because$ using first law of logarithm

$$=\log 5+\log 2+\log 3$$

By putting the values of $\log 2, \log 3$ $\log 5$

$$=(0.6990)+(0.3010)+(0.4771)$$

$= 1.4771$ **Ans**

Exercise 3.4

Q.1 Use log tables to find the value of

(i) 0.8176×13.64

Solution: 0.8176×13.64

Suppose

$x = 0.8176 \times 13.64$

Taking log on both sides

$\log x = \log(0.8176 \times 13.64)$

According to first law of logarithm

$\log x = \log 0.8176 + \log 13.64$

$= \bar{1}.9125 + 1.1348$

$\log x = -1 + 0.9125 + 1.1348$

$\log x = 1.0473$

To find antilog

$x = \text{antilog}\, 1.0473$

Ch = 1

$x = 1.115$

Reference point

$x = 11.15$ **Ans**

(ii) $(789.5)^{\frac{1}{8}}$

Solution: $(789.5)^{\frac{1}{8}}$

Let $x = (789.5)^{\frac{1}{8}}$

Taking log on both sides

$\log x = \log(789.5)^{\frac{1}{8}}$

According to third law

$\log x = \frac{1}{8}\log(789.5)$

$\log x = \frac{1}{8}(2.8974)$

$= \frac{2.8974}{8}$

$\log x = 0.3622$

To find antilog

$x = \text{antilog}\ 0.3622$

Characteristics = 0

$x = 2.302$

Reference point

$x = 2.302$ **Ans**

(iii) $\frac{0.678 \times 9.01}{0.0234}$

Solution: $\frac{0.678 \times 9.01}{0.0234}$

Suppose

$x = \frac{0.678 \times 9.01}{0.0234}$

Taking log on both sides

$\log x = \log \frac{0.678 \times 9.01}{0.0234}$

According to 1st and 2nd law of log

$\log x = \log 0.678 + \log 9.01 - \log 0.0234$

$\log x = \bar{1}.8312 + 0.9547 - \bar{2}.3692$

$= -1 + 0.8312 + 0.9547 - (-2 + 0.3692)$

$= 2.4167$

To find antilog

$x = \text{antilog}\ 2.4167$

Characteristics = 2

$x = 2.610$

$x = 261.0$ **Ans**

(iv) $\sqrt[5]{2.709} \times \sqrt[7]{1.239}$

Solution: $\sqrt[5]{2.709} \times \sqrt[7]{1.239}$

$(2.709)^{\frac{1}{5}} \times (1.239)^{\frac{1}{7}}$

Suppose:

$x = (2.709)^{\frac{1}{5}} \times (1.239)^{\frac{1}{7}}$

Taking log on both side

$\log x = \log\left[(2.709)^{\frac{1}{5}} \times (1.239)^{\frac{1}{7}}\right]$

According to law of logarithm

$\log x = \log(2.709)^{\frac{1}{5}} + \log(1.239)^{\frac{1}{7}}$

According to third law of logarithm

$\log x = \frac{1}{5}\log(2.709) + \frac{1}{7}\log(1.239)$

$\log x = \frac{1}{5}\log(2.709) + \frac{1}{7}\log(1.239)$

$=\frac{1}{5}0.4328+\frac{1}{7}0.0931$

$=\frac{0.4328}{5}+\frac{0.0931}{7}$

$0.0866+0.0133$

$=0.0999$

To find antilog

x = antilog 0.999

Characteristics = 0

$x=1.259$

Reference point

$x=1.259$ **Ans**

(v) $\frac{1.23\times 0.6975}{0.0075\times 1278}$

Solution: $\frac{1.23\times 0.6975}{0.0075\times 1278}$

Suppose

$x=\frac{1.23\times 0.6975}{0.0075\times 1278}$

$\log x=\log\frac{1.23\times 0.6975}{0.0075\times 1278}$

$=\log(1.23\times 0.6975)-\log(0.0075\times 1278)$

$=\log 1.23+\log 0.6975-(\log 0.0075+\log 1278)$

$=\log 1.23+\log 0.6975-\log 0.0075-\log 1278$

$=0.0899+\bar{1}.8435-\bar{3}.8751-3.1065$

$=0.8999+(-1+0.8435)-(-3+0.8751)+3.1065$

$=-1.0482$

$\log x=-2+2-1.0482$

$\log x=02+0.9515$

$\log x=\bar{2}.9518$

To find antilog

x = antilog $\bar{2}.9518$

Ch = $\bar{2}$

$x=8950$

$=0.08950$ **Ans**

(vi) $\sqrt[3]{\frac{0.7214\times 20.37}{60.8}}$

Solution: $\sqrt[3]{\frac{0.7214\times 20.37}{60.8}}$

Let $x=\left[\frac{0.7214\times 20.37}{60.8}\right]^{\frac{1}{3}}$

Taking log on both sides

$\log x=\log\left(\frac{0.7214\times 20.37}{60.8}\right)^{\frac{1}{3}}$

3rd of logarithm

$\log x=\frac{1}{3}\log\left[\frac{0.7214\times 20.37}{60.8}\right]$

According to first and 2nd law

$\log x=\frac{1}{3}[\log 0.7214+\log 37-\log 60.8]$

$\log x=\frac{1}{3}\left[\bar{1}.8582+1.3089-1.7839\right]$

$\frac{1}{3}[-1+0.8582+1.3089-1.7839]$

$=\frac{1}{3}(-0.6168)$

$=-0.2056$

$\log x$ is in negative, so

$\log x=-1+1-0.2056$

$=-1+79144$

$=\bar{1}.7944$

To find antilog

x = antilog $\bar{1}.7944$

Ch = $\bar{1}$

$x=6229$

Reference point

0.6229 **Ans**

(vii) $\frac{83\times\sqrt[3]{92}}{127\times\sqrt[5]{246}}$

Solution: $\frac{83\times\sqrt[3]{92}}{127\times\sqrt[5]{246}}$

Suppose: $x=\frac{83\times\sqrt[3]{92}}{127\times\sqrt[5]{246}}$

$$x=\frac{83\times(92)^{\frac{1}{3}}}{127\times(246)^{\frac{1}{5}}}$$

Taking on both side

$$\log x=\log\frac{83\times(92)^{\frac{1}{3}}}{127\times(246)^{\frac{1}{5}}}$$

According to 1st and 2nd law of log

$$\log x=\log 83+\log(92)^{\frac{1}{3}}-\log 127-\log(246)^{\frac{1}{5}}$$

According to third law of log

$$\log x=\log 83+\frac{1}{3}\log 92-\log 27-\frac{1}{5}\log 246$$

$$\log x=(1.9191)+\frac{1}{3}(1.9638)-(2.1038)$$

$$-\frac{1}{5}(2.3909)$$

= 1.9191 + 0.65460 – 2.1038 – 0.47818

$=1.9191+0.6546-2.1038-0.47818$

$=-0.0083$

$\log x$ is in negative, so

$\log x=-1+1-0.0083$

$=-1+0.9917$

$=\bar{1}.9917$

To find antilog

$x=$ antilog $\bar{1}.9917$

Ch = $\bar{1}$

$x=9.811$

Reference point

$x=0.9811$ **Ans**

(viii) $\dfrac{(438)^3\sqrt{0.056}}{(388)^4}$

Solution: $\dfrac{(438)^3\sqrt{0.056}}{(388)^4}$

Suppose: $x=\dfrac{(438)^3\sqrt{0.056}}{(388)^4}$

$$x=\frac{(438)^3(0.056)^{\frac{1}{2}}}{(388)^4}$$

$$x=\frac{(438)^3(0.056)^{\frac{1}{2}}}{(388)^4}$$

Taking log on both side

$$\log x=\log\left(\frac{(438)^3(0.056)^{\frac{1}{2}}}{(388)^4}\right)$$

According to 1st and 2nd law

$$\log x=\log(438)^3+\log(0.056)^{\frac{1}{2}}-\log(388)^4$$

According to third law

$$\log x=3\log(438)+\frac{1}{2}\log(0.056)-4\log(38)$$

$$\log x=3(2.6415)+\frac{1}{2}(\bar{2}.7482)-4(2.5888)$$

$$=7.9245+\frac{1}{2}(-2+0.7482)-10.3552$$

$$=7.9245+\frac{1}{2}(-1.2518)-10.3552$$

$=7.9245-0.6259-10.3552$

$=-3.0566$

log is in negative, so

$\log x=-4+4-3.0566$

$=-4+0.9434$

To find antilog

$x=$antilog $\bar{4}.9434$

Ch = $\bar{4}$

$x=8778$

Reference point

$=0.0008778$ **Ans**

Q.2 A gas is expanding according to the law $pv^n=C$.
Find C when p = 80, v = 3.1 and $n=\frac{5}{4}$.

Solution: Given that $pv^n=C$

Taking log on both sides

Log $(pv^n)=\log C$

Log P+log v^n= log C

Log C =log P+log v^n

Log C =log P+n log v

Putting P=80, v=3.1 and $n=\frac{5}{4}$

$\text{Log } C = \log 80 + \frac{5}{4} \log 3.1$

$= 1.9031 + \frac{5}{4}(0.4914)$

=1.9031+0.6143

Log C=2.5174

Taking antilog both sides

C=Antilog (2.5174)

C=329.2 **Ans:**

Q.3 The formula $p = 90\,(5)^{-q/10}$ applies to the demand of a product, where q is the number of units and p is the price of one unit. How many units will be demanded if the price is Rs 18.00?

Solution: Given that $p = 90(5)^{\frac{-q}{10}}$

Taking log on both sides

$Log\ p = \log\left(90(5)^{\frac{-q}{10}}\right)$

$Log\ p = \log 90 + \log 5^{\frac{-q}{10}}$

$\text{Log } P = \log 90 - \frac{q}{10} \log 5$

$\text{Log } 18 = \log 90 - \frac{q}{10} \log 5$

(P =18)

$1.2553 = 1.9542 - \frac{q}{10} \times 0.6990$

$1.2553 - 1.9542 = -\frac{q}{10} \times 0.6990$

-0.6989 x 10 = - q x 0.6990

-6.989=-*q* x 0.6996

6.989=*q* x 0.6996

$\frac{6.989}{0.6990} = q$

q =10 approximately

Hence 10 units will be demanded

Q.4 If $A = \pi r^2$, find A, when $\pi = \frac{22}{7}$ and $r = 15$.

Solution: Given that $A = \pi r^2$

Taking log on both sides

Log A=log πr^2

Log A=log π +log r^2

Log A=log π +2 log r

Putting $\pi = \frac{22}{7}$ and r =15

Log A=log $\frac{22}{7}$ +2 log 15

=log 22-log 7+2 log 15

=1.3424-0.8451+2(1.1761)

=0.4973+2.3522

Log A=2.8495

Taking antilog on both sides

A=antilog 2.8495

A=707.1 **Ans**

Q.5 If $V = \frac{1}{3}\pi r^2 h$, find V, when $\pi = \frac{22}{7}$, $r = 2.5$ and h=4.2.

Solution: Given that $V = \frac{1}{3}\pi r^2 h$

Taking log on both sides

$\text{Log}V = \log \frac{1}{3}\pi r^2 h$

$= \log \frac{1}{3} + \log \pi r^2 h$

=log 1-log 3+ log πr^2 + log h

= 0-0.4771+ log π +log r^2+ log h

=-0.4771+ log $\frac{22}{7}$ +2 log r + log h

$\left(\pi = \frac{22}{7}, r = 2.5 \text{ and } h = 4.2\right)$

$= -0.4771 + \log 22 - \log 7 + 2\log 2.5 + \log 4.2$

$= -0.4771 + 1.3424 - 0.8450 + 2x0.3979 + 0.6232$

$= -0.4771 + 1.3424 - 0.8450 + 0.7959 + 0.6232$

Log V=1.4394

Taking antilog on both sides

V=antilog 1.4394

V=27.50 **Ans**

Review Exercise 3

Q.1 Multiple choice Questions. Choose of the correct answer.

(i) **If $a^x = n$, then…**

(a) $a = \log_x n$ **(b)** $x = \log_n a$

(c) $x = \log_a n$ **(d)** $a = \log_n x$

(ii) **The relation $y=\log_z x$ implies…**

(a) $x^y = z$ **(b)** $z^y = x$

(c) $x^z = y$ **(d)** $y^z = x$

(iii) **The logarithm of unity to any base is…**

(a) 1 **(b)** 10

(c) e **(d)** 0

(iv) **The logarithm of any number to itself as base is…**

(a) 1 **(b)** 0

(c) e **(d)** 10

(v) **Log e=…,where e$\approx$ 2.718**

(a) 0 **(b)** 0.4343

(c) ∞ **(d)** 1

(vi) **The value of log $\left(\frac{p}{q}\right)$ is…**

(a) $\log p - \log q$ **(b)** $\frac{\log p}{\log q}$

(c) $\log p + \log q$ **(d)** $\log q - \log p$

(vii) **Log p-log q is same as …**

(a) $\log\left(\frac{q}{p}\right)$ **(b)** $\log(p-q)$

(c) $\frac{\log p}{\log q}$ **(d)** $\log q - \log p$

(viii) **Log(m^n) can be written as…**

(a) $(\log m)^n$ **(b)** $m \log n$

(c) $n \log m$ **(d)** $\log(mn)$

(ix) $\log_b a \times \log_c b$ **can be written as…**

(a) $\log_a c$ **(b)** $\log_c a$

(c) $\log_a b$ **(d)** $\log_b c$

(x) $\mathbf{Log}_y x$ **will be equal to…**

(a) $\dfrac{\log_z x}{\log_y z}$ **(b)** $\dfrac{\log_x z}{\log_y z}$

(c) $\dfrac{\log_z x}{\log_z y}$ **(d)** $\dfrac{\log_z y}{\log_z x}$

ANSWER KEY

i	ii	iii	iv	v	vi	vii	viii	ix	x
c	b	d	a	b	a	d	c	b	c

Q.2 Complete the following:

(i) For common logarithm, the base is…

(ii) The integral part of the common logarithm of a number is called the …

(iii) The decimal part of the common logarithm of a number is called the …

(iv) If x = log y, then y is called the… of x.

(v) If the characteristic of the logarithm of a number have...zero(s) immediately after the decimal point.

(vi) If the characteristic of the logarithm of a number is 1, that number will have digits in its integral part.

ANSWER KEY

i	ii	iii	iv	v	vi
10	**Characteristic**	**Mantissa**	**Antilogarithm**	**One**	**2**

Q.3 Find the value of x **in the following.**

(i) $\log_3 x = 5$

Solution: $\log_3 x = 5$

Write in exponential form.

$3^5 = x$

$243 = x$ **Ans**

(ii) $\log_4 256 = x$

Solution: $\log_4 256 = x$

Write in exponential form

$4^x = 256$

$4^x = 4^4$

$x = 4$

$x = 4$ **Ans**

(iii) $\log_{625} 5 = \frac{1}{4}x$

Solution: $\log_{625} 5 = \frac{1}{4}x$

Write in exponential form

$(625)^{\frac{1}{4}x} = 5$

$(625)^{\frac{x}{4}} = 5$

$(5^4)^{\frac{x}{4}} = 5$

$5^{\frac{4x}{4}} = 5$

$5^x = 5^1$

$x = 1$ **Ans**

(iv) $\log_{64} x = -\frac{2}{3}$

Solution: $\log_{64} x = -\frac{2}{3}$

Write in exponential form

$(64)^{\frac{-2}{3}} = x$

$(4^3)^{-\frac{2}{3}} = x$

$4^{-\frac{6}{3}} = x$

$4^{-2} = x$

$\frac{1}{4^2} = x$

$\frac{1}{16} = x$ **Ans**

Q.4 Find the value of x in the following.

(i) $\log x = 2.4543$

Solution: $\log x = 2.4543$

$\log x = 2.4543$

$x = \text{antilog}\, 2.4543$

$\text{Ch} = 2$

$x = 284.6$ **Ans**

(ii) $\log x = 0.1821$

Solution: $\log x = 0.1821$

$\log x = 0.1821$

$x = \text{antilog}\, 0.1821$

$\text{Ch} = 0$

$x = 1.521$ **Ans**

(iii) $\log x = 0.0044$

Solution: $\log x = 0.0044$

$\log x = 0.0044$

$x = \text{antilog}\ 0.0044$

$\text{Ch} = 0$

$x = 1.010$ **Ans**

(iv) $\log x = \bar{1}.6238$

Solution: $\log x = \bar{1}.6238$

$\log x = \bar{1}.6238$

$x = \text{antilog}\, \bar{1}6333$

$\text{Ch} = \bar{1}$

$x = 0.4206$ **Ans**

Q.5 If $\log 2 = 0.3010$, $\log 3 = 0.4771$, and $\log 5 = 0.6990$ then find the values of the following.

(i) $\log 45$

Solution: $\log 45$

$= \log(9 \times 5)$

$= \log(3^2 \times 5)$

$= \log 3^2 + \log 5$

$= 2\log 3 + \log 15$

$= 2(0.4771) + 0.6990$

$= 0.9542 + 0.6990$

$= 1.6532$ **Ans**

(ii) $\log \frac{16}{15}$

Solution: $\log \frac{16}{15}$

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

$= \log 2^4 - \log(3 \times 5)$

$= 4\log 2 - (\log 3 + \log 5)$

$= \log 2^4 - \log 3 - \log 5$

$= 4\log 2 - \log 3 - \log 5$

$= 4(0.3010) - 0.4771 - 0.6990$

$= 1.2040 - 0.4771 - 0.6990$

$= 0.0279$ **Ans**

(iii) $\log 0.048$

Solution: $\log 0.048$

$$=\log\frac{48}{1000}$$
$$=\log\frac{2\times2\times2\times2\times3}{2\times2\times2\times5\times5\times5}$$
$$=\log\frac{2^4\times3}{2^3\times5^3}$$
$$=\log 2^4+\log 3-\log 2^3-\log 5^3$$
$$=4\log 2+\log 3-3\log 2-3\log 5$$
$$=4(0.3010)+0.4771-3(0.3010)-3(0.6990)$$
$$=1.2040+0.4771-0.9030-2.0970$$
$$=-1.3189$$
$$=-1-0.3189$$
$$=-1-1+1-0.3189$$
$$=-2+0.6811$$
$$=\bar{2}.6811$$ **Ans**

Q.6 Simplify the following.

(i) $\sqrt[3]{25.47}$

Solution: $\sqrt[3]{25.47}$

Let $x=\sqrt[3]{25.74}$

$$=(25.47)^{\frac{1}{3}}$$

Taking log on both sides

$$\log x=\log(25.47)^{\frac{1}{3}}$$
$$=\frac{1}{3}\log 25.47$$
$$=\frac{1}{3}(1.4060)$$
$$\log x=0.4687$$
$$x=\text{anti}\log 0.4687$$
$$\text{Ch}=0$$
$$x=2.943$$ **Ans**

(ii) $\sqrt[5]{342.2}$

Solution: $\sqrt[5]{342.2}$

Let

$$x=\sqrt[5]{342.2}$$
$$x=(242.)^{\frac{1}{5}}$$

Taking log on both sides

$$\log x=(342.2)^{\frac{1}{5}}$$
$$\log x=\frac{1}{5}\log 342.2$$
$$=\frac{1}{5}(2.5343)$$
$$\log x=0.5069$$
$$\log x=\text{antilog}\,0.5069$$
$$\text{Ch}=0$$
$$x=3.213$$ **Ans**

(iii) $\dfrac{(8.97)^3\times(3.95)^2}{\sqrt[3]{15.37}}$

Solution: $\dfrac{(8.97)^3\times(3.95)^2}{\sqrt[3]{15.37}}$

Let $x=\dfrac{(8.97)^3\times(3.95)^2}{\sqrt[3]{15.37}}$

Taking log on both sides

$$\log x=\log\frac{(8.97)^3\times(3.95)^2}{\sqrt[3]{15.37}}$$
$$=\log(8.97)^3+\log(3.95)^2-\log(15.37)^{\frac{1}{3}}$$
$$=3\log 8.97+2\log 3.95-\frac{1}{3}\log 15.37$$
$$=3(0.9528)+2(0.5966)-\frac{1}{3}(1.1867)$$
$$=2.8584+1.1932-0.3956$$
$$\log x=3.656$$
$$x=\text{antilog}\,3.656$$
$$\text{Ch}=3$$
$$x=4529$$ **Ans**

Unit 3: Logarithms

Overview

Scientific Notation:

A number written in the form $a \times 10^n$, where $1 \le a < 10$ and n is an integer, is called the scientific notation.

Logarithm of a Real Number:

If $a^x = y$ they x is called the logarithm of y to the base 'a' and is written as $\log_a y = x$, where $a > 0, a \ne 1$ and $y > 0$

Characteristic of logarithm of the Number:

An integral part which is positive for a number greater than 1 and negative for a number less than 1, is called the characteristic of logarithm of the number.

Mantissa of the logarithm of the Number:

A decimal part which is always positive, is called the mantissa of the logarithm of the number.

Antilogarithm:

The number whose logarithm is given is called antilogarithm.