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Chapter 1

Part-1 : Mathematics Number System

1. IMPORTANT TERMINOLOGY

1.1 Digits—0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 are defined as digits in Mathematics. We can create many numbers by using these digits. For example : 10, 123, 456, 789 etc.

1.2 Number System—There are mainly two types defined in the number system. These are :

- I. **Decimal Number System**—It contains 0 to 9 digits. That's why it is called *decimal number system*. In this system, the numbers is read and written in two ways—Indian number system and International number system. In the Indian number system or Hindi-Arabic system, the numbers are read and written as per their place values. These numbers are read as per the following table.

| Periods | Crores | Lakhs | Thousands | Ones |
|---------|------------------------------|------------------------|---------------------------|---------------------|
| Values | 10,00,00,000 (Ten Crores) | 1,00,00,000 (Crore) | 10,00,000 (Ten Lakhs) | 1,00,000 (Lakh) |
| | 10^8 | 10^7 | 10^6 | 10^5 |
| | | | 10,000 (Ten Thousands) | 1,000 (Thousand) |
| | | | 10^4 | 10^3 |
| | | | | 100 (Hundred) |
| | | | | 10^2 |
| | | | | 10 (Ten) |
| | | | | 10^1 |
| | | | | 1 (One) |
| | | | | 10^0 |

Example : Number 51,45,42,786 can be read as Fifty-one Crores Forty-five Lakhs Forty-two Thousands Seven Hundred and Eighty-six. It is also called number name.

Unit Conversions :

- 1 tens = 10 units
- 1 Hundred = 10 tens = 100 units
- 1 Thousand = 10 Hundreds = 100 tens = 1000 units
- 1 Lakh = 10 Thousands = 100 Hundreds = 1000 tens
- 1 Crore = 10 Lakhs = 100 Thousands = 1000 Hundreds

In International number system, the numbers are read and written as per the following table.

| Periods | Millions | Thousands | Ones |
|---------|----------------------------------|-----------------------------|--------------------------------|
| Values | 100,00,000 (Hundred Millions) | 10,00,000 (Ten Millions) | 1,00,000 (Million) |
| | 10^8 | 10^7 | 10^6 |
| | | | 100,000 (Hundred Thousands) |
| | | | 10^5 |
| | | | 10,000 (Ten Thousands) |
| | | | 10^4 |
| | | | 1,000 (Thousand) |
| | | | 10^3 |
| | | | 100 (Hundred) |
| | | | 10^2 |
| | | | 10 (Ten) |
| | | | 10^1 |
| | | | 1 (One) |
| | | | 10^0 |

Example : Number 14,542,786 can be read as Fourteen Millions Five Hundred Forty-two Thousand Seven Hundred Eighty-six.

- II. **Roman Number System**—In this system, numbers are represented by Latin alphabets. The Roman numerals used in, are based on seven symbols or letters.

| Roman System | I | V | X | L | C | D | M |
|---------------------|---|---|----|----|-----|-----|------|
| Hindu-Arabic System | 1 | 5 | 10 | 50 | 100 | 500 | 1000 |

Example : 25 can be written as XXV and 101 as CI.

Note

- A letter repeats its value that many times (XXX = 30, CC = 200 etc.). A letter can only be repeated three times.
- If one or more letters are placed after another letter of greater value, add that amount.
For example,
VII = 7 (5 + 1 + 1); LXI = 61 (50 + 10 + 1); MCC = 1200 (1000 + 100 + 100)
- If a letter is placed before another letter of greater value, subtract that amount.
For example,
IV = 4 (5 - 1); XIV = 14 (10 + 5 - 1); CM = 900 (1000 - 100)
- Only subtract powers of ten (I, X, or C, but not V or L).
- Only subtract one number from another.
- Do not subtract a number from one that is more than 10 times greater (that is, you can subtract 1 from 10 [IX] but not 1 from 20—there is no such number as IXX.)
- A bar placed on top of a letter or string of letters increases the numeral's value by 1,000 times.
For example, XII = 12 whether $\overline{\text{XII}}$ = 12000.

2. DIGITS OF NUMBER

- **Units**—Digit 0 to 9 are called Unit digits. The smallest and the largest number of 1-digit are 0 and 9 respectively.
- **Tens**—The numbers from 10 to 99 are called ten numbers. The smallest and the largest number of 2-digits are 10 and 99 respectively.
- **Hundreds**—The numbers from 100 to 999 are called hundred numbers. The smallest and the largest number of 3-digits are 100 and 999 respectively.

- **Thousands**—The numbers from 1,000 to 9,999 are called thousand numbers. The smallest and the largest number of 4-digits are 1000 and 9999 respectively.
- **Ten thousands**—The numbers from 10,000 to 99,999 are called ten thousand numbers. The smallest and the largest number of 5-digits are 10,000 and 99,999 respectively.
- **Lakhs**—The numbers from 1,00,000 to 9,99,999 are called lakh numbers. The smallest and the largest number of 6-digits are 1,00,000 and 9,99,999 respectively.
- **Ten Lakhs**—The numbers from 10,00,000 to 99,99,999 are called ten lakh numbers. The smallest and the largest number of 7-digits are 10,00,000 and 99,99,999 respectively.
- **Crores**—The numbers from 1,00,00,000 to 9,99,99,999 are called crore numbers. The smallest and the largest number of 8-digits are 1,00,00,000 and 9,99,99,999 respectively.

3. VALUE OF DIGITS

- **Place Value**—Place value helps us determine the value of numbers. Our (base-10) number system contains numerals or digits only from 0 to 9, but we often need to use numbers greater than 9. We show numbers greater than 9 by using place value. Place value refers to the value of each digit in a number.
Example : In a number 489765, place value of 7 will be 7×100 units, i.e., 700. Similarly, the place value of 8 will be $8 \times 10,000 = 80,000$.
- **Face Value**—The actual value of a digit in a number is the digit itself. The place value of the digit is ignored in the number.
Example : In a number 59,438, the face value of 4 is 4, face value of 9 is 9 etc.

Note

If x and y be the tens digit and unit digit respectively, then the 2-digit number formed by these digits will be $10x + y$.

4. COMPARISON OF NUMBERS

- **When both numbers have unequal number of digits**
The number having more digits is greater. It means
..... 5-digit number > 4-digit number > 3-digit number
Example : Find out which is greater 5429683 or 65245893 ?
Solution : Since, the first number 5429683 is of 7-digit number whether the second number 65245893 is of 8-digit. Therefore, the second number is greater than the first number.
- **When both numbers have equal number of digits**
In case of the equal number of digits, we have to check the place value of the left-most digit of both numbers. If the digits of both numbers are also equal, then we move to its next digit placed on the right side and repeat the process until we get the desired result.

Example : Arrange the following numbers in ascending order.

5403100, 5460860, 5458087, 5420378

Solution : At first, we check the place value of the leftmost digit of each number. Then repeat the same process until we get the answer. Here, in each number, two leftmost digits are equal. After that, we check ten thousand place values and then arrange the digits in ascending order. Hence, we get

$$5403100 < 5420378 < 5458087 < 5460860$$

5. CLASSIFICATION OF NUMBERS

There are several types of numbers exist in the number system for different purposes. These numbers are classified into different groups according to their properties. These are :

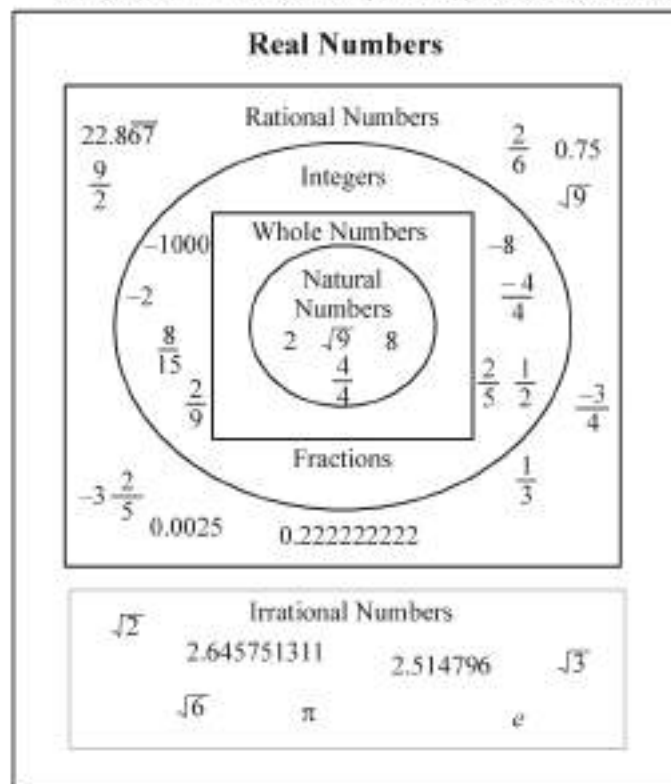
- **Natural Numbers**—Counting numbers starting from 1, 2, 3..., etc. are called natural numbers. It is represented by capital letter N . Its set is shown as
$$N = \{1, 2, 3, 4, 5, \dots\}$$
- **Whole Numbers**—All natural numbers along with 0 is known as whole numbers. It is represented by capital letter W . Its set is shown as
$$W = \{0, 1, 2, 3, 4, \dots\}$$
- **Even and Odd Numbers**—A number is even if it is a multiple of two, and is odd otherwise. Even numbers are denoted by capital letter E and odd numbers are denoted by capital letter O .
$$E = \{2, 4, 6, 8, \dots\} \text{ and } O = \{1, 3, 5, 7, \dots\}$$
- **Integers**—Positive and negative counting numbers, as well as zero are called integers. Integers are denoted by capital letter Z .
$$Z = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$$
- **Prime Numbers**—An integer with exactly two positive divisors : itself and 1, is called prime number. For example : 2, 3, 5, 7, 11, 13...etc. are few prime numbers. 2 is the smallest prime number.
- **Composite Numbers**—All those numbers greater than 1 that are not prime are called composite numbers. For example : 4, 6, 8, 9, 10 etc. are few composite numbers.
- **Rational Numbers**—Numbers that can be expressed as a ratio of an integer to a non-zero integer. Rational numbers are denoted by capital letter Q . All integers are rational, but the converse is not true.

$$Q = \left\{ \dots, -\frac{1}{2}, -1, 0, \frac{1}{4}, \frac{1}{2}, \dots \right\}$$

- **Irrational Numbers**—All the real numbers that are not rational are called irrational numbers. Irrational numbers are denoted by I .

$$I = \left\{ \dots, \frac{2}{3}, \sqrt{2}, \sqrt{3}, \dots \right\}$$

- **Real Numbers**—They can be positive, negative or zero. All rational numbers are real, but the converse is not true.



6. APPROXIMATE VALUES OF NUMBERS

Place values are considered to be the base to find approximation values in numbers. Approximation value of few place values is determined by the following methods.

- **Approximate value nearest tens place**—If the number at units place is less than 5 then it is rounded off to zero otherwise add 1 to the tens place and keep unit place as zero.
Example : 73 can be rounded off to 70, 156 can be rounded off to 160 and 4265 can be rounded off to 4270.
- **Approximate value nearest hundred place**—If the number at tens place is less than 5 then it is rounded off to zero otherwise add 1 to the hundred place and keep tens place and unit place as zero.
Example : 510 can be rounded off to 500, 9573 can be rounded off to 9600 and 53650 can be rounded off to 53700.
- **Approximate value nearest thousand place**—If the number at hundred place is less than 5 then it is rounded off to zero otherwise add 1 to the thousand place and keep hundred place, tens place and unit place as zero.
Example : 6240 can be rounded off to 6000, 17573 can be rounded off to 18000 and 553650 can be rounded off to 554000.

7. DIVISIBILITY TEST OF NUMBERS

- **Divisibility by 2 :**
If the unit digit of a number is any of 0, 2, 4, 6, 8, then the given number is divisible by 2.
Example : 84, 786, 282, 1008, 5000....., etc. are divisible by 2.
- **Divisibility by 3 :**
A number is divisible by 3, if the sum of all digits of the number is divisible by 3.
Example : 786, here $7 + 8 + 6 = 21$ (completely divisible by 3)
So, the number 786 will be divisible by 3.
- **Divisibility by 4 :**
A number is divisible by 4, if the last two-digits of the number is divisible by 4.
Example : 3464, here 64 is the last two-digit number which is divisible by 4.
So, the number 3464 will be divisible by 4.
- **Divisibility by 5 :**
A number is divisible by 5, if the unit digit of the number is either 0 or 5.
Example : 3125, 2010, 2015, 6580....., etc. are divisible by 5.
- **Divisibility by 6 :**
A number is divisible by 6, if the number is divisible by the numbers 2 and 3.
Example : Test whether number 8202 is divisible by 6.
Solution : (i) the unit digit of the number is 2 which is divisible by 2.
(ii) the sum of digits of the number $= 8 + 2 + 0 + 2 = 12$ (divisible by 3)
Since, it is clear from (i) and (ii) that the number 8202 is divisible by both 2 and 3. So, the number will be divisible by 6.
- **Divisibility by 7 :**
Take the last digit of the given number and double it. Subtract this number from the rest of the digits in the original number. If this new number is either 0 or if it is a number that is divisible by 7, then the given number is also divisible by 7.
Example : Test whether number 2492 is divisible by 7.
Solution : Here, the unit digit of the number = 2
 $249 - 2 \times 2 = 245$ (divisible by 7). So, the number will be divisible by 7.
- **Divisibility by 8 :**
A number is divisible by 8, if the last three-digits of the number is divisible by 8.

Example : Test whether number 6288 is divisible by 8.

Solution : Here, in the given number, 288 is the last three-digit number which is completely divisible by 8.

So, the number 6288 will be divisible by 8.

• **Divisibility by 9 :**

A number is divisible by 9, if the sum of its digits is divisible by 9.

Example : Test whether number 7074 is divisible by 9.

Solution : Sum of all digits of the number = $7 + 0 + 7 + 4 = 18$ (divisible by 9).

So, the number 7074 will be divisible by 9.

• **Divisibility by 11 :**

A number is divisible by 11, if difference between the sum of digits at odd places and the sum of digits at even places, is divisible by 11.

Example : Test whether number 86460 is divisible by 11.

Solution : Sum of the all digits at even places in the number = $6 + 6 = 12$

Sum of the all digits at odd places in the number = $8 + 4 + 0 = 12$

Their difference = $12 - 12 = 0$. So, the number 86460 will be divisible by 11.

8. DIVISION ALGORITHM

The number which we divide is called the dividend. The number by which we divide is called the divisor. The result obtained is called the quotient. The number left over is called the remainder. Some formula are given below for Division based questions.

• $\text{Dividend} = \text{Divisor} \times \text{Quotient} + \text{Remainder}$

• $\text{Divisor} = \frac{\text{Dividend} - \text{Remainder}}{\text{Quotient}}$

• $\text{Quotient} = \frac{\text{Dividend} - \text{Remainder}}{\text{Divisor}}$

Example : In a question, the divisor is 4 times the quotient and 2 times the remainder. If the remainder is 20, then find the value of dividend.

Solution : According to Question,

$$\text{Divisor} = 2 \times \text{Remainder} = 2 \times 20 = 40 \quad \dots(1)$$

$$\text{And, Divisor} = 4 \times \text{Quotient} \\ \Rightarrow 4 \times \text{Quotient} = 40 \quad [\text{from eq.(1)}]$$

$$\Rightarrow \text{Quotient} = 40/4 = 10$$

$$\therefore \text{Dividend} = 40 \times 10 + 20 = 400 + 20 = 420$$

9. WHOLE NUMBERS

We start counting from the number 1. Hence 1 is the first natural number and the next natural number is 2 which is obtained by adding 1 to the first number. Hence, numbers are represented in two ways according to their orderliness :

• **Predecessor** —The natural number immediately preceding a natural number is its predecessor.

Example : Predecessor number of 65 = $65 - 1 = 64$

Predecessor number of 127 = $127 - 1 = 126$

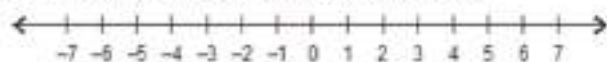
• **Successor** —The natural number immediately next to any natural number is its successor.

Example : Successor number of 785 = $785 + 1 = 786$

Successor number of 109 = $109 + 1 = 110$

10. INTEGERS

The set of all negative numbers and positive numbers on either side of the zero marked on the number line is called an integer. $-5, -4, -3, -2, -1, 0, 1, 2, 3, 4$, and 5 all are the integers. On the number line, integers are represented as follows :



11. MODULES OF A NUMBER

$$|x| = \begin{cases} x & \text{when } x \geq 0 \\ -x & \text{when } x < 0 \end{cases}$$

For Ex. $|-5| = 5$
 $|4| = 4$ etc.

12. RATIONALISATION

When a radical contains an expression that is not a perfect root, for example, the square root of 3 or cube root of 5, it is called an irrational number. So, in order to rationalize the denominator, we need to get rid of all radicals that are in the denominator. A rationalisation is a process by which radicals in the denominator of a fraction are eliminated.

Method of Rationalisation :

Step 1 : Multiply numerator and denominator by a radical that will get rid of the radical in the denominator.

Step 2 : Make sure all radicals are simplified.

Step 3 : Simplify the fraction if needed.

For example : Rationalize the denominator $\frac{1}{\sqrt{2}-1}$

$$\begin{aligned} \text{Solution :} \quad &= \frac{1}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1} \\ &= \frac{\sqrt{2}+1}{(\sqrt{2})^2 - 1^2} \\ &= \frac{\sqrt{2}+1}{2-1} \\ &= \sqrt{2}+1 \end{aligned}$$

13. PROGRESSION

Progression is a sequence of numbers in order in which a pattern follows and there is an algebraic relation among them.

For example : $2 + 4 + 6 + 8 + \dots$

Arithmetic Progression : Arithmetic progression is a sequence of numbers in order in which the difference of any two consecutive numbers is a constant value.

For example : 1, 4, 7, 10, 13 is an A.P. which has a common difference between two successive terms $4 - 1 = 7 - 4 = 3$

the n^{th} term of AP $T_n = a + (n - 1)d$

Sum of the first n terms $S_n = \frac{n}{2}[2a + (n - 1)d]$

where a = first term
 d = common difference
 n = number of terms
 T_n = n^{th} term

Example : Find the n^{th} term of A.P. : 1, 4, 7, 10 T_n , if the number of terms are 20.

Solution : Given AP : 1, 4, 7, 10 T_n
 $n = 20, d = 4 - 1 = 3$

$$\begin{aligned}T_n &= a + (n - 1)d \\T_{20} &= 1 + (20 - 1) \times 3 \\T_{20} &= 1 + 19 \times 3 \\T_{20} &= 58\end{aligned}$$

Some Special Formulae :

$$(i) (a + b)^2 = (a^2 + b^2 + 2ab)$$

$$(ii) (a - b)^2 = (a^2 + b^2 - 2ab)$$

$$(iii) (a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$$

$$(iv) (a + b)^2 - (a - b)^2 = 4ab$$

$$(v) (a^2 - b^2) = (a + b)(a - b)$$

$$(vi) (a + b)^3 = a^3 + b^3 + 3ab(a + b)$$

$$(vii) (a - b)^3 = a^3 - b^3 - 3ab(a - b)$$

$$(viii) (a^3 + b^3) = (a + b)(a^2 - ab + b^2)$$

$$(ix) (a^3 - b^3) = (a - b)(a^2 + ab + b^2)$$

$$(x) \Sigma n = 1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2}$$

$$(xi) \Sigma n^2 = 1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{1}{6} n(n+1)(2n+1)$$

Sainik School Previous Years (2018-2021) Questions

1. The additive identity for integers is :

- (A) 0 (B) 1
(C) -1 (D) does not exist

[Sainik School Entrance Exam
(Class IX) (07-02-2021)]

1. (B) The additive identity for integer is always zero.

e.g., $5 + 0 = 5$ or $0 + 1 = 1$

2. Associative property of multiplication of integers :

- (A) exists
(B) does not exist
(C) holds without 0
(D) None of these

[Sainik School Entrance Exam
(Class IX) (07-02-2021)]

2. (A) Associative properties of multiplication of integer exists.

e.g., $(3 \times 4) \times 2 = 3 \times (4 \times 2)$

3. 'If a number when divided by 4 leaves remainder 2 or 3', then which one is the correct statement ?

- (A) The number is not a perfect square
(B) The number is a perfect square
(C) The number is a prime number
(D) None of the above

Sainik School Entrance Exam
(Class IX 2020)

3. (A) The number is not a perfect square because perfect square never have their one's digit as 2, 3, 7 or 8.

4. If $\overline{148101a095}$ is a multiple of 11, where a is a digit, the value of a is :

- (A) 0 (B) 4
(C) 1 (D) 2

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(Class IX 2020)

4. (B) Given, number $\overline{148101a095}$
 Divisibility rule of 11 : A number is divisible by 11 if the sum of the digits in the odd places and the sum of the digits in the even places difference is a multiple of 11 or zero, then result is divisible by 11.
 Taking odd places terms :
 $S_1 = 1 + 8 + 0 + a + 9 = 18 + a$
 Taking even places terms :
 $S_2 = 4 + 1 + 1 + 0 + 5 = 11$
 Now, $S_1 - S_2 = 18 + a - 11 = 7 + a$
 To divisible $(7 + a)$ by 11 possible value of a is 4.

5. Find the value of A and B in

$$\begin{array}{r}BA \\ \times B3 \\ \hline 57A\end{array}$$

(A) A = 5 and B = 2

(B) A = 5 and B = 5

(C) A = 2 and B = 2

(D) A = 2 and B = 5

Sainik School Entrance Exam
(Class IX 2020)

5. (A)

BA

$\times B3$

$\hline 57A$

By hit and trial method and according to given options,

A = 5 i.e.,

B5

$\times B3$

$\hline 575$

If B = 2, then

25

$\times 23$

$\hline 75$

$50 \times$

$\hline 575$

Hence, the required value of A = 5 and B = 2.

6. Find the value of Z for which the number 471Z8 is divisible by 9.

- (A) 4 (B) 5
(C) 7 (D) 8

Sainik School Entrance Exam
(Class IX 2020)

6. (C) Given number : 471Z8

Divisibility test of 9 : The sum of the digits should be divisible by 9. then, $4 + 7 + 1 + Z + 8 = 20 + Z$

\therefore minimum value of Z for which number becomes divisible by 9 is 7.

Hence, $Z = 7$

7. If [1X2Y6Z] is a number divisible by 9, then the least value of $X + Y + Z$ is :

- (A) 0 (B) 1
(C) 6 (D) 9

Sainik School Entrance Exam
(Class IX 2019)

7. (A) According to the question,

Given number = 1X2Y6Z

If it is divisible by 9, then its sum must be divisible by 9,

$$= 1 + X + 2 + Y + 6 + Z$$

$$= 9 + X + Y + Z$$

So, for the least value, $X + Y + Z$ must be 0, so that sum is divisible by 9.

$$\therefore X + Y + Z = 0$$

8. Which of the following is the multiplicative identity for rational numbers ?

- (A) 1 (B) -1
(C) 0 (D) None of these

Sainik School Entrance Exam
(Class IX 2019)

8. (A) Let 'e' be the multiplicative identity of any rational number 'a', then

$$a \times e = a = e \times a$$

$$\therefore e = 1$$

9. You are given the multiplication of two numbers as below :

$$\begin{array}{r} 5A3 \\ \times B2 \\ \hline 1C46 \\ + 2D92 \times \\ \hline E1FG6 \end{array}$$

The values of the letters A, B, C, D, E, F and G are :

- (A) $A = 2, B = 4, C = 0, D = 0, E = 2, F = 9, G = 6$
(B) $A = 7, B = 4, C = 1, D = 0, E = 2, F = 0, G = 6$
(C) $A = 2, B = 4, C = 1, D = 0, E = 2, F = 0, G = 6$
(D) $A = 7, B = 4, C = 0, D = 9, E = 2, F = 9, G = 6$

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(Class IX 2019)

9. (A) Given,

$$\begin{array}{r} 5A3 \\ \times B2 \\ \hline 1C46 \\ + 2D92 \times \\ \hline E1FG6 \end{array}$$

From option (A), put $A = 2, B = 4, C = 0, D = 0, E = 2, F = 9, G = 6$

$$\begin{array}{r} 5\textcircled{2}3 \\ \times 4\textcircled{2} \\ \hline 1\textcircled{0}46 \\ + 2\textcircled{0}92 \times \\ \hline 2\textcircled{1}9\textcircled{6}6 \end{array}$$

These values satisfy the multiplication. Hence, option (A) is the correct answer.

10. If a number 573xy is divisible by 90, then what is the value of $x + y$?

- (A) 6 (B) 9
(C) 3 (D) 8

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(Class IX 2018)

10. (C) Since, the number 573xy is divisible by 90 (i.e. 9×10). Therefore the last digit of the given number will be 0 i.e. $y = 0$. Also it is divisible by 9. Therefore, the sum of digits is divisible by 9.

Now, sum of digits = $5 + 7 + 3 + x$

$$\begin{aligned} &+ y \\ &= 5 + 7 + 3 + x + 0 \\ &= 15 + x \end{aligned}$$

Here, we consider $x = 3$.

\therefore Sum of digits = $15 + 3 = 18$, which is divisible by 9.

$$\text{Hence, } x + y = 3 + 0 = 3$$

11. Find the values of A, B, C in the following :

$$\begin{array}{r} 9 \overline{) 4AB \ 5C} \\ \underline{-45} \\ 3B \\ \underline{-36} \\ 0 \end{array}$$

Then what is the value of ?

- (A) 10 (B) 14
(C) 16 (D) 18

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(Class IX 2018)

11. (D) In the given division method,

$$A - 5 = 3 \Rightarrow A = 8$$

$$B - 6 = 0 \Rightarrow B = 6$$

$$\text{and } 36 = 9C \Rightarrow C = 4$$

$$\therefore A + B + C = 8 + 6 + 4 = 18$$

12. If y denotes the digit at hundreds place of the number $67y19$, such that the number is divisible by 11. The value of y is—

- (A) 3 (B) 5
(C) 4 (D) 7

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(Class IX 2018)

12. (C) Given number is $67y19$.

$$\text{Sum of odd digits} = 6 + y + 9 = 15 + y$$

$$\text{Sum of even digits} = 7 + 1 = 8$$

$$\text{Now difference} = 15 + y - 8 = 7 + y$$

Since, above difference will be multiple of 11,

$$\therefore 7 + y = 11 \quad (\text{say})$$

$$y = 4$$

Important Questions

1. If the 7-digit number 134x58y is divisible by 72, then the value of $(2x + y)$ is :

- (A) 7 (B) 8
(C) 9 (D) 6

2. If the 6 digit numbers x35624 and 1257y4 are divisible by 11 and 72

respectively, then what is the value of $(5x - 2y)$?

- (A) 13 (B) 14
(C) 10 (D) 12

3. Find the value of A, B, C and D in the following addition :

$$\begin{array}{r} 3A B 6 \\ + D 1 7 C \\ \hline 7430 \end{array}$$

$$(A) A = 2, B = 5, C = 4 \text{ and } D = 4$$

$$(B) A = 5, B = 4, C = 3 \text{ and } D = 3$$

$$(C) A = 4, B = 3, C = 5 \text{ and } D = 4$$

$$(D) A = 3, B = 4, C = 5 \text{ and } D = 6$$

4. Find the value of A, B and C in the following subtraction :

$$\begin{array}{r} 43A \\ -BC9 \\ \hline 247 \end{array}$$

- (A) A = 6, B = 1, C = 7
(B) A = 6, B = 1, C = 8
(C) A = 5, B = 6, C = 3
(D) A = 4, B = 3, C = 4
5. Find the values of A and B in the following multiplication :

$$\begin{array}{r} 3A \\ \times 7 \\ \hline 2B8 \end{array}$$

- (A) A = 3, B = 4 (B) A = 5, B = 6
(C) A = 4, B = 3 (D) A = 6, B = 3
6. Find the values of A, B and C in the following multiplication :

$$\begin{array}{r} A\ B \\ \times B\ A \\ \hline C\ 0\ B \end{array}$$

- (A) A = 1, B = 3 and C = 4
(B) A = 4, B = 1 and C = 3
(C) A = 5, B = 2 and C = 3
(D) A = 2, B = 4 and C = 3
7. Find the values of A, B, C and D in the following division :

$$\begin{array}{r} A) 38C(4D \\ -28 \\ \hline 0C \\ -0C \\ \hline \times \end{array}$$

- (A) A = 4, B = 3, C = 3 and D = 6
(B) A = 3, B = 4, C = 8 and D = 4
(C) A = 7, B = 4, C = 3 and D = 9
(D) A = 4, B = 7, C = 4 and D = 8

8. Find the values of A, B, C, D, E, F and G in the following

$$\begin{array}{r} AB)3CDE(IFO \\ -27 \\ \hline 6D \\ -54 \\ \hline 8E \\ -8E \\ \hline \times \end{array}$$

(A) A = 2, B = 7, C = 3, D = 2, E = 1, F = 2, G = 3

(B) A = 7, B = 2, C = 2, D = 1, E = 2, F = 3, G = 4

(C) A = 3, B = 4, C = 6, D = 3, E = 4, F = 3, G = 6

(D) A = 4, B = 2, C = 1, D = 3, E = 4, F = 4, G = 7

9. The sum of the squares of 3 consecutive positive numbers is 365. Accordingly, what is the sum of those numbers ?

- (A) 30 (B) 33
(C) 36 (D) 45

10. In a division question, the denominator is 10 times its quotient and 5 times the remainder. Accordingly, if the remainder is 46, what will be the dividend ?

- (A) 4236 (B) 4306
(C) 4336 (D) 5336

11. 30% of one number is equal to 40% of the other number. 25% of the sum of both those numbers is equal to 420. Find the smaller number.

- (A) 780 (B) 760
(C) 720 (D) 700

12. Four prime numbers are in the ascending order. Product of the first three numbers is 455 and product of the last three numbers is 1729. Find the largest prime number of them.

- (A) 7 (B) 13
(C) 19 (D) 23

13. The maximum score of runs in an innings was $\frac{3}{11}$ of the total score. The second score in the same innings was the maximum score of $\frac{3}{11}$ of the remaining runs. If the difference of both scores is 9, then what was the total score ?

- (A) 106 (B) 146
(C) 118 (D) 121

14. Find such three numbers that the twice the first number, thrice the second and 4 times of the third number make a sum of 191.

- (A) 19, 20, 21 (B) 21, 22, 23
(C) 20, 21, 22 (D) 22, 23, 24

15. Divide 37 in such two parts that the sum of 5 times of the first part and 11 times of the second part is 227.

- (A) 15, 22 (B) 20, 17
(C) 25, 12 (D) 30, 7

16. There are 12000 soldiers in an army, some of whom are Indians and the rest are European. The average height of a European soldier is 1.80 m, that of an Indian soldier is 1.75 m, and the length of the entire army is $1\frac{47}{60}$ m. So, how much are the Indian soldiers ?

- (A) 6000 (B) 8000
(C) 1000 (D) 4000

17. A teacher wants to keep his students in an equal number in rows and columns. If the total number of students is 1369, then find the number of students in the last row ?

- (A) 37 (B) 33
(C) 63 (D) 47

18. After his death, Ram left $\frac{1}{3}$ of his asset in the name of his widowed wife and left the remaining $\frac{3}{5}$ in the name of his daughter and gave the remaining property to the son. If the son got 6400, then what was the original asset of Rama ?

- (A) ₹ 16000 (B) ₹ 32000
(C) ₹ 24000 (D) ₹ 1600

19. The sum of perfect squares of numbers between 120 and 300 is :

- (A) 1204 (B) 1024
(C) 1296 (D) 1400

20. Average age of P, Q and R is 5 more than the age of R. If sum of ages of P and Q is 39 years, then find the age of R.

- (A) 16 yr. (B) 14 yr.
(C) 12 yr. (D) 24 yr.

21. The sum of two numbers is 8 and their product is 15. Find the sum of their reciprocals.

- (A) $\frac{8}{15}$ (B) $\frac{15}{8}$
(C) 23 (D) 7

22. How many $\frac{1}{6}$'s together make $41\frac{2}{3}$?

- (A) 125 (B) 150
(C) 250 (D) 350

23. The product of all prime numbers between 80 and 90 is :

- (A) 83 (B) 89
(C) 7387 (D) 7200

24. Which statement among the following is not true?

- (A) Every natural number is an integer.
 (B) Every natural number is a real number.
 (C) Every real number is a rational number.
 (D) Every integer is a rational number.

25. A man has some hens and cows. If heads : feet = 2 : 35 and total number of heads is 48, then find the number of hens.

- (A) 28 (B) 26
 (C) 24 (D) 22

26. Find the sum of all those prime numbers that are not larger than 17.

- (A) 59 (B) 58
 (C) 41 (D) 42

27. Find the unit digit in the product $(122)^{173}$

- (A) 2 (B) 4
 (C) 6 (D) 8

28. Find the unit digit in the sum of $(124)^{172} + (124)^{173}$.

- (A) 5 (B) 4
 (C) 2 (D) 0

Solutions

1. (B) $134x587y$ given number is divisible by 72 when it is divisible by 2 and 3.

So, y must be 0, 2, 4, 6 and 8

And $(1 + 3 + 4 + x + 5 + 8 + y)$ must be divisible by 3.

$(21 + x + y)$ must be divisible by

For $y = 0$, $x = 0, 3$, then $2x + y = 0, 6$

For $y = 2$, $x = 1$, then $2x + y = 4$

For $y = 4$, $x = 2$, then $2x + y = 8$.

The, among the given option only '8' is correct.

2. (B) Given number, $x35624$

Sum of digits at even places

$$= 3 + 6 + 4$$

$$= 13$$

Sum of digits at odd places

$$= x + 5 + 2$$

$$= 7 + x$$

to be divisible by 11, difference between above both sums must be zero or divisible by 11.

$$\text{So, } 13 - (7 + x) = 6 - x$$

$$\therefore x = 6$$

and given number = $1257y4$

$$1 + 2 + 5 + 7 + y + 4 = 19 + y$$

to be divisible by 72 number must be divisible by 2, 3 and 4

There is 4 in the last of number so it is divisible by 2.

to be divisible by 3 and 4

$$y = 8$$

$$\text{So } 5x - 2y = 5 \times 6 - 2 \times 8$$

$$= 30 - 16$$

$$= 14$$

3. (A) $6 + C = 10$

$\Rightarrow C = 4$, and 1 is carried over.

Also, $(1 + B) + 7$ is a number whose units digit is 3.

$$\therefore (1 + B) + 7 = 13$$

$$\Rightarrow B + 8 = 13$$

$$\Rightarrow B = 5$$

and 1 is carried over.

$$\text{Now, } (1 + A) + 1 = 4$$

$$\Rightarrow A + 2 = 4$$

$$\Rightarrow A = 2$$

$$\text{Further, } 3 + D = 7$$

$$\Rightarrow D = 7 - 3 = 4$$

Hence, $A = 2$, $B = 5$, $C = 4$ and $D = 4$

4. (B) $16 - 9 = 7$

$\Rightarrow A = 6$, and 1 is borrowed from 3.

$$\text{Now, } 12 - 8 = 4.$$

So, $C = 8$ and 1 is borrowed from 4.

$$\text{Finally, } 3 - 2 = 1$$

$$\text{So, } B = 1$$

Hence, $A = 6$, $B = 1$ and $C = 8$.

5. (C) Clearly, $4 \times 7 = 28$

So, $A = 4$ and 2 is carried over.

$$\text{Now, } 3 \times 7 + 2 = 23$$

$$\text{So, } B = 3$$

Hence, $A = 4$ and $B = 3$

6. (A) Here, $AB = B$, So, $A = 1$

Now, we have the following

$$\begin{array}{r} 1 \quad B \\ \times \quad B \quad 1 \\ \hline 1 \quad B \\ B \quad B^2 \\ \hline B^1 + B^2 \quad B \end{array}$$

The middle digit of the number $B(1 + B^2)B$ is 0. But $1 + B^2$ cannot be equal to zero.

$$\therefore 1 + B^2 = 10$$

$$\Rightarrow B^2 = 9$$

$$\Rightarrow B = 3$$

Hence, $A = 1$, $B = 3$ and $C = 4$

$$\text{Thus, } \begin{array}{r} 1 \quad 3 \\ \times \quad 3 \quad 1 \\ \hline 4 \quad 0 \quad 3 \end{array}$$

7. (C) Here, $A \times 4 = 28$

$$7 \overline{) 343} \quad 49$$

$$\underline{-28}$$

$$6 \quad 3$$

$$\underline{-63}$$

$$\times$$

$$\Rightarrow A = 28 + 4 = 7$$

$$\text{Also, } 3B - 28 = 6$$

$$\Rightarrow 3B - 28 + 6 = 34$$

$$\Rightarrow B = 4$$

$$7 \times 8 = 63, \text{ So, } C = 3 \text{ and } D = 9$$

Hence, $A = 7$, $B = 4$, $C = 3$ and $D = 9$.

8. (A) Clearly, $AB \times 1 = 27$

$$27 \overline{) 3321} \quad 123$$

$$\underline{-27}$$

$$62$$

$$\underline{-54}$$

$$81$$

$$\underline{-81}$$

$$0$$

$$\Rightarrow A = 2 \text{ and } B = 7$$

$$\text{Then, } 27 + 6 = 33$$

$$\Rightarrow C = 3$$

$$\text{Next, } 54 + 8 = 62$$

$$\Rightarrow D = 2 \text{ and } F = 2$$

$$\text{Finally, } 27 \times 3 = 81$$

$$\Rightarrow E = 1 \text{ and } G = 3$$

Hence, $A = 2$, $B = 7$, $C = 3$, $D = 2$, $E = 1$, $F = 2$ and $G = 3$

9. (B) Let, three consecutive positive numbers are $(x - 1)$, x and $(x + 1)$ respectively.

According to question,

$$(x - 1)^2 + (x)^2 + (x + 1)^2 = 365$$

$$\Rightarrow x^2 + 1 - 2x + x^2 + x^2 + 1 + 2x = 365$$

$$\Rightarrow 3x^2 + 2 = 365$$

$$\Rightarrow 3x^2 = 365 - 2 = 363$$

$$\Rightarrow x^2 = \frac{363}{3} = 121 = (11)^2$$

$$\therefore x = 11$$

$$\therefore x - 1 = 11 - 1$$

$$= 10$$

$$\text{and } x + 1 = 11 + 1 = 12$$

$$\therefore \text{Required sum} = 10 + 11 + 12 = 33$$

10. (D) According to the question,

$$\text{Divisor} = \text{Quotient} \times 10$$

$$\text{Divisor} = \text{Remainder} \times 5$$

$$\text{Divisor} = 46 \times 5 = 230$$

$$\text{Quotient} = \frac{\text{Divisor}}{10} = \frac{230}{10} = 23$$

$$\text{Dividend} = \text{Divisor} \times \text{Quotient} + \text{Remainder}$$

$$= 230 \times 23 + 46$$

$$= 5290 + 46 = 5336$$

11. (C) Let the numbers be x and y .

According to the question,

$$\frac{x \times 30}{100} = \frac{y \times 40}{100}$$

$$\Rightarrow 3x = 4y$$

$$\therefore x = \frac{4y}{3}$$

$$\frac{(x+y) \times 25}{100} = 420$$

$$\therefore x + y = 1680$$

$$\Rightarrow \frac{4y}{3} + y = 1680$$

$$\Rightarrow \frac{4y+3y}{3} = 1680$$

$$\Rightarrow \frac{7y}{3} = 1680$$

$$\therefore y = \frac{1680 \times 3}{7} = 720$$

So, the smaller number = 720

12. (C) Let, 4 prime numbers a, b, c, d are in ascending order.

According to question,

$$a \times b \times c = 455$$

$$\text{and } b \times c \times d = 1729$$

$$\therefore \frac{a \times b \times c}{b \times c \times d} = \frac{455}{1729}$$

$$\Rightarrow \frac{a}{d} = \frac{5}{19}$$

So, the smallest number = 5, and the largest number = 19

13. (D) Let, the total score = x

$$\text{Maximum score} = \frac{3x}{11}$$

and maximum number of 2nd number

$$= \frac{3}{11} \times \text{Remaining runs}$$

$$\frac{3}{11} \times \left(x - \frac{3x}{11} \right) = \frac{3}{11} \times \frac{8x}{11} = \frac{24x}{121}$$

According to the question,

$$\frac{3x}{11} - \frac{24x}{121} = 9$$

$$\Rightarrow \frac{33x - 24x}{121} = 9$$

$$\Rightarrow \frac{9x}{121} = 9$$

$$\therefore x = \frac{9 \times 121}{9} = 121$$

14. (C) The numbers are $x, x+1$ and $x+2$.

$$\therefore 2x + 3x + 3 + 4x + 8 = 191$$

$$\Rightarrow 9x = 191 - 11 = 180$$

$$\Rightarrow x = 20$$

\therefore Answer = 20, 21 and 22

15. (D) If 1st part be x .

Then, the 2nd number = $37 - x$

$$\therefore x \times 5 + (37 - x) \times 11 = 227$$

$$\Rightarrow 5x + 407 - 11x = 227$$

$$\Rightarrow 6x = 407 - 227 = 180$$

$$\Rightarrow x = 30$$

$$\therefore \text{the 2nd number} = 7$$

16. (D) Let, the number of Indian soldiers be x .

$$\therefore \text{European soldiers} = 12000 - x$$

$$\therefore (12000 - x) \times 1.8 + x \times 1.75$$

$$= 12000 \times \left(1 \frac{47}{60} \right)$$

$$\Rightarrow 21600 - 1.8x + 1.75x = 21400$$

$$\Rightarrow -0.05x = -200$$

$$\therefore x = \frac{200}{0.05} = 4000$$

17. (A) Required numbers of students in the last row = $\sqrt{1369} = 37$

18. (C) Let, Ram's asset = x .

According to question,

$$\frac{x}{3} + \left(x - \frac{x}{3} \right) \frac{3}{5} + 6400 = x$$

$$\Rightarrow \frac{x}{3} + \frac{2x}{3} \times \frac{3}{5} + 6400 = x$$

$$\Rightarrow x - \left(\frac{x}{3} + \frac{2x}{5} \right) = 6400$$

$$\Rightarrow x - \left(\frac{5x+6x}{15} \right) = 6400$$

$$\Rightarrow \frac{15x - 11x}{15} = 6400$$

$$\Rightarrow 4x = 6400 \times 15$$

$$\therefore x = 1600 \times 15$$

$$x = ₹ 24000$$

19. (D) Perfect square between 120 and 300 are : $(11)^2, (12)^2, (13)^2, (14)^2, (15)^2, (16)^2, (17)^2$

$$\text{Required sum} = 121 + 144 + 169 + 196 + 225 + 256 + 289 = 1400$$

20. (C) According to question,

$$\frac{P+Q+R}{3} = (R+5)$$

$$\Rightarrow P+Q+R = 3R+15$$

$$\Rightarrow P+Q = 2R+15$$

$$\Rightarrow 2R+15 = 39 \quad [\because P+Q = 39]$$

$$\Rightarrow 2R = 39 - 15$$

$$\Rightarrow 2R = 24$$

$$\therefore R = 12 \text{ yr.}$$

21. (A) Let the two numbers be x and y .

According to question,

$$x + y = 8$$

$$\text{and } x \times y = 15$$

$$\frac{1}{x} + \frac{1}{y} = \frac{y+x}{xy}$$

$$= \frac{8}{15}$$

$$22. (C) 41 \frac{2}{3} \div \frac{1}{6} = \frac{125}{3} \div \frac{1}{6} = \frac{125}{3} \times \frac{6}{1} = 250$$

23. (C) Prime numbers between 80 and 90 = 83 and 89

$$\therefore \text{Required product} = 83 \times 89 = 7387$$

24. (C) Every real number is a rational number.

25. (B) Let, total hens = x , then

number of cows = $48 - x$

$$\therefore 2x + (48 - x) \times 4 = 35 \times 4$$

$$\Rightarrow 2x + 192 - 4x = 140$$

$$\Rightarrow 2x = 192 - 140 = 52$$

$$x = \frac{52}{2} = 26$$

$$\therefore \text{total hens} = 26$$

26. (B) Prime numbers up to 17

$$= 2, 3, 5, 7, 11, 13, 17$$

\therefore Required sum

$$= 2 + 3 + 5 + 7 + 11 + 13 + 17$$

$$= 58$$

27. (A) Unit digit in $(122)^{173}$

$$= \text{Unit digit in } (2)^{173}$$

$$= \text{Unit digit in } (2)^{172+1}$$

$$= \text{Unit digit in } (2)^1 = 2$$

28. (D) $(124)^{372} + (124)^{373}$

$$= (124)^{372} [1 + 124]$$

$$= (124)^{372} \times 125 = [(124)^3]^{93} \times 125$$

$$\therefore \text{Required Unit digit}$$

$$= \text{Unit digit in } (4)^1 \times 125$$

$$= 6 \times 5 = 30$$

$$\therefore \text{Required Unit digit} = 0$$



Chapter 1

The Sentence

Part-2 : English

1. Definition

A sentence is a group of words that are arranged in a way to convey a complete and meaningful sense. *i.e.*, The boys fly kites. A group of words like this which conveys complete sense is called sentence.

2. Kinds of Sentences

Sentences are of four kinds :

- I. Assertive/Statement/Declarative sentence.
- II. Interrogative sentence.
- III. Imperative sentence.
- IV. Exclamatory sentence.

I. Assertive/Statement/Declarative sentence

[Subject + Verb + Object]

A sentence that makes only a statement or assertion and ends with a full stop. It may be affirmative or negative.

Examples :

- Vijayshree is playing in the garden.
- He may win the prize.
- I have no money.
- Shubham is not living in Noida these days.
- They never come in time.

II. Interrogative sentence

[Helping verb + Subject + Main verb + Object [Not necessary]

[Wh-word + Helping verb + Subject + Main verb + obj.]

A sentence that asks a question is called an **interrogative** question.

Note : An interrogative sentence ends with a mark of interrogation [?].

Examples :

- Is that your book ?

- Do you read any newspaper ?
- Does he smoke ?
- Will she pass the examination ?
- What is your favourite colour ?
- How are you ?

III. Imperative sentence

[Verb 1st form/donot/always/Never/Please + Verb 1st form + ...]

A sentence that expresses a command, request, order or invitation is called an **imperative sentence**.

Note : The subject 'you' is understood.

Examples :

- Shut the door. (Command)
- Please pass the salt. (Request)
- Do not waste food. (Advice)
- Do not pluck that flowers. (Prohibition)
- Come in time. (Order)

IV. Exclamatory sentence

A sentence that expresses some strong and sudden feeling. The feelings can be of joy, sorrow, wonder or surprise etc.

Usually it begins with an interjection *i.e.* Alas! how! what! oh Hurrah, God etc.

Note : The mark of exclamation [!] is put at the end of either the exclamatory word or the exclamatory sentence.

Examples :

- How beautiful ! (Joy)
- How dare you ! (Anger)
- Alas! I am undone. (Sorrow)
- What a nice case ! (Surprise)
- What a tragic end ! (Regret)

Usually it begins with an interjection *i.e.*, alas! how! what! oh, Hurrah, God etc.

Important Questions

Direction (Q. No. 1 to 30)

Read each sentence to determine if it is a Declarative, Imperative, Interrogative or Exclamatory sentence.

1. Our family is planning a trip to the mountains.
(A) Interrogative (B) Exclamatory
(C) Imperative (D) Declarative
2. Wow! I've never been in a city this huge!

- (A) Imperative (B) Exclamatory
(C) Interrogative (D) Declarative
3. Nature is the best physician.
(A) Imperative (B) Interrogative
(C) Declarative (D) Exclamatory
4. Watch your stop when you get off the bus.
(A) Imperative (B) Declarative
(C) Exclamatory (D) Interrogative

5. Where do you live ?
(A) Declarative (B) Interrogative
(C) Imperative (D) None of these
6. How cold the night is !
(A) Exclamatory (B) Interrogative
(C) Declarative (D) Imperative
7. The plant is green.
(A) Imperative (B) Interrogative
(C) Declarative (D) Exclamatory

8. Please help me to climb down the tree.
(A) Imperative (B) Declarative
(C) Exclamatory (D) Interrogative
9. What a shame !
(A) Exclamatory (B) Declarative
(C) Optative (D) Interrogative
10. It is raining cats and dogs.
(A) Imperative (B) Declarative
(C) Interrogative (D) Exclamatory
11. How well she sings!
(A) Declarative (B) Imperative
(C) Exclamatory (D) Interrogative
12. Did I say anything to make you angry ?
(A) Interrogative (B) Exclamatory
(C) Imperative (D) Declarative
13. She does not eat meat of fish.
(A) Exclamatory (B) Declarative
(C) Interrogative (D) optative
14. How beautiful she is !
(A) Declarative (B) Interrogative
(C) Exclamatory (D) None of these
15. I have two brothers.
(A) Declarative (B) Imperative
(C) Interrogative (D) Exclamatory
16. Wow ! those firework are beautiful ;
(A) Interrogative
(B) Assertive Or Declarative
(C) Exclamatory
(D) Imperative
17. Show me your homework.
(A) Imperative (B) Interrogative
(C) Exclamatory (D) None of these
18. She does not learn her lesson.
(A) Declarative (B) Imperative
(C) Interrogative (D) Exclamatory
19. Hurrah! we have won the match.
(A) Interrogative (B) Imperative
(C) Exclamatory (D) None of these
20. No man can serve two masters.
(A) Declarative (B) Interrogative
(C) Exclamatory (D) Optative
21. My daughter loves eating cake in the morning?
(A) Declarative (B) Imperative
(C) Interrogative (D) Both (B) & (C)
22. I can't believe how fast that car was moving!
(A) Interrogative (B) Imperative
(C) Exclamatory (D) None of these
23. Please leave your shoes outside :
(A) Imperative (B) Declarative
(C) Exclamatory (D) None of these
24. How often do you read this article ?
(A) Imperative (B) Interrogative
(C) Declarative (D) Exclamatory
25. Peanut is better than Jam :
(A) Declarative (B) Exclamatory
(C) Imperative (D) Interrogative
26. Will the teacher be late ?
(A) Imperative (B) Interrogative
(C) Exclamatory (D) None of these
27. I completed the essay for my college application :
(A) Interrogative (B) Declarative
(C) Imperative (D) None of these
28. Which type of sentence must end with a question mark ?
(A) Interrogative (B) Exclamatory
(C) Imperative (D) None of these
29. "Sit down and be quiet". What type of sentence is this ?
(A) Exclamatory (B) Interrogative
(C) Imperative (D) None of these
30. Which is a declarative sentence ?
(A) ouch !
(B) stop hurting me !
(C) that hurts !
(D) none of these

Answer Key

1. (D) 2. (B) 3. (C) 4. (A) 5. (B)
6. (A) 7. (C) 8. (A) 9. (A) 10. (B)
11. (C) 12. (A) 13. (B) 14. (C) 15. (A)
16. (C) 17. (A) 18. (A) 19. (C) 20. (A)
21. (A) 22. (C) 23. (A) 24. (B) 25. (A)
26. (B) 27. (B) 28. (A) 29. (C) 30. (C)



Chapter

1

Fossil Fuel (Coal and Petroleum), Finding Calorific Value of Fuels and Combustion of Flame

1. Resources and its Types

- We use various materials for our basic needs. Some of them are found in nature and some have been made by human efforts. These have been classified as under :

I. Natural Resources

The resources which are obtained from nature are called natural resources. These are of two types :

(i) Inexhaustible Natural Resources

These resources are present in unlimited quantities in nature and are not likely to be exhausted by human activities. Examples : Sunlight, air, etc.

(ii) Exhaustible Natural Resources

The amount of these resources in nature is limited and thus these can be exhausted by excessive human usage. Examples : Forests, coal, petroleum, minerals, wild life, natural gas, etc.

II. Man-Made Resources

- When a natural resource undergoes drastic change by human intervention, it becomes human-made resource. For example; iron ore is processed to make steel and hence steel is a man-made resource. Buildings, bridges, railways, machines, etc. are examples of human-made resources. Technology is also a human-made resource.
- Exhaustible natural resources like coal, petroleum and natural gas were formed from the dead remains of living organisms (fossils), therefore, they are called **fossil fuels**. Wood is not a fossil fuel.

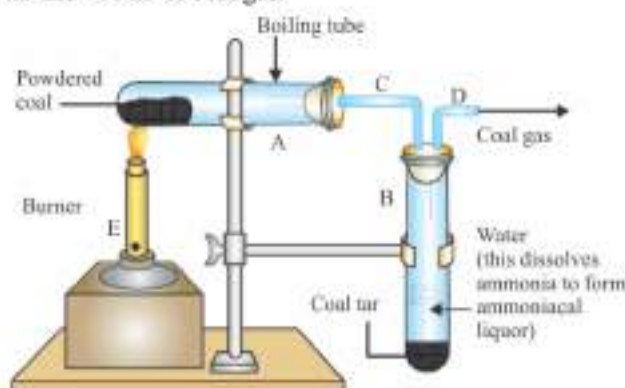
2. Coal

- Coal is a complex mixture of free carbon and compounds of carbon containing hydrogen, oxygen, nitrogen and sulphur.
- It is believed that millions of years ago, the forests got buried under the surface of earth and had no contact with oxygen. They slowly started to decompose and formed dense sponge like material called peat. Over millions of years, due to tremendous pressure and heat, finally these got transformed into coal.
- As coal mainly contains carbon, the slow process of conversion of dead vegetation into coal is called **carbonization**. Upon heating in air, coal burns and produces mainly carbon dioxide.
- Coal is classified into five main categories based on the amount of carbon it contains and the heat energy it can produce :
 - Peat** : It is the first stage of coal and contains 10-15% of carbon. It is the poorest variety of coal.
 - Lignite** : The carbon content is 25-35%.
 - Subbituminous coal** : It contains 35-44% carbon

(iv) **Bituminous coal** : It contains 45-86% carbon. It is common household fuel and industrial fuel.

(v) **Anthracite coal** : It contains 86-97% carbon

- Destructive/Fractional Distillation of Coal** : The process of heating coal in the absence of air is called the destructive distillation of coal. When coal is heated in the absence of air, a number of products are obtained such as Coke, Coal tar and Coal gas. On destructive distillation, 1000 kg of coal gives 700kg of coke, 100 liters of ammonia, 50 litres of coal tar and 400 m³ of coal gas.



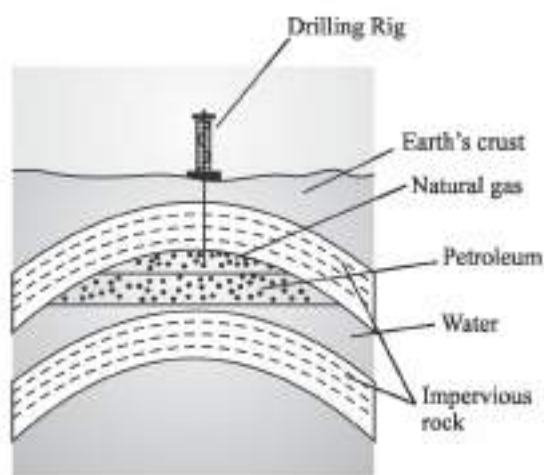
- Coke** : It contains 98 % carbon. It is porous and the purest form of coal. It is a good fuel and burns without smoke. It is largely used as a reducing agent in the extraction of metals from their ores. It is also used in making fuel gases like water gas and producer gas.
 - Coal Tar (Liquid)** : It is a mixture of different carbon compounds. Its fractional distillation gives many chemical substances (Benzene, Toluene, Phenol and Aniline) which are further used in the preparation of dyes, explosives, paints, synthetic fibers, drugs, photographic materials, roofing materials and pesticides. Naphthalene balls (also obtained from coal tar) are used to repel moths and other insects. Initially coal tar was used in metalling the roads but these days bitumen, a petroleum product is used. **Bitumen** is a sticky, black, highly viscous liquid or semi-solid form of petroleum.
 - Coal Gas** : Coal gas is mainly a mixture of hydrogen, methane and carbon monoxide. It is obtained during the processing of coal to get coke. It is an excellent fuel. It was earlier used for lighting houses, factories and streets in Mumbai until 1950. Now it is mainly used as a source of heat.
- (iv) **Liquid Ammonia** : It is used to make fertilizers.

3. Petroleum

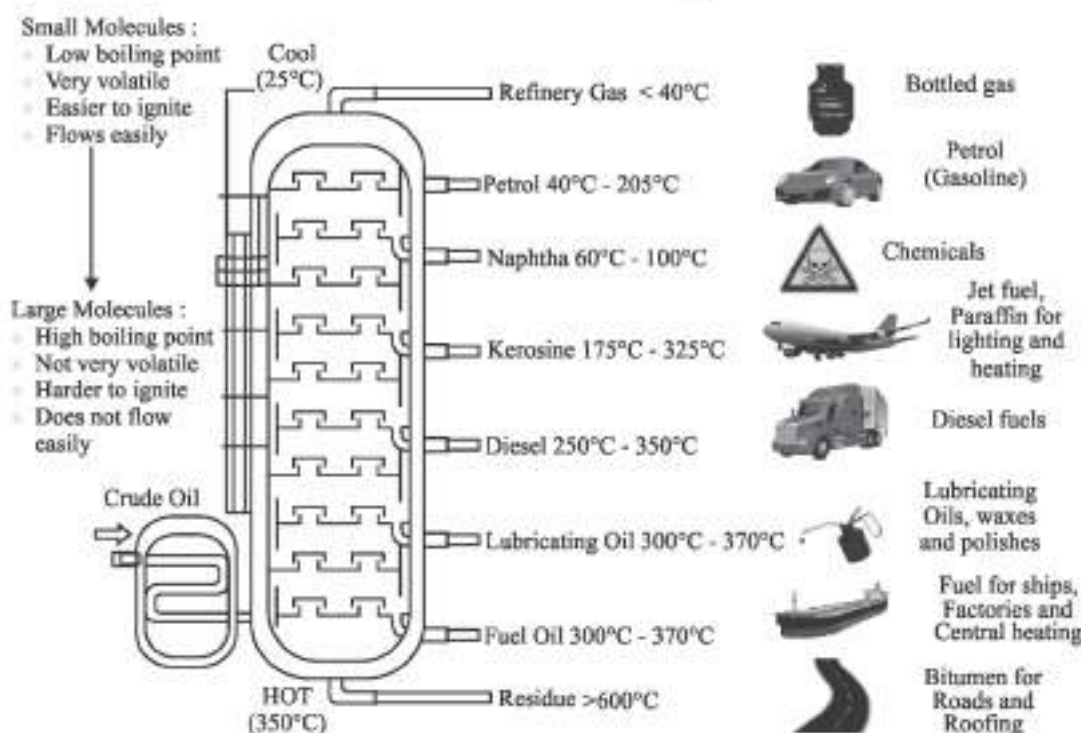
- It is dark brownish to green coloured viscous liquid. It is also a fossil fuel. It has a strong foul smell due to the

presence of sulphur containing compounds in it. It is generally referred to as crude oil and black gold.

- Its name is derived from Latin words Petra (meaning rock) and Oleum (meaning oil). Thus, petroleum literally means "Rock Oil". Petroleum is a complex mixture of solid, liquid and hydrocarbons, mixed with salt water and earthy particles. It is always found trapped between two impervious rocks.



- **Formation of Petroleum** : It is believed that petroleum is formed by the anaerobic (in the absence of oxygen) decomposition of extremely small sea animals and plants which got buried in the sea bed millions of years ago.
- **Occurrence of Petroleum** : Petroleum occurs at a moderate depth (500 m to 200 m) between the 2 layers of impervious rocks. The petroleum is lighter than water and thus it can float over it. Above petroleum, natural gas is found and it is found trapped between the rock cap and petroleum layer.
- **The Drilling of Oil Wells to get Petroleum** : To get petroleum, a hole is drilled in the Earth's crust & when it reaches the rock cap, the natural gas comes out first with a great pressure. When the pressure of gas subsides, petroleum starts flowing out due to the pressure of natural gas.
- **Refining of Petroleum** : Petroleum being a mixture of several hydrocarbons cannot be used in natural form. Before being put to use, it has to be purified or refined. The process of separating the various components of petroleum from one another is known as the refining of petroleum and is carried out in petroleum refineries. This is done by a process called "Fractional Distillation" in which, on heating the crude oil, its different components get separated on their respective boiling points.



- **Uses of Petroleum** : Many useful substances are obtained from petroleum and natural gas. These are termed as 'Petrochemicals'. These are used in the manufacture of detergents, fibres (polyester, nylon, acrylic etc.), polythene and other man-made plastics.
- Below are the various constituents of petroleum and their uses

| S. No. | Constituents of petroleum | Uses |
|--------|------------------------------------|--|
| 1. | Petroleum Gas in Liquid form (LPG) | Fuel for home and industry |
| 2. | Petrol | Motor fuel, aviation fuel, solvent for dry cleaning, |

| S. No. | Constituents of petroleum | Uses |
|--------|---------------------------|---|
| 3. | Kerosene | Fuel for stoves, lamps and for jet aircrafts. |
| 4. | Diesel | Fuel for heavy motor vehicles, electric generators. |
| 5. | Lubricating oil | Lubrication |
| 6. | Paraffin wax | Ointments, candles, vaseline etc. |
| 7. | Bitumen | Paints, road surfacing. |



Do you know?

- The world's first petroleum well was drilled in Pennsylvania, USA in 1859.
- In 1867, oil was struck at Makum in Assam. In India, oil is found in Assam, Gujarat, Mumbai High and in the river basins of Godavari and Krishna.

4. Natural Gas

- Natural gas was formed millions of years ago along with petroleum when small sea plants & animals died & got buried under the earth. Further due to anaerobic conditions these got changed to gas.
- It also occurs in coal mines and petroleum wells. It mainly contains 90% methane.
- Composition of Natural Gas :** It consists mainly of methane (about 85%), ethane (about 10%) propane (about 3%) and butane. The way of using natural gas is in form of CNG (Compressed Natural Gas) or LNG (Liquefied Natural Gas).
- CNG :** When natural gas is compressed at high pressure then it is called CNG. CNG is used for power generation and nowadays auto, buses and cars run on it, because it is less polluting. The great advantage of CNG is that it can be supplied through pipes and hence used in burning in homes and industries. Such a network of pipelines exists in Vadodara (Gujarat), some parts of Delhi and other places.
- Occurrence :** It is generally found trapped between impervious rocks, sometimes along with petroleum & sometimes without petroleum. In our country, Tripura, Rajasthan, Maharashtra and in the Krishna Godavari Delta are the reserves of natural gas.
- Liquefied Petroleum Gas (LPG) :** It is an important product of natural gas. LPG is the abbreviation or short form for liquefied petroleum gas. Main components of LPG are propane, butane and small quantities of methane. Like all fossil fuels, it is a non-renewable source of energy.

It is extracted from crude oil and natural gas. Normally, the gas is stored in liquid form under pressure in a steel container, cylinder or tank. LPG is highly inflammable and must therefore be stored away from sources of ignition and in a well-ventilated area, so that any leak can disperse safely.

It is used for standard heating and cooking purposes. Hydrogen gas obtained from natural gas, is used in the production of fertilisers (urea).



Do you know?

Burning of fuels causes air pollution which leads to global warming. So we need to use fuels only when it is necessary. In India, the Petroleum Conservation Research Association (PCRA) advises people how to save petrol/diesel while driving.

5. Alternative Sources of Energy

- Biodiesel :** It is a fuel obtained from vegetable oils such as Soyabean oil, Jatropha oil, Cornoil, Sunflower Oil, Cotton seed oil, Rice bran oil and Rubber seed oil.
- Wind Mills :** When wind blows, they rotate and current is produced in the dynamo.
- Solar Energy :** Sun is the foremost energy source that makes life possible on our earth. Solar energy is harnessed using (i) solar cookers (ii) solar water heaters (iii) solar cells.
- Gobar Gas :** It is obtained by the fermentation of cow dung in the absence of air (anaerobic conditions). It mainly contains methane and a little ethane. It is widely used in rural areas for cooking and operating engines.



Do you know?

- Hydrogen could be the best alternative fuel. It is a clean fuel as it gives out only water while burning. Moreover, it has the highest energy content. It does not pollute the air.
- Sewage sludge can be decomposed by microorganisms to produce methane gas along with impurities like carbon dioxide and hydrogen sulphide. After removing these impurities, methane gas can be used as an efficient fuel.

6. Combustion

- A chemical process in which a substance reacts with oxygen to give off heat is called **combustion**.
- The substances such as paper and fuel etc., which undergo combustion are known as **combustible substances**. Sometimes, heat is accompanied by light, either as a flame or as a glow, during combustion.
- A combustion reaction may be written as :
 - Charcoal burns in air to give carbon dioxide and heat.

$$C + O_2 \rightarrow CO_2 + \text{Heat}$$
 - Methane burns in air forming carbon dioxide, water and heat.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + \text{Heat}$$
- It is important to note that different substances burn at different temperatures. For a substance to burn, some minimum temperature is required and this minimum

temperature is known as “**Ignition Temperature**”. For example, the Ignition temperature of phosphorus is 35°C . So, unless phosphorus is heated to 35°C , it will not catch fire.

- Substances which have very low ignition temperature or can easily catch fire are called **Inflammable Substances**. eg. Petrol, Alcohol, LPG, etc.

Ignition Temperature of Different Materials

| Material | Ignition Temperature |
|------------------|----------------------|
| White Phosphorus | 35 degree Celsius |
| Petrol | 246 degree Celsius |
| Kerosene | 220 degree Celsius |
| Diesel | 210 degree Celsius |
| Wood | 300 degree Celsius |
| Coal | 454 degree Celsius |
| Piece of paper | 233 degree Celsius |
| Alcohol | 365 degree Celsius |



Do you know?

In the sun, heat and light are produced by nuclear reactions.

- Controlling Fire** : There are 3 conditions necessary for producing and sustaining combustion.
 - Presence of a combustible substance (Fuel)
 - Presence of a supporter of combustion. (Air for oxygen)
 - Attainment of ignition or kindling temperature. (Heat)
 Thus, fire can be controlled by removing one or more of these requirements for producing and sustaining combustion. The fire extinguisher also tries to cut off the supply of air or bring down the temperature of the fuel or both, to control the fire.
- Fire Extinguishers** : For fires involving electrical equipment and inflammable materials like petrol, carbon dioxide (CO_2) is the best fire extinguisher and not water. CO_2 , being heavier than oxygen, covers the fire like a blanket, hence cutting off the contact of fuel with oxygen and bringing down the temperature. Dry powder of chemicals like sodium bicarbonate (baking soda) or potassium bicarbonate release CO_2 near fire. Hence, are another good source to extinguish fire.



Do you know?

History of Matchsticks

More than five thousand years ago small pieces of pinewood dipped in sulphur were used as matches in ancient Egypt. A mixture of antimony trisulphide, potassium chlorate and white phosphorus with some glue and starch was applied on the head of a match made of suitable wood. When struck against a rough surface, white phosphorus got ignited due to the heat of friction. This started the combustion of the match. However, white phosphorus proved to be dangerous both for the workers involved in the manufacturing of matches and for the users. These days the head of the safety match contains only antimony trisulphide and potassium chlorate. The rubbing

surface has powdered glass and a little red phosphorus (which is much less dangerous). When the match is struck against the rubbing surface, some red phosphorus gets converted into white phosphorus. This immediately reacts with potassium chlorate in the matchstick head to produce enough heat to ignite antimony trisulphide and start the combustion.

- Types of Combustion** : Combustion is mainly of three types—

(i) **Rapid combustion** : The combustion in which the gas burns rapidly and produces heat and light is called rapid combustion.

For example : When a burning matchstick is brought near a gas burner and the gas tap is opened, the gas immediately starts burning with the production of heat and light. Magnesium ribbon burns to form magnesium oxide and produces heat and light

(ii) **Spontaneous combustion** : The combustion in which no external heat is given is known as spontaneous combustion. For example: Forest fires are the result of spontaneous combustion due to heat of sun or lightning strike. Burning of white phosphorus in air at room temperature.

(iii) **Explosion** : The combustion in which large amount of gases are evolved with the production of a tremendous amount of heat, light and sound is called explosion. For example : When a cracker is ignited, a sudden reaction, takes place—in which at high speed large amount of gas is evolved with the production of tremendous amount of heat, light and sound.

- Difference between Rapid and Spontaneous Combustion**

| Rapid combustion | Spontaneous combustion |
|---|---|
| It is to be initiated once | It takes place by itself. |
| External heat is required | No external heat is required to start it |
| Large amount of heat is evolved in a short time | Small amount of heat and light is evolved |
| Example : Burning of domestic cooking gas exposed in a gas burner | Burning of white phosphorus on its own when kept in air for some time |

7. Flame

- A region of burning gases is called flame. A substance will burn with a flame, only if some gaseous substance is there to burn.
- The substances which vapourise during burning, give flames. For example, kerosene oil and molten wax rise through the wick and are vapourised during burning and form flames. Charcoal, on the other hand, does not vapourise and so does not produce a flame.
- Structure of a flame** : In order to understand the structure of a flame, light a wax candle and watch its flame. There are

different coloured zones in the flame. Starting from the base of the flame, a flame has **three zones**.

Structure of Candle Flame



(i) Outermost non-luminous zone of complete combustion (Blue)

This zone is poorly visible and is slightly blue. It is the hottest part of the flame where complete oxidation (burning) of the fuel is taking place. Goldsmiths blow the outermost zone of a flame with a metallic blow-pipe for melting gold and silver.

(ii) Luminous zone of partial combustion (Yellow)

In this region of the flame, hydrogen burns with a brilliant **yellow luminous flame**. Burning hydrogen

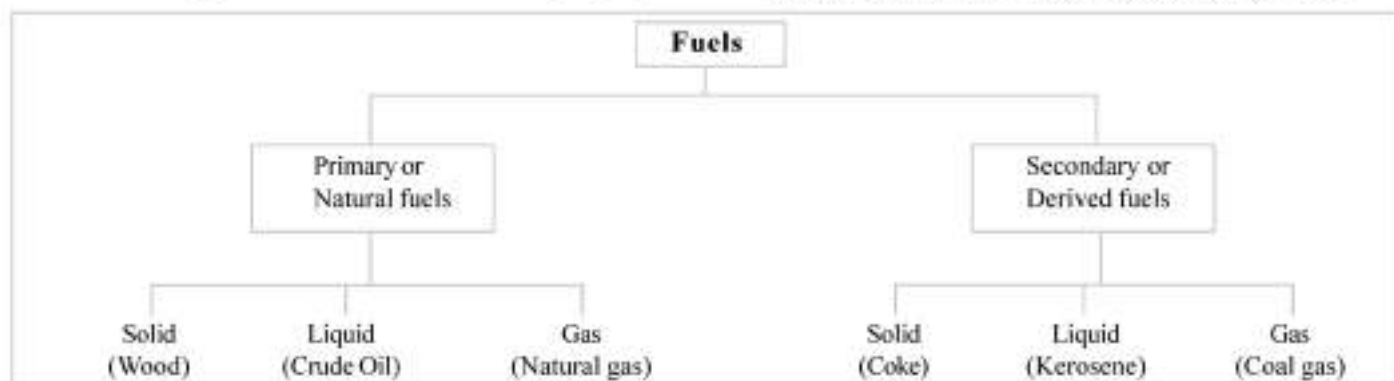
combines with oxygen to form water vapour. Carbon also burns in this zone giving some luminosity to the flame and producing carbon dioxide. Some unburnt carbon particles are left which give rise to soot.

(iii) Dark innermost zone of unburnt wax vapours (Black)

Surrounding the wick is the dark zone. There is no burning in this zone. If we pass a wooden splinter through the dark zone of the flame, it comes out unscratched (unburnt) showing that there is no 'burning' in this zone. However, some burnt wax vapours are present in this zone.

8. Fuel

- Any substance which is easily available and burns in air at a moderate rate, producing a large amount of heat energy, without leaving behind any undesirable residue is called **fuel**. For e.g., Wood, charcoal, petrol, kerosene, etc.
- If a fuel is present in its natural state then it is known as a natural fuel, while a fuel is known as a derived fuel if it is processed to improve its quality. It can be classified into natural (primary) fuels and derived (secondary) fuels.



Characteristics of a Good Fuel

- It should be cheap and readily available.
- It should be easy to store.
- It should burn at a slow rate and its rate of combustion should be controllable.
- It should have low ignition temperature.
- It should produce a very small amount of residues such as ash.
- It should have large calorific value.
- It should not produce gases which pollute the air.
- It should not produce any hazards during transportation.

Classification of fuels : On the basis of physical state, fuels are classified into three types :

- Solid fuels** : The fuels which occur in a solid state at room temperature are called solid fuels. Example : Wood, agricultural residues, charcoal, coal, coke, etc.
- Liquid fuels** : The fuels which occur in a liquid state at room temperature are called liquid fuels. Example : Liquefied hydrogen, petrol, oil, kerosene, diesel, etc.

(iii) **Gaseous fuels** : The fuels which occur in a gaseous state at room temperature are called gaseous fuels. Example : Water gas, producer gas, coal gas, compressed natural gas (CNG) and gobar gas, etc.

- Fuel efficiency** : Any fuel contains carbon as its main constituent. During the combustion of fuel carbon combines with oxygen and liberates large amounts of heat. It is expected that a fuel liberates maximum amount of heat in a short time. The efficiency of a fuel can be understood from the following terms :

(i) **Specific Energy** : Specific energy is the amount of energy produced by the **unit mass of a fuel**. It is defined as the **energy per unit mass**. It is used to measure the stored energy in certain substances. Its unit is J/kg.

(ii) **Calorific Value** : It is the quantity of heat produced by the complete combustion of 1 kg of fuel at constant pressure and normal conditions. In case of liquid or gaseous fuels to measure the calorific value, their volumes are taken into consideration while for solid fuels their masses are taken into account. It is measured in

Kilo Joule per Kilogram (kJ/Kg). The more the calorific value of a fuel, the more is the efficiency of the fuel.

$$\text{Calorific Value} = \frac{\text{Amount of heat liberated}}{\text{Total mass or volume of fuel}}$$

Examples for understanding Calorific Value :

④ Example 1.

In an experiment 4.5 kg of a fuel was completely burnt. The heat produced was measured to be 180,000 kJ. Calculate the calorific value of the fuel.

Solution :

Given : Weight of fuel burnt = 4.5 kg

To find : Calorific value = ?

Formula used :

$$\text{Calorific value} = \frac{\text{Amount of heat produced}}{\text{Weight of fuel burnt}}$$

Solution :

$$\text{Calorific value} = \frac{180000}{4.5}$$

$$\therefore \text{Calorific value} = 40,000 \text{ kJ/kg.}$$

④ Example 2.

The total amount of heat produced by a fuel having a calorific value of 20 kJ/kg 1 was found to be 50,000 joules. How much fuel was burnt ?

Solution :

1 kg of fuel when burnt gives 20Kj or 20000 Joules of heat energy. On applying unitary method, 20000 joules heat energy is given by burning 1 kg of fuel. Therefore, 50000 joules heat energy will be given by burning $50000/20000 = 2.5$ kg of fuel.

- Calorific value of some fuels is given in the following table :

| Fuel | Calorific Value (KJ/kg) |
|---------------|-------------------------|
| Cow dung cake | 6000 – 8000 |
| Wood | 17000 – 22000 |
| Coal | 25000 – 33000 |
| Petrol | 45000 |
| Kerosene | 45000 |
| Diesel | 45000 |
| Methane | 50000 |
| CNG | 50000 |
| LPG | 55000 |
| Biogas | 35000 – 40000 |
| Hydrogen | 150000 |

- Ideal Fuel :** An ideal fuel is one which :

- Has high calorific value.
- Do not cause any pollution or produce harmful gases on combustion.
- Is easily available at low cost.
- Is easy to handle, store and transport.
- Has moderate ignition temperature.
- Has moderate rate of combustion.

- Harmful effects of burning fuels :** The increasing fuel consumption has harmful effects on the environment. The main products formed during the fuel combustion which produce harmful effect are :

- Carbon fuels** like wood, coal, petroleum release unburnt carbon particles. These fine particles are dangerous pollutants causing respiratory disease, such as asthma.
- Incomplete combustion** forms carbon monoxide gas. It is a very poisonous gas. It is dangerous to burn coal in a closed room. The carbon monoxide gas produced can kill persons sleeping in that room.
- Combustion of most fuels releases carbon dioxide in the environment. Increased percentage of carbon dioxide in the air causes **global warming**. Global warming is the rise in temperature of the earth. This results in melting of polar glaciers which leads to rise in sea level and floods in the sea coast.
- Burning of coal and diesel releases sulphur dioxide gas. It is an extremely suffocating and corrosive gas. Sulphur dioxide and nitrogen oxide dissolve in rain water to form acid. Such rain is called **acid rain**. It is very harmful for crops, buildings and soil.
- Wood is also used as a fuel. Burning of wood gives a lot of smoke which causes **air pollution** and is also very harmful for humans. It may lead to many respiratory problems. Cutting of trees for obtaining wood leads to deforestation which is quite harmful to the environment. Therefore, wood is replaced by coal or other fuels such as LPG.
- Carbon particles of smoke or ash get suspended in the air. Excessive amounts of them in the air causes **breathing problems**.

Sainik School Previous Years (2018-2021) Questions

- The slow process of conversion of dead vegetation into coal is called :
(A) Decomposition
(B) Evolution
(C) Carbonification
(D) Carbonisation

[Sainik School Entrance Exam
(Class IX) (07-02-2021)]

- (C) Carbonification is the process of conversion of dead vegetation into coal. The coal found in sedimentary rocks has been made by this process only. The age in which coal was formed below the earth surface is known as Carboniferous Age.

- Which amongst the following is a petroleum product which can be used for metalling of roads ?
(A) Coke (B) Bitumen
(C) Coal tar (D) Coal

[Sainik School Entrance Exam
(Class IX) (07-02-2021)]

2. (B) Bitumen is the petroleum product which can be used for metalling of roads. Bitumen is also known as Asphalt and it is a sticky, black, highly viscous liquid or semi-solid form of petroleum.

3. Name the gas present in LPG :

- (A) Hydrogen (B) Oxygen
(C) Methane (D) Butane

Sainik School Entrance Exam.

(Class IX 2020)

3. (D) LPG (Liquid Petroleum Gas) is a mixture of Butane and Propane. To detect its leakage, Ethyl Mercaptan is mixed.

4. Rapid combustion is :

- (A) When gas burns, it produces heat and light
(B) When material suddenly burst into flames
(C) When there is evolution of heat
(D) None of these

Sainik School Entrance Exam.

(Class IX 2020)

4. (A) Rapid combustion is a form of combustion in which large amount of heat and light energy are released.

5. Ramesh was cooking potato curry on a chulha. To his surprise he observed that the copper vessel was getting blackened from outside. It may be due to :

- (A) Proper combustion of fuel

- (B) Improper cooking of potato curry
(C) Improper combustion of the fuel
(D) Burning of copper vessel

Sainik School Entrance Exam.

(Class IX 2019)

5. (C) The copper vessel is getting blacked due to improper combustion of the fuel i.e. incomplete combustion.

When the combustion of fuel takes place under insufficient supply of oxygen, it is called 'incomplete combustion'. Incomplete combustion of fuel releases many hydrocarbons resulting in blackening of cooking utensils.

6. There are following zones of a flame :

- (A) two (B) three
(C) four (D) no any zone

Sainik School Entrance Exam.

(Class IX 2019)

6. (B) Flame is actually a gaseous, glowing hot part of fire. It has three zones:

- (i) **Innermost Zone** of lowest temperature.
(ii) **Middle Zone** of yellow luminous area formed due to the partial combustion of fuel.
(iii) **Outermost zone** which is the hottest zone of flame. It is blue, non-luminous & formed due to complete combustion of fuel.

7. Naphthalene balls are obtained from :

- (A) carbon (B) coke
(C) coal tar (D) coal gas

Sainik School Entrance Exam.

(Class IX 2019)

7. (C) Naphthalene ($C_{10}H_8$) balls are obtained from coal tar. It is used as a germicide and moth repellent.

8. John accidentally placed his hand over a flame and immediately pulled it back. He felt the sensation of heat and reacted due to the action of :

- (A) nerve cells (B) blood cells
(C) skin surface (D) nucleus of cells

Sainik School Entrance Exam.

(Class IX 2019)

8. (A) John pulls back his hands immediately away from the flame due to reflex action. Such an action is possible with the help of nerve cells.

9. In India, PCRA advises how to save petrol/diesel while driving. For this, PCRA gave several tips. Here, PCRA stands for :

- (A) Pollution Control Research Association
(B) Petroleum Conservation Research Association
(C) Petroleum Collection and Reserve Association
(D) None of the above.

Sainik School Entrance Exam.

(Class IX 2018)

9. (B) PCRA stands for Petroleum Conservation Research Association.

Important Questions

- PCRA stands for ;
(A) Pollution Control Research Association
(B) Petroleum Conservation Research Association
(C) Petroleum Control Research Association
(D) Petrol, Coal Reserve Association
- Acid rain is caused by oxides of :
(A) sulphur, nitrogen
(B) sulphur, carbon
(C) carbon, nitrogen
(D) phosphorous, carbon
- Name the fossil fuel which is mostly found in Tripura, Rajasthan, Maharashtra and in Krishna Godavari delta.
(A) Coal (B) Petroleum
(C) Natural gas (D) None of these
- The total amount of heat or energy produced by one kg of fuel is the :
(A) heat content
(B) net calorific value (NCV)

- (C) gross calorific value (GCV)
(D) specific heat

5. Refining is :

- (A) extracting petroleum gas
(B) separation of various fractions of petroleum
(C) heating of coal
(D) sedimentation of fossil fuel

6. Fuel formed under the earth's surface by the decomposition of organic matter is called :

- (A) organic fuel
(B) biogas
(C) fossil fuel
(D) underground fuel

7. In India, vast reserves of natural gas are found in :

- (A) Tripura (B) Rajasthan
(C) Maharashtra (D) All of the above

8. Bitumen is used in :

- (A) electric generators
(B) road surfacing

- (C) coal tar
(D) natural gas

9. What is called 'black gold'?

- (A) Petroleum (B) Coal
(C) Coal tar (D) Natural gas

10. CO_2 is stored as a liquid in cylinder at :

- (A) high pressure
(B) low pressure
(C) high temperature
(D) low temperature

11. Petrol can be saved by :

- (A) driving at a constant & moderate speed
(B) ensuring correct tyre pressure
(C) switching off the engine at traffic lights
(D) all of the above

12. CNG is :

- (A) highly polluting
(B) less polluting
(C) not at all polluting
(D) none of the above

13. Kerosene is used in/as :
(A) jet engines (B) fuel
(C) ointments (D) lubricants
14. Useful substances obtained from petroleum and natural gases are called :
(A) chemicals
(B) petroleum products
(C) petrochemicals
(D) none of the above
15. Petrochemicals are used in the manufacture of :
(A) polythene (B) detergents
(C) fibres (D) all of these
16. Dead organisms are transformed into petroleum and natural gas in :
(A) absence of air
(B) presence of air
(C) presence of sunlight
(D) none of the above
17. Diesel is used in :
(A) cooling oil
(B) paints
(C) road surfacing
(D) electric generators
18. Which of them is used in extraction of metals ?
(A) Coke (B) Coal gas
(C) Coal tar (D) Petroleum
19. Which of them is used as solvent for dry cleaning ?
(A) Diesel (B) Kerosene
(C) Petrol (D) Paraffin wax
20. The fibres manufactured by petrochemicals are :
(A) Nylon (B) Polyester
(C) Acrylic (D) All of these
21. What is the percentage of oxygen by volume in the atmosphere ?
(A) 14% (B) 23%
(C) 20.9% (D) 79%
22. LPG is predominantly a mixture of propane and :
(A) methane (B) isopropane
(C) butane (D) ethane
23. Combustion of which of the following fuels requires the highest amount of excess air :
(A) light diesel oil (LDO)
(B) natural gas
(C) LPG
(D) coal
24. The presence of carbon monoxide (CO) in fuel gas means :
(A) high excess air
(B) poor combustion
(C) high thermal efficiency
(D) all of the above
25. When magnesium ribbon burnt, it produces :
(A) magnesium hydroxide
(B) magnesium oxide
(C) magnesium chloride
(D) magnesium sulphate
26. Charcoal burns in air producing :
(A) CO_2 (B) CO
(C) H_2 (D) O_2
27. Combustion is a :
(A) physical process
(B) chemical process
(C) both (A) and (B)
(D) none of the above
28. The lowest temperature at which a substance catches fire is called its :
(A) boiling point
(B) melting point
(C) ignition temperature
(D) critical temperature
29. Which of the following has lower ignition temperature ?
(A) Wood (B) Paper
(C) Vegetable oil (D) Kerosene oil
30. In the presence of water, ignition temperature of paper :
(A) decrease
(B) increase
(C) remain constant
(D) none of the above
31. The main constituent of CNG is :
(A) methane (B) butane
(C) ethane (D) propane
32. Fire extinguisher is used to :
(A) cut off the supply of air
(B) bring down the temperature of fuel
(C) both (A) and (B)
(D) none of the above
33. Explosion is the evolution of :
(A) heat (B) light
(C) sound (D) all of these
34. Substance which vapourise during burning gives :
(A) sound (B) flame
(C) combustion (D) none of these
35. Which is the hottest part in the flame of the candle ?
(A) Blue (B) Yellow
(C) Black (D) Wax part
36. Innermost zone is the :
(A) hottest part
(B) moderately hot part
(C) least hot part
(D) cold part
37. Yellow colour in the flame denotes :
(A) outermost part
(B) middle zone
(C) innermost zone
(D) none of these
38. Name the fossil fuel used in making food, railway engine and thermal power plants :
(A) Coal (B) Petroleum
(C) Natural gas (D) None of these
39. Use of in vehicle reduces pollution.
(A) petrol (B) diesel
(C) CNG (D) none of these
40. Ideal fuel has calorific value.
(A) low (B) high
(C) moderate (D) zero
41. Calorific value gives the :
(A) fuel efficiency
(B) amount of heat
(C) amount of light
(D) none of the above
42. Calorific value is measured in :
(A) kilo joule
(B) kilograms
(C) kilo joule per kg
(D) kilometre
43. Unburnt carbon particles causes :
(A) stomach infections
(B) respiratory problems
(C) brain infections
(D) throat problems
44. Incomplete combustion gives :
(A) CO_2 (B) CO
(C) Carbon (D) None of these
45. Goldsmith uses part of the flame for melting gold.
(A) outermost
(B) middle
(C) innermost
(D) both (B) and (C)
46. Name the gas obtained during the processing of coal to get coke :
(A) Coke (B) Coal tar
(C) Coal gas (D) None of these
47. Combustion of most fuels releases :
(A) CO_2 (B) SO_2
(C) NO_2 (D) O_2
48. Name the black thick liquid substance used in synthetic dyes, explosive, photographic materials :
(A) Coke (B) Coal tar
(C) Coal gas (D) None of these

49. Petrol engine gives off gaseous oxides of:
(A) sulphur (B) nitrogen
(C) phosphorous (D) carbon
50. Which is a solid fuel?
(A) Petrol (B) Diesel
(C) Kerosene (D) Wood
51. In the sun, heat and light are produced by:
(A) chemical reactions
(B) nuclear reactions
(C) ionic reactions
(D) none of the above
52. The head of the safety match contains:
(A) antimony trisulphide
(B) potassium chlorate
(C) both (A) and (B)
(D) none of the above
53. When the matchstick is struck against rubbing surface, red phosphorous:
(A) gets converted into white phosphorous
(B) reacts with potassium chlorate
(C) ignites antimony trisulphide
(D) none of the above
54. Best extinguisher for inflammable materials is:
(A) Water (B) SO_2
(C) CO_2 (D) CO
55. CO_2 is given off by chemicals like:
(A) sodium bicarbonate
(B) calcium sulphate
(C) sodium sulphate
(D) sulphuric acid
56. Coal is in nature:
(A) soft (B) hard
(C) thin (D) hot
57. Coal mainly contains:
(A) hydrogen (B) oxygen
(C) carbon (D) sodium
58. Carbonisation is:
(A) slow conversion of dead vegetation into coal
(B) deposition of soil
(C) falling of trees
(D) none of these
59. Coal is produced in industry to get:
(A) coke (B) coal tar
(C) coal gas (D) all of these
60. Coke is used in the manufacturing of:
(A) lead (B) iron
(C) steel (D) copper
61. Which is an almost pure form of carbon?
(A) Coke (B) Coal tar
(C) Coal gas (D) None of these
62. Coal tar is used in manufacture of:
(A) synthetic dyes (B) drugs
(C) explosives (D) all of these
63. Naphthalene balls are obtained from:
(A) carbon (B) coke
(C) coal tar (D) coal gas
64. Name the resources that is found in nature and can be used by people:
(A) Natural resource
(B) Man-made resource
(C) Human resource
(D) None of the above
65. Air is an example of:
(A) Human resource
(B) Man-made resource
(C) Natural resource
(D) None of these
66. Name the resources present in unlimited quantity in nature:
(A) Inexhaustible natural resources
(B) Exhaustible natural resources
(C) Limited natural resources
(D) None of the above
67. Name the resources present in limited quantity in nature:
(A) Inexhaustible natural resources
(B) Exhaustible natural resources
(C) Limited natural resources
(D) None of the above
68. Name the resources exhausted by human activities:
(A) Inexhaustible natural resources
(B) Exhaustible natural resources
(C) Limited natural resources
(D) None of the above
69. Name the fossil fuel which is hard solid and black in colour:
(A) Coal (B) Petroleum
(C) Natural gas (D) None of these
70. Name the process which is used to separate various constituent of petroleum:
(A) Lubrication (B) Refining
(C) Paraffin (D) None of these
71. Refining of petroleum is done in:
(A) Fractionating column
(B) Zone refining column
(C) Pronounce column
(D) None of the above
72. Name the fossil fuel formed from the dead organisms present in the sea:
(A) Coal (B) Petroleum
(C) Windmill (D) None of these
73. Name the substance which is used in candle and ointment:
(A) Lubricating oil (B) Petrol
(C) Bitumen (D) Paraffin wax
74. Name the gas which mainly contains methane, but also contains CO_2 , H_2S in small amount:
(A) Coal (B) Petroleum
(C) Natural gas (D) None of these
75. At high temperature, natural gas is compressed as:
(A) CNG (B) LPG
(C) JPG (D) None of these
76. Name the fuel which is used in stoves, lamps:
(A) Petrol (B) Diesel
(C) Kerosene (D) Paraffin wax
77. Name the substance which is used in lubrication:
(A) Lubricating oil
(B) Lubricating fibre
(C) Both of the above
(D) None of the above
78. Name the substance which is used in paints, road surfacing:
(A) Lubricating oil (B) Petrol
(C) Bitumen (D) Paraffin wax
79. Name the coal product used in manufacture of steel and extraction of metals:
(A) Coke (B) Coal tar
(C) Coal gas (D) None of these

Answer Key

1. (B) 2. (A) 3. (C) 4. (B) 5. (B)
6. (C) 7. (D) 8. (B) 9. (A) 10. (A)
11. (D) 12. (B) 13. (A) 14. (C) 15. (D)
16. (A) 17. (D) 18. (A) 19. (C) 20. (D)
21. (C) 22. (C) 23. (D) 24. (B) 25. (B)
26. (A) 27. (B) 28. (C) 29. (D) 30. (B)
31. (A) 32. (C) 33. (D) 34. (B) 35. (A)
36. (C) 37. (B) 38. (A) 39. (C) 40. (B)
41. (A) 42. (C) 43. (B) 44. (B) 45. (A)
46. (C) 47. (A) 48. (B) 49. (B) 50. (D)
51. (B) 52. (C) 53. (A) 54. (C) 55. (A)
56. (B) 57. (C) 58. (A) 59. (D) 60. (C)
61. (A) 62. (D) 63. (C) 64. (A) 65. (C)
66. (A) 67. (B) 68. (B) 69. (A) 70. (B)
71. (A) 72. (B) 73. (D) 74. (C) 75. (A)
76. (C) 77. (A) 78. (C) 79. (A)



Chapter 1

Part-4 : Social Science (History)

Delhi Sultanate

I. Introduction

- During the eleventh century, the Turkish horsemen pillaged northern India and due to their persistent campaigns, they succeeded in seizing political control of the Gangetic plain by the next century.
- Though the success of their conquests could be attributed to their audacity and ferocity, their success is really due to the failure of Indians to defend themselves and their territories.
- Indians viewed each other with distrust, failing to take note of the success of Islam in early years of its spread.
- The superior military might of Muslim soldiers was yet another factor that contributed to success in their conquests.
- Muhammad Ghori defeated Prithviraj Chauhan in the Second Battle of Tarain in 1192 AD.
- It was an important event in the history of Medieval India. The result of the battle was the beginning of the Afghan-Turkish Rule in India.
- The Afghan-Turkish Rule lasted for 15 years, however, the successors of Muhammad Ghori assumed power in 1206 and ruled India successfully till 1526.
- Since these rulers called themselves as Sultans, this period in the history of India is called as the Sultanate period.



Do you know?

Delhi as a Seat of Power : The Rajputs were Kshatriyas of Central India. The Tomars and Chauhans were prominent among them. It was under the Tomar kings, who were Rajputs, that Delhi first became a seat of power in the 8th century. Back then, Delhi was known as 'Dhillika'. Following the Tomars, the Chauhan dynasty ruled Delhi. Prithviraj Chauhan was the last king of the Chauhan dynasty. Coins called 'Dehliwal' were minted here and had a wide circulation.

2. Establishment and Expansion of the Delhi Sultanate

- The rulers who ruled substantial parts of North India between AD1200 to AD1526 were termed as Sultans and the period of their rule as the Delhi Sultanate.
- These rulers were of Turkish and Afghan origin. They established their rule in India after defeating the Indian ruling dynasties which were mainly Rajputs in northern India. The main ruler who was overthrown by the invading Turk Muhammad Ghori from Delhi was Prithvi Raj Chauhan.
- These Sultans ruled for more than 300 years (from around AD 1200 to AD 1526). The last of the Delhi Sultan, Ibrahim Lodi was defeated by the Mughals under the leadership of

Babur in AD1526 who established the Mughal Empire in India.

- During this period of around three hundred years five different dynasties ruled Delhi. These were the Mamluks (AD 1206–AD 1290) (popularly known as slave dynasty), the Khaljis (AD 1290–AD 1320), the Tughlaqs (AD 1320–AD 1412), the Sayyids (AD 1412–AD 1451) and the Lodhis (AD 1451–AD 1526). All these dynasties are collectively referred to as the Delhi Sultanate.



Do you know?

The **Delhi Sultanate** refers to the **five** short-lived Muslim kingdoms of Turkic and Pashtun (Afghan) origin that ruled the territory of **Delhi** between 1206 and 1526 CE. In the 16th century, the last of their line was overthrown by the Mughals, who established the Mughal Empire in India.

3. Sultans of Delhi

I. Mamluk, or Slave dynasty (1206 – 1290)

- Qutb-ud-din Aibak (1206 - 1210)
- Aram Shah (1210 - 1211)
- Shams-ud-din Iltutmish (1211 - 1236)
- Rukn ud din Firuz (1236)
- Raziyyat ud din Sultana (Raziyya Sultana) (1236 - 1240)
- Muiz ud din Bahram (1240 - 1242)
- Ala ud din Masud (1242 - 1246)
- Nasir ud din Mahmud (1246 - 1266)
- Ghiyas ud din Balban (1266 - 1286)
- Muiz ud din Qaiqabad (1286 - 1290)
- Shamsuddin Kayumars (1290)

II. Khilji (Khalji) dynasty (1290 - 1320)

- Jalal ud din Firuz Khilji (1290 - 1294)
- Ala ud din Khilji (1294 - 1316)
- Qutb ud din Mubarak Shah (1316 - 1321)

III. Tughlaq dynasty (1321 - 1398)

- Ghiyas ud din Tughluq Shah I (1321 - 1325)
- Muhammad Shah II (1325 - 1351)
- Mahmud Ibn Muhammad (March 1351)
- Firuz Shah Tughluq (1351 - 1388)
- Ghiyas ud din Tughluq II (1388 - 1389)
- Abu Bakar (1389 - 1390)
- Nasir ud din Muhammad Shah III (1390 - 1393)
- Sikander Shah I (March - April 1393)
- Mahmud Nasir ud din (Sultan Mahmud II) at Delhi (1393- 1394)
- Nusrat Shah at Firuzabad (1394 - 1398)

IV. Sayyid (Syed) Dynasty (1414 - 1451)

- Khizr Khan (1414 - 1421)
- Mubarrak Shah II (1421 - 1435)
- Muhammad Shah IV (1435 - 1445)
- Aladdin Alam Shah (1445 - 1451)

V. Lodi (Lodhi) dynasty (1451 - 1526)

- Bahlol Khan Lodi (1451-1489)
- Sikandar Lodi (1489-1517)
- Ibrahim II (1517-1526)



Do you know?

- With the First Battle of Panipat in 1526, in which Babur defeated Ibrahim Lodhi, the empire of Delhi Sultanate collapsed.
- It embarked the rule of Mughal dynasty for a period of about 300 years.
- This rule was briefly interrupted in 1540 when Sher Shah Suri defeated Humayun in Battle of Chausa in 1540
- Suri, or Sur dynasty (1540 - 1555)
- Sher Shah Suri (Farid Khan Suri) (1540 - 1545)
- Islam Shah (1545 - 1553)
- Muhammad V (1553 - 1554)
- Firuz Shah (29 April - 2 May 1554)
- Ibrahim III (1554 - 1554/5)
- Sikander Shah (1554/5 - 1555).

4. How do we know about the Delhi Sultans: Sources

- The main sources of Delhi Sultanate are inscriptions. They are found on old coins, historical monuments, milestones, and tombstones.
- Monuments are also an important source of information about the Delhi Sultanate.
- We also get information about the Sultanate from the history written in the Persian language (official language under the Delhi Sultanate) known as tarikh (singular) or the tawarikh (plural). The tawarikh were written by learned men who often occupied important posts in the administration.



Do you know?

- The authors of tawarikh lived mainly in cities like Delhi. So they were unaware of the conditions in rural areas.
- They wrote histories with the aim of receiving rich rewards from the Sultan, so the authenticity of their descriptions is questionable. The descriptions may be biased.
- These authors advised the Sultan to preserve the ideal social order based on birthright and gender distinctions.
 - **Birthright** : Privileges claimed on account of birth. e.g. Nobles were believed to have the right to rule

because they were born in certain families.

- **Gender Distinctions** : Social differences between men and women on account of their biological differences. Mostly used for establishing the superiority of men over women.
- **Circle of Justice** : The idea that the King and his subjects are connected to each other in a circle was put forward by Fakhr-i Mudabbir. It promoted a healthy relationship between the King and his subjects as it was essential for the happiness of the kingdom as a whole.
- The manuscripts were prepared in four stages :
 - (i) Preparing the paper
 - (ii) Writing the text
 - (iii) Melting gold to highlight important words and passages
 - (iv) Preparing the binding
- **The Masjid** : A mosque called a masjid in Arabic, is a place where a Muslim prostrates in reverence to Allah. In a "congregational mosque" (masjid-i-jami or jama masjid) Muslims read their prayers (namaz) together. Members of the congregation choose the most respected, learned male as their leader (imam) for the rituals of prayer, who also delivers the sermon (khutba) during the Friday prayer. During prayer, Muslims stand facing Mecca. In India this is to the west. This is called the qibla. Delhi Sultans built several mosques in cities all over the subcontinent and it demonstrated their claims to be protectors of Islam and Muslims.
 - **Moth ki Masjid** was built in the reign of Sikandar Lodi by his minister.
 - **Bandagan** : It is a Persian term which means "Slaves purchased for military service".
 - **Iqta** : It was a term used for territories. Their holders were known as "Iqtadar/Muqtis".

5. The Delhi Sultans

I. The Slave Dynasty

The Slave dynasty was founded in 1206 AD by Qutubuddin Aibak. The prominent rulers of the Slave dynasty have been mentioned below :

(i) Qutubuddin Aibak (1206-1210 AD)

- Qutubuddin Aibak, who was a Turkish slave, had played an important role in the expansion of the territories of Muhammad Ghori.
- He declared himself the ruler after the death of Muhammad Ghori. He founded the Slave dynasty. His successors were called Mamluk which means 'slave' or 'the son of a slave'.
- Qutb-ud-din-Aibak began his rule by establishing Lahore as the capital of his kingdom. Later he shifted his capital to Delhi. He personally led

military campaigns to the central and western Indo-Gangetic plain (north India) and left the conquest of the eastern Gangetic Plain (Bihar, Bengal) to the care of Bakhtiar Khalji.

- Qutubuddin Aibak was very kind to all his subjects hence he was called as Lakhbaksh which means the 'Giver of Lakhs'.
- He was successful in suppressing the internal revolts and external disturbances caused by the Mongols who invaded from the North-western part of India.
- Qutubuddin Aibak built several mosques in Delhi and Agra. He built Quwat-ul-Islam mosque in Delhi, which is considered to be the oldest mosque in India.
- He also laid the foundations of Qutub Minar in Delhi but could not complete it as he died falling from a horse while playing polo in 1210.

(ii) Shamsuddin Iltutmish (1210-1236 AD)

- Iltutmish was the slave and the son-in-law of Qutubuddin Aibak.
- He succeeded the throne and was conferred the title of Sultan.
- He was known for his efficient administration.
- Iltutmish introduced the following administrative reforms :
 1. His army was organized.
 2. He had the nobility, a select group of forty, called the Chalisa of Chahalgani.
 3. He divided the empire into small units called Iqtas which were given to the nobles as salaries.
 4. He strengthened the North-Western Frontier which protected the empire from the attacks of Mongols from Central Asia.
 5. He introduced Tankas-silver coins and Jitals-Copper coins.
 6. The Qutub Minar at Delhi was completed by Iltutmish. He also built a mosque at Badaun and a tomb at Delhi.

(iii) Razia Sultana (1236-1240)

- Iltutmish nominated his daughter Razia Sultana as his successor to the throne of Delhi. Razia was an able and brave fighter.
- Despite her obvious qualities, Razia did not fare significantly better primarily because of her attempts to create a counter nobility of non-Turks and invited the wrath of the Turkish amirs.
- Razia made an Ethiopian Slave named Jalal-ud-din Yakut as her personal attendant.
- The nobility realized that, though a woman, Razia was not willing to be a puppet in their hands, therefore the nobles started revolting against her in the provinces.

- She got killed after she was defeated by the nobles. Thus, her reign was a brief one and came to end in AD 1240.



Do you know?

Some Interesting Facts about Razia :

- Razia's reign was opposed by many. A chronicler of her times, Minhaj-i-Siraj, though recognized her abilities, yet he did not accept a woman being the ruler. He believed that God had made women subordinate to men.
- Razia mentioned on her inscriptions and coins that she was the daughter of Sultan Iltutmish. This was in contrast with her other contemporary female ruler, Rudramadevi. She was a Kakatiya ruler of Warangal. She had to change her name on the coins and pretend to be a man.
- But contrary to both these situations, Didda, the female ruler of Kashmir, was showered with love and affection by her subjects.

(iv) Ghiyasuddin Balban (1266-1287 AD)

- In 1266 AD, a Turkish slave called Balban took over the throne after the death of Razia Sultana. Balban is known for his firm policies and his efficient spy system.
- He successfully defeated the local enemies and defended his kingdom from all invasions.
- The Divine Right of Kingship was introduced by Balban.
- His policy is generally called Blood and Iron Policy because he mercilessly punished the robbers and zamindars, who did not accept him as ruler.
- Balban adopted a policy of consolidation rather than expansion. He introduced a new theory of kingship and redefined the relations between the Sultan and nobility.
- Through these measures Balban strengthened the Delhi Sultanate. Balban died in AD 1287.

II. The Khalji Dynasty

- The death of Balban led to unrest in the empire.
- Balban's grandson Kaikubad ascended the throne but he was murdered by Jalaluddin Khalji who became the ruler and established the Khalji Dynasty.
- The prominent rulers of Khalji dynasty were :

(i) Jalaluddin Khalji (1290-1296 AD)

- Jalaluddin Khalji laid the foundation of the Khalji dynasty. He ascended the throne at the age of 70 years.
- Although Jalaluddin retained the earlier nobility in his administration, the rise of Khaljis to power ended the monopoly of nobility of slaves to high offices.

- He was the first ruler of the Delhi Sultanate to clearly put forward the view that the state should be based on the willing support of the governed, and that since the large majority of the people in India were Hindus, the state in India could not be a truly Islamic state.
- Jalaluddin tried to win the goodwill of the nobility by a policy of tolerance. He avoided harsh punishments, even to those who revolted against him.
- Jalaluddin's policy was reversed by Alauddin Khalji who awarded drastic punishments to all those who dared to oppose him.
- There were many military campaigns during the reign of Jalal-ud-din. But they were mostly organised and led by his nephew, Ala-uddin, the governor of Kara. One significant military expedition was against the Deccan kingdom Devagiri. Ala-ud-din, after defeating the Yadava king Ramachandra, plundered the city and returned with huge wealth.
- Alaud-din treacherously killed Jalal-ud-din after buying off the prominent nobles and important commanders with the wealth he had brought from the Deccan and declared himself as the Sultan of Delhi in 1296.

(ii) Alauddin Khalji (1296-1316 AD)

- Alauddin Khalji was a great military leader and adopted expansionist policy.
- He built a city called Siri in Delhi and also constructed Alai Darwaza near the Qutub Minar.
- Alauddin Khalji conquered Gujarat, Rajasthan, Malwa Devagiri, Warangal and Dwarasamudra.
- He managed the Mongols invasion by strengthening the forts.
- He took measures to prevent rebellions and stopped the intermixing of nobles.
- New reforms were introduced to collect revenues. Revenue was collected on the basis of measurement of the land. Special officers were appointed to collect the revenue.
- Alauddin introduced a market control system according to which the prices of all goods were fixed. There were three markets one for foodgrains, another for clothes, and the third one for slaves, animals and cattle.
- In the army, he introduced a system called Huliya in which the identity of soldiers was recorded. A Dagh (branding of horses) was used for cavalry with a royal seal.
- The Spy system was very efficient and well organised.
- There were three types of taxes:

- on cultivation called kharaj and amounting to about 50% of the peasant's produce
- on cattle and
- on houses
- Ala-ud-din died in 1316. The failure of his successors to retain power led to the seizure of power by Ghiyas-ud-din Tughluq, who founded the Tughlaq dynasty.



Do you know?

Sack of Chittor (1303): When Ala-ud-din's army overwhelmed the Rajput army in Chittoor and in the context of threat of defeat, the men and women of the fortress, in accordance with their old custom, performed the rite of jauhar. According to this custom, left with no other way to survive, the men would go out and die in the field of battle and women would burn themselves on a pyre.

III. The Tughlaq Dynasty

- In 1320 AD, Ghiyasuddin Tughlaq killed the last Khalji ruler and founded the Tughlaq dynasty.
- The prominent rulers of the Tughlaq dynasty have been mentioned below :

(i) Ghiyasuddin Tughlaq (1320-1325 AD)

- Ghiyasuddin Tughlaq was an efficient ruler and statesman, a good administrator.
- He was able to establish peace in his territory.
- The famous Tughlaqabad Fort in Delhi was constructed by him.
- He died in 1325 AD under mysterious circumstances.

(ii) Muhammad-bin-Tughlaq (1325-1351AD)

- Jauna Khan succeeded his father Ghiyas Uddin Tughlaq and took the title Muhammad-bin-Tughlaq in 1325 AD.
- The source of information was the writings of Moroccan traveller, Ibn Batuta.
- Muhammad bin-Tughlaq was a scholar and chose reasonable and rational methods to solve all religious issues.
- He restricted the influence of the Ulemas on society. He also tried to break the barrier between northern and southern India.
- Most of his projects were controversial and led to his downfall. The significant of those decisions are :
 1. One such project was the transfer of the capital from Delhi to Devagiri, renamed as Daulatabad, in 1327 AD. He actually decided to change the capital because it was closer to South India but North India was far away from this place hence its administration suffered. This decision brought the downfall of his rule. He ordered all the people to shift with their bag and baggage which caused inconvenience

to all. The Mongols also started attacking the North-west Frontier regions. The long travel and journey caused misery to all people. However, Tughlaq decided to come back to Delhi within five months which caused a lot of hardship to all the people.

2. The introduction of the token currency was the second project. In order to overcome the shortage of silver, a token currency was introduced which was made of bronze and copper. Since the right to mint the coins was not reserved, every household started minting coins. As a result there was circulation of counterfeit coins. This resulted in confusion in trade and finally all coins had to be withdrawn which caused heavy loss for the government.
3. The third project was to increase the tax in the Ganga-Yamuna Doab at a time when it was affected by famine. By the time it was withdrawn, it was already too late and the agriculture sector was badly affected.
4. Tughlaq ruled as Sultan for 25 years. During his long reign, he had to face many revolts of the provincial governors. The Governors of Awadh, Multan and Sind revolted and declared themselves independent.
5. In South India, several states arose. The new Daulatabad and the conquered territories around them were declared independent sultanates called Bahmani. Its founder, after whom it was named, was a soldier formerly in Tughluq service.
6. Madurai was proclaimed a separate sultanate in 1334. Bengal became independent in 1346. Tughluq died on 23 March 1351.

(iii) Firoz Shah Tughlaq (1351-1388 AD)

- Firoz Shah Tughlaq succeeded Mohammad-bin-Tughlaq. He was the son of Ghiyasuddin's longer brother.
- He was a very soft ruler. His policies were very moderate. During his reign the punishment became less severe. All laws granted by the earlier rulers were written off.
- He introduced the Jaziya, a non-muslim tax.
- Feroz Shah Tughlaq did not strengthen the army. However he did a lot of welfare activities for his people such as construction of canals and baolis, a separate department for the poor, construction of various sarais and madarasas and setting up of workshops for handicrafts.
- The reign of Firoz Shah Tughlaq was a period of peace and prosperity. He established many towns such as Hisar, Firozabad, Jaunpur and Ferozepur. Firoz Shah Tughlaq died in 1388 AD.
- After his death, the Tughlaq dynasty could not survive for long.

- It was during the reign of Naziruddin Mohammed Tughlaq, the last ruler of the Tughlaq dynasty, that Timur, the Turk ruler of Samarkand invaded India in 1398.

IV. Sayyid Dynasty

- Khizr Khan (representative of Timur) captured the throne when Timur left India and established the Sayyid dynasty in 1414.
- The prominent rulers of the Sayyid dynasty have been mentioned below :
 - (i) Khizr Khan (1414-1421)
 - (ii) Mubarak Shah (1421-1434)
 - (iii) Muhammad Shah (1434-1443)
 - (iv) Alam Shah (1443-1451)

V. The Lodhi Dynasty

- The last ruler of the Sayyid dynasty, Ala-ud-din Alam Shah, abdicated the throne in 1451.
- This gave Bahlol Lodi, then the governor of Sirhind (Punjab), the opportunity to become the new Sultan of Delhi, leading to the establishment of the Lodhi dynasty.
- The prominent rulers of the Lodhi dynasty have been mentioned below :
 - (i) Bahlol Lodhi (1451-1488)
 - (ii) Sikandar Lodhi (1489-1517)
 - (iii) Ibrahim Lodhi (1517-1526 AD)



Do you know?

In 1489, Bahlol Lodhi was succeeded by his son Sikandar Lodhi. Sikandar was a patron of arts and learning. He founded the city of Agra and made it his capital. He died in 1517 and was succeeded by his son, Ibrahim Lodhi, who was defeated by Babur in 1526 in the Panipat battle. Thus, the Lodhi dynasty and the Delhi Sultanate were ended by Babur who went on to establish the Mughal Empire in India.

6. Expansion of Delhi Sultanate

- In the early 13th century, the control of Delhi Sultans was limited. They remained in their fortified towns occupied by garrisons. A garrison referred to the army that secured the boundaries of the Sultan's fortified town.
- The Sultan's did not control the hinterlands, i.e., the lands adjacent to a city or a port that supplied it with goods and services. Due to this the Sultans had to rely on trade, tribute or plunder for supplies.
- The rule of Delhi Sultans was limited because they could not control Bengal and Sind from Delhi. Fragile communication could also be disrupted due to bad weather or rebellion. Mongol invasions and continuous rebellions of governors also challenged the authority of the Sultan from time to time.

- But things changed for the first time under the rule of Ghiyasuddin Balban.
- Alauddin Khilji and Muhammad bin Tughluq further expanded the control of Delhi Sultanate.
- The expansion took place in two phases.
- The first phase involved expansion in internal frontiers. In this campaign, the hinterlands of garrison towns were captured. Agriculture was set up. New fortresses and towns were created to encourage trade and protect trade routes.
- The second phase involved the expansion of the external frontier. Military expeditions were sent to southern India during the reign of Alauddin Khilji. These expeditions reached their apex under Muhammad bin Tughluq.

7. Art and Culture

During the Sultanate period there were important developments in the field of religion, literature, language, music, sculpture and painting.

I. Religion

- Khawaja Saint Moinuddin Chisti had come to India during the invasion of Ghori. In 1206AD he went to Ajmer. He died in 1235AD in Ajmer. He propagated the Sufi ideology. He developed a mixed culture between the Hindus and Muslims.
- Apart from Chisti, Saints like Sohrawardi, Nakshbandi, Kadri, also became popular in India. Leading saints like Ramanad, Kabir, Chaitanya, Nanak, Raidass also spread the message of Devotion, Vaishnavism, Shavism.

II. Literature

- In Delhi Sultanate Persian language was given state protection. This led to the growth of Persian language and literature. There was a decline in the progress of Sanskrit but Hemchandra Suri and Chaitanya wrote their compositions in Sanskrit. A new writing style called 'champu' poetic style developed.
- Amir Khusro wrote 'Qiran-Us-Sadain', 'Miftah-ul-Futuh', 'Tuglaqnama', 'Khazain-ul-futuh', volumes in Persian language. 'Mahabharata' and 'Rajtarangini' were translated into Persian language. Sufi literature was written in the form of 'Malfujat'. Urdu language flourished during the Sultanate era. Regional languages in the form of Bengali, Assamese, Odiya, Telugu, Malayalam and Kannada literature developed.

III. Music

- Modern ragas such as Amon, Gora, Sanam and Qwallis became a trend in the Sultanate period due to Amir Khusro.
- Sitar was a mix of Indian Veena and Persian tambura. Swami Haridas of Vrindavan and his favourite pupil Tansen earned forward the legacy of music. The Turks brought Rabab and Saiangi to India,

- In sultanate period Bhiti pictures, Mehrabi walls. Pari paintings and Manuscripts were developed in the form of Qurani calligraphy and drawings. In the 15 century, Gujarat, Malwa and Jaunpur were the centers of painting.

8. Architecture in Delhi Sultanate

- The Delhi Sultans built several mosques in cities all over the subcontinent to strengthen their claim to be the protectors of Islam.
- A mosque is called masjid in Arabic which means "a place where a Muslim prostrates in reverence to Allah".
- Jama Masjid is a congregational mosque where Muslims offer prayers in groups.
- Their leader is a learned man called 'Imam'.



Do you know?

- Some Famous Mosques :
 1. **Quwwat al- Islam Mosque** : It was built during the last decade of 12th century. It was a congregational mosque built in Delhi-i-Kuhna, the first city established by the Delhi Sultans. The mosque was enlarged by Iltutmish and Alauddin Khilji. Its minar was built by two Sultans – Qutubuddin Aibak and Iltutmish.
 2. **Begumpuri Mosque** : It was built in the reign of Muhammad bin Tughluq in his new capital, Jahanpanah.
 - The qibla is the direction towards the Kaaba in the Sacred Mosque in Mecca, which is used by Muslims in various religious contexts, particularly the direction of prayer for the salah.

9. Administration of the Delhi Sultanate

- Delhi Sultanate was a vast empire that needed able and loyal administrators.
- Instead of appointing aristocrats or landed chieftains, the early Delhi Sultans, especially Iltutmish, appointed his special slaves called 'Bandagan'. These slaves were specially purchased for military service. This was so because these Bandagans were totally dependent on the Sultan for their survival, so their loyalty was unquestionable.
- The Khaljis and Tughluqs continued this practice. But they also introduced 'Clients', the people of humble origin brought up by the Sultan to suit his administrative needs.
- These slaves and clients were loyal to their masters but not to their heirs.



Do you know?

Sultan Muhammad bin Tughluq had appointed people of humble origin like Aziz Khummar, a wine distiller, Firuz Hajjam, a barber, Manka Tabbakh, a cook and Ladha and

Pira, two gardeners, to high administrative posts. Ziauddin Barani, a chronicler of the medieval period criticized the Sultan for this act and claimed that this decision was evidence of the Sultan's loss of political judgement.

- The Khalji and Tughluq rulers appointed military commanders as Governors for various territories. These lands were called iqtas and their holders were called iqtdars or muqti.
- Muqtis had twofold duties : to lead military campaigns and to maintain law and order in their respective Iqtas.
- In exchange for their services, they were allowed to collect revenue from their land. It was from this revenue that they paid their soldiers.
- During Alauddin's reign, the position of muqtis was non hereditary and iqtas were assigned for a short period of time.
- Despite all these firm military policies, the Delhi Sultans could not penetrate throughout India. As Ibn Battuta mentions that certain local chieftains that resided in forests could not be subdued even by greatest armies.



Do you know?

Kharāj is a type of individual Islamic tax on agricultural land and its produce developed under Islamic law. With the passage of time, the practical result of that reform was that kharaj was levied on most land without regard for the cultivator's religion.

10. Economic Reforms - Agriculture, Market System

- All the rulers of Delhi Sultanate more or less gave attention towards the agriculture system because the main source of state income was from land revenue. To increase revenue from land many measures were adopted.
- Tughlaq dynasty played an important part in the development of agriculture. To help in agriculture growth they established a new department known as 'Diwan-Eh-

Kohi'. Farmers were helped by providing them with seeds and grains. If the harvest failed or there was a famine the farmer were provided loans.

- Firoz Tughlaq constructed canals and laid many gardens. Fallow land was turned into agriculture land. Different crops were grown. In irrigated areas, two crops were harvested in a year. Apart from rice, wheat pulses, jowar, bajra etc, fruits, vegetables spices were also cultivated.
- Major part of agriculture depended on rainfall. Different methods of irrigation and fertilizers were used to increase production. Irrigation was done through wells, rivers, ponds, canals and lakes. Cash crops like sugarcane, cotton, poppy and silk were cultivated.
- In Delhi Sultanate, Allauddin Khilji the ruler of Khilji dynasty was especially famous for his market system. For the supervision of these markets he appointed a 'Shahna-Eh-Mandi'.
- Under 'Shahna-Eh-Mandi' were 'Barid' (Information officer) and Muhin (Spies) who worked for him. They provided daily information about the markets.
- The reason for price control over the sale of horses was to lower the rate of horses and thus make sure about their supply to the army, in the same way, prices of essential articles and their supply was determined, keeping the needs of the army in mind. Weight and measure system was strictly applied.

11. Comparison between the Administration of Alauddin Khalji and Muhammad Tughluq

- The Administration of Delhi Sultanate was largely influenced by their religion.
- The Sultans were the head of the state that enjoyed unlimited power in legislative, executive and judicial.
- Here, we are giving the brief story of the comparison between two personalities of Delhi Sultanate—Muhammad bin Tughlaq will forever be remembered for the wild swings in policy, whereas Alauddin Khilji's administrative measures made him most powerful ruler of the Delhi Sultanate.

Comparison between the Administration of Alauddin Khalji and Muhammad Tughlaq

| Administration of Alauddin Khalji | Administration of Muhammad Tughluq |
|---|--|
| He increased his large standing army to protect from invasion (defensive measure) because Delhi was attacked twice, in 1299/1300 AD and 1302-03 AD. | He increased his large standing army to attack Transoxiana. |
| He constructed a new garrison town named Siri for his soldiers. | He evacuated four oldest cities of Delhi (Delhi-i Kuhna) and made soldiers garrison. The residents of the old city were relocated to the new capital of Daulatabad in the south. |
| Soldiers were fed from the tax collected from the lands between the Ganga and Yamuna. Tax was fixed at 50 percent of the produce. | The tax collected from the area between Ganga and Yamuna was used to feed the army. But to meet the need of the large number of soldiers the Sultan levied additional taxes, including those areas which were suffering from famine. |

| Administration of Alauddin Khalji | Administration of Muhammad Tughluq |
|---|---|
| He paid his soldiers salaries in cash rather than kind. The soldiers were to buy their supplies from the local market. | He paid salary in cash to the soldiers but never controlled the prices. He introduced the token system without royal verification |
| To stop the fear of price rise, he controlled the prices of goods. Prices were carefully monitored by officers, and if merchants did not sell at the prescribed rates, they were punished. | somewhat like present-day paper currency, but made out of cheap metals, not gold and silver. |
| His administrative measures like Military Reforms, Revenue Reforms and Economic Reforms (Market Regulations) were quite successful. He successfully withstood the threat of Mongol invasions. | His administrative measures like shifting of capital; plans to invade Transoxiana and disbanding his large army; raising of taxes and famine in the Ganga-Yamuna belt led to widespread rebellion; and token system were failed measures. |

- Muhammad Bin Tughlaq was one of the most interesting personalities of Medieval Indian history because he is popularly called by scholars as an intelligent fool.

12. Decline of the Sultanate

The succeeding Sultans were not very successful. Most of the rulers were very soft and weak which led to the downfall of the empire. The reasons were many, such as :

- The imposition of Jazia, a tax for non-Muslims, conversion

of people to Islam, destruction of temples and other places of worship made the rulers unpopular.

- Many rulers were weak which made the nobles assume powers.
- The succession war after the king had died weakened the kingdom.
- The invasions of foreign rulers gave the final blow to the empire.
- Many revolts led to the formation of independent kingdoms such as Vijayanagar and Bahmani.

Sainik School Previous Years (2018-2021) Questions

1. Who were the European artists appointed by Muhammad Ali Khan of Arcot ?
(A) Tilly Kettle and George Willison

- (B) Francis Hayman and William Daniell
(C) Thomas Daniell and William Daniell
(D) Johan Zoffany and Tilly Kettle

[Sainik School Entrance Exam
(Class IX) (07-02-2021)]

1. (C) Thomas Daniell and William Daniell were the European artists appointed by Mohammad Ali Khan of Arcot.

Important Questions

- Which of the following was NOT the king of the Rajput Dynasty?
(A) Tomaras
(B) Ananga Pala
(C) Prithviraj Chauhan
(D) Bahlol Lodhi
- Which ruler first established his capital at Delhi?
(A) Chauhan ruler
(B) Tomara Rajput ruler
(C) Turkish ruler
(D) Khalji dynasty
- Who was the first slave king of Delhi Sultanate?
(A) Qutbuddin Aibak
(B) Iltutmish
(C) Razia Sultan
(D) Alauddin Khalji
- Who was successor of Muhammad-bin Tughluq?

- (A) Ghiyasuddin Tughluq
(B) Firoz Shah Tughluq
(C) Ibn Battuta
(D) None of these
- What was the language of administration under the Delhi Sultans?
(A) Urdu (B) Persian
(C) Hindi (D) English
 - The position of standing facing Mecca during namaz is known as :
(A) Khutba (B) Qibla
(C) Sijdah (D) Kharaj
 - In whose reign did the Sultanate reach its farthest extent?
(A) Tomara Rajput
(B) Razia
(C) Alauddin Khalji
(D) Muhammad-bin-Tughluq

- Who was Ulema?
(A) A slave purchased for military service
(B) A ruler
(C) A scholar of Islamic learning
(D) An invader
- A fortified settlement with soldiers was :
(A) hinterland (B) garrison town
(C) jagir (D) none of these
- Which was NOT the kind of taxes during Delhi Sultanate?
(A) Kharaj (B) Tax on cattle
(C) Tax on houses (D) Bandagans
- Kharaj was a type of tax on :
(A) houses (B) cattle
(C) trade (D) cultivation

Answer Key

1. (D) 2. (B) 3. (A) 4. (B) 5. (B)
6. (B) 7. (D) 8. (C) 9. (B) 10. (D)
11. (D)



Chapter 1

Part-5 : Intelligence Illustration

Arranging the Words According to Dictionary

Arranging the words in alphabetical order implies 'to arrange them in the order as they appear in a dictionary' is called arranging the words. In such types of questions, given four or five words which are not in alphabetical order, we arrange that letters in the English alphabet or according to dictionary.

Ex. 1. If the following five words are arranged in alphabetical order, which word will come in 4th place?

- (A) Propense (B) Prophet
(C) Prong (D) Propine

Sol. (D): Letters P, R, and O are same in all words.

The letters after P, R and O are different in all. If these letters are arranged in order of English alphabet, letter N will come first, then letter P will come. Letter 'P' is the same in three words. On arranging the words in alphabetical order.

¹Pro²ng > Pro²pense > Pro³phet > Pro⁴pine

According to a dictionary, 'Propine' will come on 4th place.

Ex. 2. Arrange the following words according to dictionary arrangement.

- (i) Live (ii) Litter
(iii) Little (iv) Literacy
(A) (iv) (iii) (i) (ii) (B) (iv) (ii) (iii) (i)
(C) (iii) (iv) (ii) (i) (D) (iii) (ii) (iv) (i)

Sol. (B): Words are arranged according to dictionary.

- (iv) LITE RACY (ii) LIT TE R
(iii) LIT TL E (i) LI V E

Order is : (iv) (ii) (iii) (i)

Sainik School Previous Years (2018-2021) Questions

1. Arrange the following words as per order in the dictionary :

1. Quilt 2. Quite
3. Queen 4. Queue
(A) 1, 4, 2, 3 (B) 4, 3, 1, 2
(C) 2, 3, 4, 1 (D) 3, 4, 1, 2

[Sainik School Entrance Exam
(Class IX) (07-02-2021)]

1. (D) On arranging the words as per order in the dictionary :

- Queen → 3
Queue → 4
Quilt → 1
Quite → 2

Hence, 3412 is the correct sequence.

2. Arrange the following words as per order in the dictionary.

1. Live 2. Litter 3. Little 4. Literacy
5. Living

- (A) 3, 4, 2, 1, 5 (B) 3, 2, 4, 5, 1
(C) 4, 3, 5, 2, 1 (D) 4, 2, 3, 1, 5

Sainik School Entrance Exam,
(Class IX 2020)

2. (D) Arrange the sequence according to dictionary.

- Literacy → 4
Litter → 2
Little → 3
Live → 1
Living → 5

Hence, 42315 is the correct sequence of the words.

3. What is the sequence of the following when arranged in a dictionary?

1. Telegraph 2. Telephone
3. Teleprint 4. Telemetry
5. Telepathy
(A) 14523 (B) 14253
(C) 15423 (D) 14325

Sainik School Entrance Exam,
(Class IX 2018)

3. (A) Arrange the words according to the dictionary -

- Telegraph → 1
Telemetry → 4
Telepathy → 5
Telephone → 2
Teleprint → 3

Hence, 14523 is the correct sequence.

Important Questions

Direction (Q. 1 to 9)

Arrange the following words as per order in the dictionary :

1. 1. Decoration 2. Decorum
3. Declaration 4. Decision
(A) 4, 2, 1, 3 (B) 4, 3, 1, 2
(C) 4, 3, 2, 1 (D) 3, 4, 1, 2

2. 1. Necessary 2. Navigate
3. Nautical 4. Naval
(A) 2, 4, 3, 1 (B) 4, 3, 2, 1
(C) 3, 4, 2, 1 (D) 3, 2, 4, 1

3. 1. Obstacle 2. Observe
3. Obvious 4. Obstain

5. Obstruct
(A) 2, 4, 1, 5, 3 (B) 2, 5, 4, 1, 3
(C) 2, 1, 4, 5, 3 (D) 4, 2, 1, 5, 3

4. 1. Rationalism
2. Rationale
3. Rationalization

4. Rationalize
5. Rationality
(A) 2, 3, 5, 1, 4
(B) 1, 3, 5, 4, 2
(C) 1, 2, 3, 4, 5
(D) 2, 1, 5, 3, 4
5. 1. Consume 2. Consciousness
3. Conscience 4. Conservation
5. Consequence
(A) 3, 2, 1, 5, 4
(B) 3, 1, 2, 5, 4
(C) 3, 5, 2, 4, 1
(D) 3, 2, 5, 4, 1
6. 1. Euphrasy 2. Eupepsy
3. Euphonic 4. Eugenic
5. Euphony
(A) 4, 3, 2, 1, 5, (B) 3, 4, 1, 2, 5
(C) 4, 2, 3, 5, 1 (D) 3, 5, 2, 4, 1
7. 1. Liver 2. Long
3. Late 4. Load
5. Luminous 6. Letter
(A) 3, 1, 6, 2, 5, 4
(B) 3, 6, 1, 2, 4, 5
(C) 3, 6, 1, 4, 2, 5
(D) 3, 1, 6, 2, 4, 5
8. 1. Intrinsic 2. Intrude
3. Intricate 4. Introvert
5. Intrigue 6. Introduce
(A) 3, 5, 1, 4, 6, 2
(B) 3, 5, 1, 6, 4, 2
(C) 3, 1, 5, 4, 6, 2
(D) 5, 1, 3, 2, 4, 6
9. 1. Dissipate 2. Dissuade
3. Disseminate 4. Distract
5. Dissociate 6. Dissect
(A) 6, 3, 1, 5, 2, 4
(B) 1, 6, 3, 2, 4, 5
(C) 4, 6, 3, 1, 5, 2
(D) 4, 6, 3, 1, 5, 2
10. If the following words are arranged in reverse dictionary order, which word comes second?
(A) Explosion (B) Express
(C) Exploit (D) Expulse
11. Which will appear fourth in the dictionary?
(A) Intensive (B) Inheritance
(C) Instrument (D) Innocent
12. Which will appear second in the dictionary?
(A) Coventry (B) Covariant
(C) Covalent (D) Covenant
13. Which is the third word when put in an alphabetic order?
(A) Dialysis (B) Diarchy
(C) Diamond (D) Diagonal
14. Which word comes last in the dictionary?
bonanza, beautiful, balance, bottle

- (A) bottle (B) bonanza
(C) beautiful (D) balance
15. Which word comes third in the dictionary?
seize, season, secret, seed
(A) seed (B) seize
(C) season (D) secret

Solutions

1. (B) According to dictionary
4. Decision 3. Declaration
1. Decoration 2. Decorum
Option (B) is right.
2. (C) According to dictionary
3. Nautical 4. Naval
2. Navigate 1. Necessary
Option (C) is right.
3. (C) According to dictionary
2. Observe 1. Obsacle
4. Obstain 5. Obstruct
3. Obvious
Option (C) is right.
4. (D) According to dictionary
2. Rationale 1. Rationalism
5. Rationality 3. Rationalization
4. Rationalize
Option (D) is right.
5. (D) According to dictionary
3. Conscience
2. Consciousness
5. Consquence
4. Conservation
1. Consume
Option (D) is right.
6. (C) According to dictionary
4. Eugenic 2. Eupepsy
3. Euphonic 5. Euphony
1. Euphrasy
Option (C) is right.
7. (C) According to dictionary
3. Late 6. Letter
1. Liver 4. Load
2. Long 5. Luminous
Option (C) is right.

8. (B) According to dictionary
3. Intricate 5. Intrigue
1. Intrinsic 6. Introduce
4. Introvert 2. Intrude
Option (B) is right.
9. (A) According to dictionary
6. Dissect
3. Disseminate
1. Dissipate 5. Dissociate
2. Dissuade 4. Distract
Option (A) is right.
10. (B) All words arrange according to dictionary
(D) Expulse (B) Express
(A) Explosion (C) Exploit
Option (B) is right.
11. (A) According to dictionary
(B) Inheritance (D) Innocent
(C) Instrument (A) Intensive
Option (A) is right.
12. (B) According to dictionary
(C) Covalent
(B) Covariant
(D) Covenant
(A) Coventry
Option (B) is right.
13. (C) According to dictionary
(D) Diagonal (A) Dialysis
(C) Diamond (B) Diarchy
Option (C) is right.
14. (A) According to dictionary
ballance > beautiful >
bonanza > bottle
Option (A) is right.
15. (A) According to dictionary
Season > Secret > Secd >
Seize
Option (A) is right.



Practice Set-1

SECTION A MATHEMATICS

- If the cost of 37 pens and 53 pencils together is ₹ 320, while 53 pens and 37 pencil together cost ₹ 400. The cost of two pens is :
(A) ₹ 6.50 (B) ₹ 1.50
(C) ₹ 13.00 (D) ₹ 15.00
- The sum of a two digit number and the number formed by interchanging its digits is 110. If 10 is subtracted from the first number, the new number is 4 more than 5 times the sum of the digits in the first number. The first number is :
(A) 46 (B) 64
(C) 84 (D) 92
- The denominator of a fraction is 4 more than twice the numerator. When both the numerator and denominator are decreases by 6, then the denominator becomes 12 times the numerator. Then the fraction is :
(A) 7/18 (B) 18/7
(C) 5/14 (D) 9/19
- Ten years ago, Father was twelve times as old as his son and after ten years father will be twice as old his son. Then the present age of father is :
(A) 34 years (B) 46 years
(C) 12 years (D) 18 years
- A boat covers 32 km upstream and 36 km downstream in 7 hours. Also, it covers 40 km upstream and 48 km downstream in 9 hours. The speed of the boat in still water is :
(A) 2 km/hr (B) 10 km/hr
(C) 12 km/hr (D) None of these
- On selling a tea-set at 5% loss and a lemon-set at 15% gain, a crockery seller gains a total of ₹7. If he sells the tea-set at 5% gain and the lemon-set at 10% gain, he gains ₹13. The actual prize of the tea-set is :
(A) ₹ 13.50 (B) ₹ 18
(C) ₹ 80 (D) ₹ 100
- If the perimeter of a semi-circular protractor is 66 cm, the diameter of the protractor is :
(A) 21 cm (B) 42 cm
(C) 14.6 cm (D) None of these
- A race track is in the form of a ring whose inner circumference is 352 meter and the outer circumference is 396 meter. The width of the track is :
(A) 63 meter (B) 56 meter
(C) 7 meter (D) 65 meter
- A wheel has diameter 84 cm. How many complete revolutions it should take to cover 792 meters.
(A) 100 (B) 200
(C) 300 (D) 400
- The length of minute hand of a clock is 14 cm. The area swept by the minute hand in one minute is :
(A) 10.26 cm² (B) 16.80 cm²
(C) 18.33 cm² (D) 20.52 cm²
- Three metallic solid cubes whose edge are 3 cm, 4 cm and 5 cm, are melted and formed into a single cube. The edge of the cube so formed is :
(A) 6 cm (B) 216 cm
(C) 12 cm (D) 9 cm
- The dimensions of a metallic cuboid are 100 cm × 80 cm × 64 cm. It is melted and recast into a cube. The surface area of the new cube is :
(A) 512000 cm² (B) 38400 cm²
(C) 6400 cm² (D) 12800 cm²
- If $4^x - 4^{x-1} = 24$, then the value of $2x$ is :
(A) 32 (B) 5/2
(C) 5 (D) None of these
- Find the value of $(343)^{-2/3}$:
(A) 1/7 (B) 1/49
(C) 49 (D) 1/149
- If $x + \frac{1}{x} = 6$, then the value of $x^4 + \frac{1}{x^4}$ is :
(A) 34 (B) 1296
(C) 1154 (D) 2308
- If $a + b = 10$ and $a^2 + b^2 = 58$, then the value of $a^3 + b^3$ is :
(A) 21 (B) 1360
(C) 370 (D) 360
- If $a + b + c = 15$ and $a^2 + b^2 + c^2 = 83$. Then the value of $a^3 + b^3 + c^3 - 3abc$ is :
(A) 71 (B) 180
(C) 2310 (D) 360
- If $x^4 + x^3 + 8x^2 + ax + b$, is divisible by $x^2 + 1$ then the value of a and b is :
(A) $a = 1, b = 7$ (B) $a = -1, b = 7$
(C) $a = 1, b = -7$ (D) None of these
- Solution of $\frac{x+b}{a-b} = \frac{x-b}{a+b}$ is :
(A) $x = a$ (B) $x = b$
(C) $x = -a$ (D) $x = -b$
- On the graph the line $x = -2$ does not pass through the point :
(A) $(-2, 3)$ (B) $(-2, -2)$
(C) $(1, -2)$ (D) $(-2, 0)$
- Which is the largest among the following rational numbers?
(A) $-11/28$ (B) $-5/7$
(C) $-9/14$ (D) $-29/24$
- The age ratio between Rahul and ravi is 5 : 7. After 4 years, sum of their ages will become 56 years. Find the present age (in years) of Ravi.
(A) 14 (B) 21
(C) 28 (D) 35
- Corresponding angles of a parallelogram are $(2x + 25)^\circ$ and $(3x - 5)^\circ$. Find x .
(A) 32 (B) 34
(C) 36 (D) 42
- A shopkeeper displays the marked price as 20% more than its cost price and gives 5% discount on it. Find his profit percentage.
(A) 14 (B) 15
(C) 16 (D) 18
- Which of the following numbers is not a perfect cube ?
(A) 343 (B) 2197
(C) 2744 (D) 2916
- On adding 75 to 75% of a number equals the number itself. Find the number.
(A) 150 (B) 200
(C) 225 (D) 300
- There will be a loss of 10% on selling a toy for 10.80 per unit. At what price per

unit should the toy be sold for getting 20% profit on it?

- (A) 12.96 (B) 14.40
(C) 14.04 (D) 15.12

28. At what period of time, an amount of ₹ 64,000 will become ₹ 68,921, if the annual rate of interest is 5% compounded half-yearly?

- (A) $1\frac{1}{2}$ (B) 2
(C) $2\frac{1}{2}$ (D) 3

29. If $\left(x + \frac{1}{x}\right) = 3$, then find $\left(x^2 + \frac{1}{x^2}\right)$.

- (A) 5 (B) 7
(C) 9 (D) 11

30. $(2a - b)^2 + 2(2a - b) - 8 = \dots\dots\dots$

- (A) $(2a - b + 4)(2a - b + 2)$
(B) $(2a - b - 4)(2a - b - 2)$
(C) $(2a - b - 4)(2a - b + 2)$
(D) $(2a - b + 4)(2a - b - 2)$

31. The cost of painting the total surface area of a cube at 13 paise per sq. cm. is 343.98. Volume of the cube is:

- (A) 80 cm^3
(B) 926 cm^3
(C) 10648 cm^3
(D) 13824 cm^3

32. The difference between length and breadth of a rectangle is 23 meters. If its perimeter is 206 meters, then its area will be:

- (A) 2120 m^2 (B) 2480 m^2
(C) 2520 m^2 (D) 2720 m^2

33. 550 people can finish a work in 100 days. 50 more people join them. Now, find the total days required to finish the work.

- (A) $82\frac{1}{2}$ (B) $82\frac{1}{3}$
(C) $83\frac{1}{2}$ (D) $83\frac{1}{3}$

34. Two dices are thrown simultaneously. Find the probability for getting even number on a dice and multiple of 3 on another dice.

- (A) $\frac{1}{6}$ (B) $\frac{5}{12}$
(C) $\frac{5}{6}$ (D) $\frac{11}{36}$

35. If $7A = 5B = 2C$, then find the value of the ratio A : B : C.

- (A) 35 : 14 : 10 (B) 14 : 10 : 35
(C) 2 : 5 : 7 (D) 10 : 14 : 35

36. If $P = 99$, then find $p(p^2 + 3p + 3)$.

- (A) 989898 (B) 998889
(C) 988899 (D) 999999

37. Ram and Shyam appeared in an examination. Ram got 24 more marks than Shyam that is 65% of the sum of the marks of both. Find the obtained marks of both.

- (A) 78 and 54 (B) 85 and 61
(C) 67 and 43 (D) 52 and 28

38. What will be the number of sides of a regular polygon if its each interior angle is 135° ?

- (A) 8 (B) 7
(C) 6 (D) 10

39. If 50% of $(x - y) = 30\%$ of $(x + y)$, then what percent of x is y ?

- (A) 25% (B) $33\frac{1}{3}\%$
(C) 40% (D) 400%

40. The mean of 10 numbers is 55. If a number is discarded from them, the mean of the remaining numbers is 50. Find the discarded number.

- (A) 60 (B) 70
(C) 80 (D) 100

41. A boat goes some distance in upstream in 6 hours and covers the same distance in downstream in 4 hours. If the speed of stream is 3 km then the distance is—

- (A) 60 km (B) 72 km
(C) 90 km (D) 108 km

42. A road roller takes 750 complete revolution more once over to level a road. If the diameter of road roller is 84 cm and length is 1m, then area of the road is—

- (A) 396 m^2 (B) 3960 m^2
(C) 198 m^2 (D) 1980 m^2

43. if $\frac{x+b}{a-b} = \frac{x-b}{a+b}$, then $x = ?$

- (A) a (B) $-a$
(C) b (D) $-b$

44. Water is pouring into a cuboidal reservoir at the rate of 60 liters per minute. If the volume of reservoir is 108 cubic meter, then number of hours to fill the reservoir is—

- (A) 18 (B) 180
(C) 30 (D) 300

45. The angles of a pentagon are x° , $(x + 20)^\circ$, $(x + 40)^\circ$, $(x + 60)^\circ$ and $(x + 80)^\circ$. The smallest angle of the pentagon is—

- (A) 85° (B) 78°
(C) 75° (D) 68°

46. On dividing $10x^4 + 17x^3 - 62x^2 + 30x - 3$ by $2x^2 + 7x - 1$, gives the quotient—

- (A) $5x^2 - 9x - 3$ (B) $5x^2 - 9x + 3$
(C) $5x^2 + 9x + 3$ (D) $5x^2 + 9x - 3$

47. The equation representing the y axis is—

- (A) $x = 0$ (B) $y = 0$
(C) $x = a$ (D) $y = a$

48. One card is drawn from a well-shuffled deck of 52 cards. Calculate the probability that the card will be an ace—

- (A) $\frac{1}{13}$ (B) $\frac{12}{13}$
(C) $\frac{1}{4}$ (D) $\frac{3}{4}$

49. The ratio of radii of two cylinders is 2 : 3 and the ratio of their height is 5 : 3. The ratio of their volumes will be—

- (A) 27 : 20 (B) 20 : 27
(C) 9 : 4 (D) 4 : 9

50. The base of a triangle is four times its height and its area is 50 square meter. The length of the base is—

- (A) 5 m (B) 10 m
(C) 15 m (D) 20 m

SECTION B ENGLISH

Direction (Q. No. 51 to 55)

Read the passage carefully and choose the best answer to each question out of the four alternatives.

Passage

Chameleons can make their skin colour change, but not because they decide to. The colour changes to help the chameleon avoid its enemies. It is a form of camouflage, a disguise that lets it blend in with its surroundings. The changes are actually determined by environmental factors, such as light and temperature.

Bright sunlight causes the skin to get darken. On cool nights, the colour fades to a creamy colour. The colour also changes when chameleons are excited, angry or afraid. The colour change is rapid and increases when the chameleon is handled, injured, or approached by another chameleon. There are many types of chameleons. Almost half of them are found on the African Island of Madagascar. The others mostly occur in the Sahara desert, with few in Western Asia and Southern Europe. Chameleons live in trees; where they usually

eat insects. Very large chameleons may even use their sticky tongues to catch birds.

51. A chameleon's colour changes to help it—
 (A) fly away
 (B) look beautiful
 (C) avoid its enemies
 (D) attract prey
52. Chameleons change colour when they are—
 (A) excited, angry or hungry
 (B) afraid, excited or angry
 (C) angry, excited or happy
 (D) afraid, angry or hungry
53. The colour changing ability of a chameleon is a form of camouflage which is a—
 (A) colour that fades
 (B) disguise that lets it blend in with its surroundings
 (C) dance done by chameleons
 (D) disease which affects chameleons
54. The colour changes are determined by—
 (A) light and wind
 (B) light and pressure
 (C) light and temperature
 (D) pressure and temperature
55. Half of the world's chameleons are found—
 (A) on the Asian Island of Madagascar
 (B) in the Sahara Desert
 (C) on the African Island of Madagascar
 (D) in the continent of Asia
56. She didn't remember and neither did I. Here 'neither' in the sentence is used as :
 (A) Noun (B) Adjective
 (C) Adverb (D) Conjunction
57. Select from the four options, the correct reported speech of the following direct speech :
 She asked me, "how much did you pay for this bag ?"
 (A) She asked me how much I had paid for that bag.
 (B) She asked me how much I did pay for that bag.
 (C) She asked me how much I have paid for that bag.
 (D) She asked me how much I paid for that bag.
58. Fill in the blank in the sentence given below from the four alternatives.
 She is married Ravi.
 (A) with (B) to
 (C) in (D) from
59. How many syllable (s) is/are there in the word rhythmic ?
 (A) Three (B) Two
 (C) One (D) Four
60. A person who lives alone and like to avoid other people is called :
 (A) Narcissist (B) Introvert
 (C) Veteran (D) Recluse
61. Which of the following is the correct passive voice of the following sentence ?
 They believe that Mr. Mohan is very rich.
 (A) Mr. Mohan was believed to be very rich.
 (B) Mr. Mohan has been believed to be very rich.
 (C) Mr. Mohan was believed as very rich.
 (D) Mr. Mohan is believed to be very rich.
62. Select the option that is nearest in meaning to the underlined phrasal verb in the sentence given below :
 How had he managed to run up so many debts ?
 (A) Accumulate (B) Dissipate
 (C) Dissolve (D) Divide
63. Select the option that best expresses the meaning of the underlined word in the sentence given below :
 He became even more resolute in his opposition to the plan.
 (A) Indefinite (B) Determined
 (C) Flexible (D) Afraid
64. Select the option that best expresses the opposite meaning of the underlined word in the sentence given below :
 She couldn't disguise her glee at their embarrassment.
 (A) Delight (B) Gloom
 (C) Euphoria (D) Mirth
65. Which of the following sentence is incorrect ?
 (A) Three and three is six
 (B) We shouldn't blame ourselves for what happened.
 (C) No sooner had she said it then she burst into tears.
 (D) I neither knew nor cared what had happened to him.
66. The word Thrift' means :
 (A) Wickedness (B) Miserliness
 (C) Economy (D) Extravagance

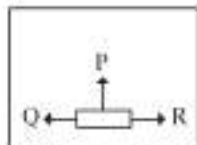
67. Antonym of the word 'Parsimonious' is :

- (A) Generous (B) Frugal
 (C) Crude (D) Stingy
68. A person who does not believe in any religion, is called :
 (A) Philatelist (B) Rationalist
 (C) Atheist (D) Pagan
69. One who despises persons of lower social position, is called :
 (A) Prim (B) Snob
 (C) Prig (D) Aristocrat
70. Choose the mis-spelt word :
 (A) Deficient (B) Efficient
 (C) Magnificent (D) Reticent
71. Choose the one which best expresses the meaning of the phrase, 'Above board' :
 (A) Decent (B) Friendly
 (C) Open (D) Simple
72. The phrase 'French Leave' is generally used to denote :
 (A) Long absence
 (B) Leave on the pretext of illness
 (C) Casual leave
 (D) Absence without permission
73. Choose the appropriate preposition in the sentence given below :
 Please write me this address
 (A) to (B) at
 (C) on (D) upon
74. The place where aircrafts are kept is called :
 (A) Hanger (B) Runway
 (C) Airstrip (D) Hangar
75. Choose the correctly spelt word :
 (A) Enterpreneur (B) Entrepreneur
 (C) Entreprenuer (D) Enteruepencur

SECTION C GENERAL SCIENCE

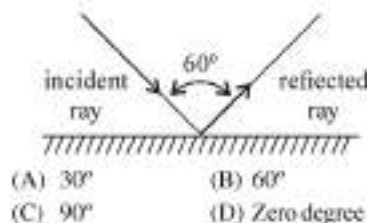
76. Faulty function of an endocrine gland can make a person very short or very tall. This gland is :
 (A) thyroid (B) Pituitary
 (C) Adrenal (D) Pancreas
77. Which one of the following statements about alkali metals is correct ?
 (A) Lithium is the most powerful reducing agent
 (B) Sodium is the least powerful reducing agent
 (C) Both (A) and (B)
 (D) None of the above

78. Only present in plant cells :
 (A) Cell membrane (B) Cell wall
 (C) Mitochondria (D) Nucleus
79. Causes of ringworm in humans are :
 (A) Bacteria (B) Fungi
 (C) Nematodes (D) Virus
80. What is the general trend for atomic radii of alkali metals as we move down the group ?
 (A) It increases
 (B) It decreases
 (C) It remains constant
 (D) None of the above
81. Curcuma Longa is the source of :
 (A) Ginger (B) Clove
 (C) Red chilli (D) Turmeric
82. Which one of the metals is most reactive out of the given options ?
 (A) Potassium (B) Sodium
 (C) Calcium (D) Magnesium
83. The method of heating of water is :
 (A) Radiation (B) Convection
 (C) Conduction (D) None of these
84. The force exerted on the unit area is called :
 (A) acceleration (B) momentum
 (C) mass (D) pressure
85. As shown in the figure, if three persons P, Q and R draw an object with equal force, then the direction of motion of the object will be :



- (A) Left in horizontal direction
 (B) Right in horizontal direction
 (C) Upward in vertical direction
 (D) Object will remain constant
86. Whose unit is 'hertz' ?
 (A) frequency (B) dimension
 (C) time period (D) speed
87. The force of attraction between molecules of different substances is called :
 (A) Cohesive force
 (B) Adhesive force
 (C) Gravitational force
 (D) Electromagnetic force
88. Electroscope is a device :
 (A) To check the heartbeat
 (B) To check blood pressure
 (C) To find the electric charge
 (D) To test the electron

89. The heat used to convert ice into water is called :
 (A) Specific heat
 (B) Secret heat of evaporation
 (C) Latent heat of melting
 (D) None of these
90. Which of the following is not a compound ?
 (A) Caustic soda (B) Alum
 (C) Silica (D) Graphite
91. Which one of the following metals is the major constituent of Pewter alloy ?
 (A) Tin (B) Indium
 (C) Titanium (D) Lead
92. Which of these metals is commonly used in tanning of leather ?
 (A) Phosphorous (B) Iodine
 (C) Manganese (D) Chromium
93. Which metal is used in the Galvanization process ?
 (A) Tin (B) Lead
 (C) Zinc (D) Copper
94. Which of the following elements is not a component of stainless steel ?
 (A) Iron (B) Carbon
 (C) Zinc (D) Chromium
95. Rutherford's alpha particle dispersion experiment eventually led to the conclusion that :
 (A) Mass and energy are related
 (B) The position of electrons around the nucleus is
 (C) Neutrons are buried deep inside the nucleus
 (D) The point of reflection can be accurately determined by the substance
96. Loudness of sound depends on :
 (A) Its amplitude (B) Frequency
 (C) Wavelength (D) None of these
97. In the figure shown, angle of incidence is :



- (A) 30° (B) 60°
 (C) 90° (D) Zero degree
98. Porters place on their heads round piece of cloth because :
 (A) Pressure on their head is increased by doing so
 (B) Pressure on their head is reduced by doing so

- (C) The decrease the area of contact of the load with their head
 (D) None of the above

99. Which one of these metals comes into use in the treatment of bipolar disorders ?
 (A) Carbon (B) Lithium
 (C) Nickel (D) Cobalt
100. Which one of these non-metals is liquid at room temperature ?
 (A) Helium (B) Argon
 (C) Bromine (D) Sulphur

SECTION D SOCIAL STUDIES

101. Under which article of Indian constitution comes 'right to life' ?
 (A) Article 14 (B) Article 15
 (C) Article 20 (D) Article 21
102. Freedom, equality and brotherhood are related to :
 (A) From the Revolution of Russia
 (B) China Revolution
 (C) Iran's Revolution
 (D) French Revolution
103. Who is called the father of Green Revolution in India ?
 (A) M.S. Swaminathan
 (B) Varghese Kurien
 (C) C. N. R. Rao
 (D) A. P. J. Abdul Kalam
104. How many schedules are there in Indian constitution ?
 (A) 9 (B) 10
 (C) 11 (D) 12
105. Which of the following is not a constitutional body ?
 (A) Finance Commission
 (B) Law Commission
 (C) Election Commission
 (D) NITI Ayog
106. In which year the Monarchy came to an end in Nepal ?
 (A) 2006 (B) 2007
 (C) 2008 (D) 2009
107. Who is the Ex-officio Chairman of Rajya Sabha ?
 (A) Prime Minister
 (B) Vice President
 (C) President
 (D) None of the above

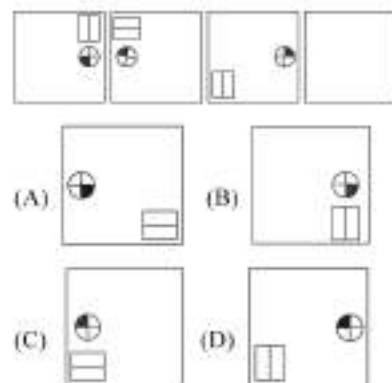
108. Who founded the first Women University in India ?
 (A) D.K. Kurve
 (B) Atmaram Pandurang
 (C) Swami Vivekanand
 (D) Raja Ram Mohan Roy
109. The Slogan "Inquilab Zindabad" was coined by :
 (A) Molana Azad
 (B) Hasrat Mohani
 (C) Mohd. Ali Jinnah
 (D) Bhagat Singh
110. Which of the following books is related to Jainism ?
 (A) Sutta Pitaka
 (B) Bhagwati Sutra
 (C) Abhidhamma Pitaka
 (D) Vinay Pitaka
111. In which mandal of Rigveda is 'Gayatri Mantra' written ?
 (A) First (B) Second
 (C) Third (D) Fourth
112. In which year Santhal Rebellion took place ?
 (A) 1655 (B) 1755
 (C) 1855 (D) 1955
113. When was the 'Direct Action Day' called ?
 (A) August 16, 1946
 (B) August 16, 1947
 (C) August 16, 1948
 (D) 16 August, 1949
114. The thinnest layer of the Earth is :
 (A) Crust (B) Mantle
 (C) Core (D) Atmosphere
115. Indian group of Islands located in the Arabian Sea :
 (A) Java
 (B) Maldives
 (C) Andaman and Nicobar
 (D) Lakshadweep
116. India's Standard Timeline is :
 (A) 84° 5' E. (B) 84° 5' E.
 (C) 82° 30' E. (D) 82° 30' E.
117. The situation of maximum distance between the earth and the sun is called ?
 (A) Perihelion (B) Aphelion
 (C) Equinox (D) Operations
118. Red Data Book is published by ?
 (A) United Nations Environment Programme
 (B) World Wildlife Fund
 (C) World Environment Facility

- (D) International Union for the Conservation of Nature and Natural Resources
119. Which one among the following fertilizers is least likely to affect the soil pH ?
 (A) Urea
 (B) Rock Phosphate
 (C) Ammonia
 (D) Muriate of Potash
120. Indian standard time is ahead of GMT by :
 (A) 4 hrs 30 min. (B) 14 hrs. 10 min.
 (C) 5 hrs. 30 min. (D) 4 hrs. 50 min.
121. Where is Jim Corbett Wild Life Sanctuary located ?
 (A) Odisha (B) Goa
 (C) Meghalaya (D) Uttarakhand
122. Bhakra dam is on which river ?
 (A) Jhelum (B) Sutlej
 (C) Ravi (D) Chenab
123. Who is called the magician of Hockey ?
 (A) Dhyan Chand (B) Milkha Singh
 (C) Bishan Singh (D) Kapil Dev
124. When was East India Company established ?
 (A) 1664 (B) 1600
 (C) 1560 (D) 1700
125. Which game is Japan's National Game ?
 (A) Shooting (B) Judo
 (C) Football (D) Basketball

SECTION E INTELLIGENCE ILLUSTRATION

126. Each one of the following options consists of pairs of words. Choose the best pair to match with the pair in the question.
 Contractor : Building
 (A) Cow : Stable (B) Lawyer : Books
 (C) Potter : Paint (D) Cobbler : Shoe
127. Select the alternative that is related to the third term in the same way as the second term is related to the first term.
 MAGIC : NCJMH :: WITCH : ?
 (A) XKWGM (B) XXGN
 (C) YKWGN (D) YKWGM
128. Find the missing number.
 11, 14, 19, 26, 35, ?
 (A) 44 (B) 46
 (C) 48 (D) 50
129. Fill the missing value in this series.
 IBDF, H3JL, NP5R, ?
 (A) SVX7 (B) SVY9
 (C) TVX7 (D) TVY9

130. A left home and cycled 10 km towards north, then turned right and cycled 5 km and then again turned right and cycled 10 km. After this he turned left and cycled 10 km. How many kilometers and in which direction will he have to cycle to reach his home straight ?
 (A) 10 km east (B) 15 km west
 (C) 5 km east (D) 5 km west
131. At 9 pm, the hour hand faces north, Which direction will the minute hand face at 6:30 am ?
 (A) North (B) East
 (C) West (D) South
132. Which of the following words has its letters in alphabetical order ?
 (A) Believe (B) Cease
 (C) Beely (D) Aerious
133. Which of the words CANNOT be formed by the letters of the word "NIGHTINGALE" ?
 (A) Light (B) Thing
 (C) Angle (D) Eagle
134. Select the option that is related to the third word in the same way as the second word is related to the first word.
 Dozen : Twelve :: Score : ?
 (A) Twenty (B) Fifty
 (C) Twenty five (D) Ten
135. Which of the following answer figure patterns can complete the series given in the question figure ?

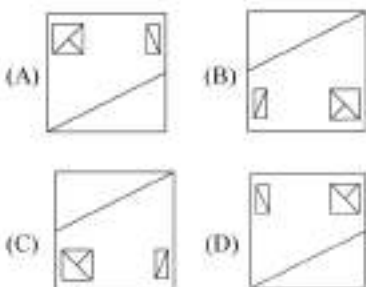


136. What is the minimum number of lines required to make the given image ?



- (A) 12 (B) 13
 (C) 14 (D) 15

137. If a mirror is placed on the line MN, then which of the answer figures is the correct image of the given figure?



138. Arrange the following words as per their order in an English dictionary and choose the one that comes first.

pocket; podium; plutonic; poacher

- (A) plutonic (B) pocket
(C) podium (D) poacher

139. If the 3rd day of a month is Monday, which of the following would be the 4th day before the 21st day of that month?

- (A) Monday (B) Tuesday
(C) Sunday (D) Wednesday

140. A series is given, with one term missing. Choose the correct alternative from the given ones that will complete the series.
Y9Q0, U6P1, R4R1, P302, ?

- (A) P2S3 (B) O3S2
(C) O3R2 (D) P2R2

141. In a code language 319 means 'ice is cold', 431 means 'winter is cold', 249 means 'ice in winter'. Find the code for 'in'.

- (A) 9 (B) 4
(C) 1 (D) 2

142. In a certain code, PLUS is written as 6275 and ATOM is written as 4813. How is PALM written in that code?

- (A) 6423 (B) 8817
(C) 3548 (D) 5708

143. '+' represents '×', '-' represents '+', '×' represents '+' and '+' represents '-'. Find the answer to the following question.

$$4 + 2 - 9 \times 3 + 6 = ?$$

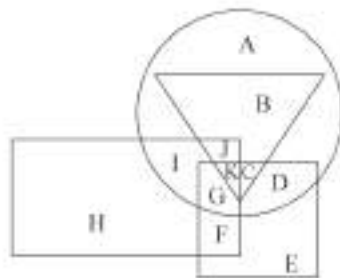
- (A) 5 (B) 29
(C) 7 (D) 17

144. A said to B, "You are my wife's son-in-law's daughter." How is B related to A?

- (A) B is the granddaughter of A
(B) B is the grand-mother of A

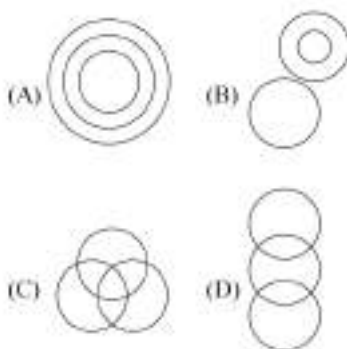
- (C) B is the mother of A
(D) B is the daughter of A

145. In the following figure, the square represents painters, the triangle represents men, the circle represents accountants and the rectangle represents Americans. Which set of letters represents Americans who are NOT men?



- (A) CDE (B) AIGD
(C) JBKC (D) HIGF

146. Which of the following Venn diagrams best represents the relationship between fathers, women and doctors?



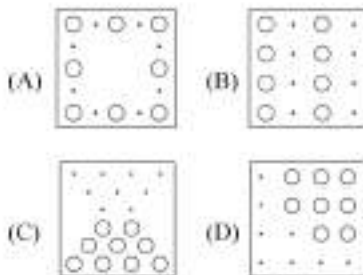
147. Which word does NOT match with the others?

- (A) Pencil (B) Paper
(C) Pen (D) Crayon

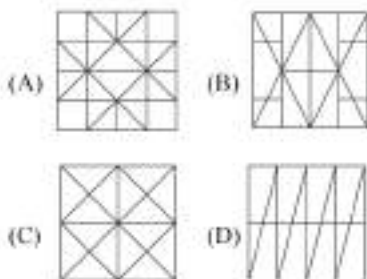
148. Find the odd letters cluster from the given options:

- (A) ECA (B) QOM
(C) GIK (D) VTR

149. Choose the figure which is different from the rest.



150. From the given answer figures, select the one in which the question figure is hidden/embedded.



Solutions

1. (C) Let,

No. of Pens = X and pencils = Y

$$37X + 53Y = 320 \quad \dots(1)$$

$$53X + 37Y = 400 \quad \dots(2)$$

On Adding

$$90X + 90Y = 720$$

$$\Rightarrow X + Y = 8 \quad \dots(3)$$

On subtraction eg. (1) from eq. (2),

$$16X - 16Y = 80$$

$$\Rightarrow X - Y = 5 \quad \dots(4)$$

On adding eq. (3) & eq. (4)

$$2X = 13$$

$$\therefore \text{C.P. of 2 pens} = ₹ 13$$

2. (B) Let, 2-digit number = $10x + y$

I Condition,

$$10x + y + x + 10y = 110$$

$$11x + 11y = 110$$

$$x + y = 10 \quad \dots(1)$$

II Condition,

$$10x + y - 10 = 5(x + y) + 4$$

$$10x + y - 10 = 5x + 5y + 4$$

$$5x - 4y = 14 \quad \dots(2)$$

On adding eq. (1) $\times 4$ + eq (2)

$$4x + 4y = 40$$

$$5x - 4y = 14$$

$$9x = 54$$

$$\Rightarrow x = \frac{54}{9} = 6$$

$$\therefore y = 10 - x = 10 - 6 = 4$$

\therefore Required number

$$= 10x + y$$

$$= 60 + 4 = 64$$

3. (A) Let, numerator = x ;
denominator = y
According to question,
$$y = 2x + 4 \quad \dots(1)$$
and $y - 6 = 12(x - 6)$
$$y = 12x - 66 \quad \dots(2)$$
from eq. (1) & (2),
$$12x - 66 = 2x + 4$$
$$10x = 70 \text{ or } x = 7$$
put the value of x in eq. (1)
$$y = 2 \times 7 + 4 = 18$$

$$\therefore \text{fraction} = \frac{7}{18}$$

4. (A) Let, Present age of father = x years
present age of son = y years
According to question,
Before 10 years
$$x - 10 = 12(y - 10) \quad \dots(1)$$
After 10 years
$$x + 10 = 2(y + 10) \quad \dots(2)$$
Subtract eq. (1) from eq. (2),
$$10y = 120 \text{ or } y = 12 \text{ years}$$
$$\therefore x = 12y - 110$$
$$x = 144 - 110 = 34 \text{ years}$$

5. (A) Let, boat's speed = x km/h
Current's speed = y km/h
So boat's upstream speed
$$= (x - y) \text{ km/h}$$
and boat's downstream speed
$$= (x + y) \text{ km/h}$$
According to question,

$$\frac{36}{x+y} - \frac{32}{x-y} = 7 \quad \dots(1)$$

and $\frac{48}{x+y} - \frac{40}{x-y} = 9 \quad \dots(2)$

Let, $\frac{1}{x+y} = a$ and $\frac{1}{x-y} = b$

$$\therefore 36a - 32b = 7 \quad \dots(3)$$

$$48a - 40b = 9 \quad \dots(4)$$

on solving eq. (3) & eq. (4)

$$a = \frac{1}{12} \text{ and } b = -\frac{1}{8}$$

Put the value of a and b

$$x + y = 12 \quad \dots(5)$$

$$x - y = -8 \quad \dots(6)$$

on adding eq. (5) & eq. (6)

$$2x = 4 \text{ or } x = 2 \text{ Km/h}$$

6. (D) Let, original price of Tea-set = ₹ x
original price of Lemon-set = ₹ y
According to question,

$$\frac{15}{100}y - \frac{5}{100}x = 7$$

$$\Rightarrow 15y - 5x = 700$$

$$\Rightarrow 3y - x = 140 \quad \dots(1)$$

and $\frac{5}{100}x + \frac{10}{100}y = 13$

$$\Rightarrow 5x + 10y = 1300$$

$$\Rightarrow x + 2y = 260 \quad \dots(2)$$

On adding eq. (1) & eq. (2)

$$5y = 400 \text{ or } y = 80$$

$$\therefore x = 260 - 2y$$

$$= 260 - 2 \times 80$$

$$= 260 - 160 = ₹ 100$$

7. (B) Circumference of Semi-circle = 66 cm

$$\pi r = 66$$

$$r = \frac{66 \times 7}{22} \text{ (where } \pi = \frac{22}{7} \text{)}$$

$$r = 21 \text{ cm}$$

$$\therefore \text{Diameter} = 2r = 42 \text{ cm}$$

8. (C) Inner circumference of track = 352 m

$$2\pi r_1 = 352$$

$$r_1 = \frac{352 \times 7}{2 \times 22}$$

$$r_1 = 56 \text{ m}$$

Outer circumference of track = 396 m

$$2\pi r_2 = 396$$

$$r_2 = \frac{396 \times 7}{2 \times 22}$$

$$r_2 = 63 \text{ m}$$

$$\therefore \text{width of the track} = r_2 - r_1$$

$$= 63 - 56 = 7 \text{ m}$$

9. (C) Diameter = 84 cm

$$\Rightarrow \text{Radius } (r) = 42 \text{ cm}$$

from formula,

$$a \times 2\pi r = 792 \times 100$$

$$a = \frac{792 \times 100}{2\pi r}$$

$$= \frac{792 \times 7 \times 100}{2 \times 42 \times 22} = 300$$

10. (A) Area covered by minute hand in 1 min

$$= \frac{\pi r^2}{60}$$

$$= \frac{22 \times 14 \times 14}{7 \times 60}$$

$$= 10.26 \text{ cm}^2$$

11. (A) Volume of new cube

$$= (3)^3 + (4)^3 + (5)^3$$

$$= 27 + 64 + 125$$

$$= 216 \text{ cm}^3$$

$$\therefore \text{Length of side} = \sqrt[3]{216}$$

$$= 6 \text{ cm}$$

12. (B) Volume of cube = $100 \times 80 \times 64$
$$= 512000 \text{ cm}^3$$

(\because volume of cube = Volume of cuboid)

$$\therefore \text{Side of cube} = \sqrt[3]{\text{Volume}}$$

$$= \sqrt[3]{512000}$$

$$= 80 \text{ cm}$$

$$\therefore \text{Total surface area of cube}$$

$$= 6 \times (\text{Side})^2$$

$$= 6 \times 80 \times 80$$

$$= 38400 \text{ cm}^2$$

13. (C) $4^x - 4^{x-1} = 24$

$$\Rightarrow 4^x - \frac{4^x}{4} = 24$$

$$\Rightarrow 4^x \left(1 - \frac{1}{4}\right) = 24$$

$$\Rightarrow 4^x \times \frac{3}{4} = 24$$

$$\Rightarrow 4^{x-1} = 8$$

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

\therefore bases are same so powers will be equal

$$\Rightarrow 2(x-1) = 3$$

$$\Rightarrow 2x = 5$$

14. (B) $(343)^{-2/3} = (7)^{3 \times \frac{-2}{3}}$
$$= (7)^{-2} = \frac{1}{(7)^2} = \frac{1}{49}$$

15. (C) $x + \frac{1}{x} = 6$

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

$$= (6)^2 - 2 = 36 - 2 = 34$$

$$\therefore x^4 + \frac{1}{x^4} = \left(x^2 + \frac{1}{x^2}\right)^2 - 2$$

$$= (34)^2 - 2 = 1154$$

16. (C) $a + b = 10$; $a^2 + b^2 = 58$

from, $2ab = (a + b)^2 - (a^2 + b^2)$

$$2ab = (10)^2 - 58$$

$$2ab = 100 - 58 = 42$$

$$ab = 21$$

from $a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$

$$a^3 + b^3 = 10 \times (58 - 21)$$

$$a^3 + b^3 = 10 \times 37 = 370$$

$$\begin{aligned}
 17. (B) \quad a + b + c &= 15; a^2 + b^2 + c^2 = 83 \\
 \text{from, } 2(ab + bc + ca) &= (a + b + c)^2 \\
 &\quad - (a^2 + b^2 + c^2) \\
 2(ab + bc + ca) &= (15)^2 - 83 \\
 2(ab + bc + ca) &= 142 \\
 ab + bc + ca &= 71 \\
 \therefore a^3 + b^3 + c^3 - 3abc \\
 &= (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca) \\
 &= 15 \times (83 - 71) \\
 &= 15 \times 12 \\
 &= 180
 \end{aligned}$$

$$\begin{array}{r}
 18. (A) \quad x^2 + 1 \overline{) \begin{array}{r} x^2 + x + 7 \\ x^4 + x^3 + 8x^2 + ax + b \\ \hline x^3 + 7x^2 + ax + b \\ x^3 + x \\ \hline 7x^2 + (a-1)x + b \\ 7x^2 + 7 \\ \hline (a-1)x + (b-7) \end{array}} \\
 \hline
 \end{array}$$

∴ The dividend is completely divisible by divisor, so the remainder will be zero
Compare $(a-1)x + (b-7)$ with $0x + 0$
 $a-1=0 \Rightarrow a=1$
 $b-7=0 \Rightarrow b=7$

$$\begin{aligned}
 19. (C) \quad \frac{x+b}{a-b} &= \frac{x-b}{a+b} \\
 \Rightarrow (x+b)(a+b) &= (x-b)(a-b) \\
 \Rightarrow xa + xb + ab + b^2 &= xa - xb - ab + b^2 \\
 \Rightarrow xb + ab &= -xb - ab \\
 \Rightarrow 2xb &= -2ab \\
 \Rightarrow x &= \frac{-2ab}{2b} = -a
 \end{aligned}$$

20. (C) On the graph line $x = -2$ the following point doesn't exist = $(1, -2)$

$$21. (A) \quad -\frac{11}{28} = -0.39; -\frac{5}{7} = -0.71$$

$$-\frac{9}{14} = -0.64; -\frac{29}{24} = -1.21$$

∴ We know that the smallest negative number is the largest.
∴ -0.39 will be the largest.

Hence, $-\frac{11}{28}$ is the largest rational number.

22. (C) Let, Rahul's present age is $5x$ years and Ravi's present age is $7x$ years.
According to question,
 $(5x+4) + (7x+4) = 56$

$$12x + 8 = 56$$

$$12x = 48$$

$$x = 4$$

∴ Ravi's present age = $7x = 28$ years

23. (A) ∴ Sum of corresponding angles of a parallelogram is 180° . So,

$$\therefore 2x + 25 + 3x - 5 = 180^\circ$$

$$5x + 20 = 180^\circ$$

$$5x = 160^\circ$$

$$x = 32^\circ$$

24. (A) Let, M.P. = ₹ 100

$$\therefore \text{S.P.} = 100 - 5 = ₹ 95$$

$$\begin{aligned}
 \therefore \text{C.P.} &= \frac{100 \times 100}{120} \\
 &= ₹ \frac{250}{3}
 \end{aligned}$$

$$\begin{aligned}
 \therefore \text{Profit} &= 95 - \frac{250}{3} \\
 &= ₹ \frac{35}{3}
 \end{aligned}$$

$$\begin{aligned}
 \therefore \text{Profit \%} &= \frac{35/3}{250/3} \times 100 \\
 &= \frac{35 \times 100}{250} \\
 &= 14\%
 \end{aligned}$$

$$\begin{aligned}
 25. (D) \quad 343 &= 7 \times 7 \times 7 = (7)^3 \\
 2197 &= 13 \times 13 \times 13 = (13)^3 \\
 2916 &= 2 \times 2 \times 729 \\
 2744 &= 14 \times 14 \times 14 = (14)^3
 \end{aligned}$$

Hence, 2916 is not a perfect cube.

26. (D) Let, the number = x

$$75\% \text{ of } x + 75 = x$$

$$x \times \frac{75}{100} + 75 = x$$

$$\frac{3x}{4} + 75 = x$$

$$\begin{aligned}
 3x + 300 &= 4x \\
 x &= 300
 \end{aligned}$$

27. (B) S.P. = ₹ 10.80

Loss = 10%

$$\text{C.P.} = 10.80 \times \frac{100}{90}$$

$$\text{C.P.} = ₹ 12$$

∴ Profit = 20%

$$\begin{aligned}
 \therefore \text{New S.P.} &= 12 \times \frac{120}{100} \\
 &= ₹ 14.40
 \end{aligned}$$

28. (A) If the interest is compounded half-yearly, then the time becomes double

and the rate of interest becomes half.
So,

$$\begin{aligned}
 \text{Time} &= 2n, r = \frac{5}{2}\%, A = 68921, \\
 P &= 64000
 \end{aligned}$$

$$\text{Formula, } A = P \left(1 + \frac{r}{100}\right)^{2n}$$

$$\frac{68921}{64000} = \left(1 + \frac{5}{200}\right)^{2n}$$

$$\left(\frac{41}{40}\right)^3 = \left(\frac{41}{40}\right)^{2n}$$

$$\Rightarrow 2n = 3 \text{ or } n = \frac{3}{2} \text{ or } 1\frac{1}{2} \text{ years}$$

$$29. (B) \quad x + \frac{1}{x} = 3 \quad (\text{given})$$

$$\begin{aligned}
 x^2 + \frac{1}{x^2} &= \left(x + \frac{1}{x}\right)^2 - 2 \\
 &= (3)^2 - 2 \\
 &= 9 - 2 = 7
 \end{aligned}$$

30. (D) $(2a-b)^2 + 2(2a-b) - 8$

$$\text{Let, } 2a-b = m$$

$$\begin{aligned}
 \therefore m^2 + 2m - 8 \\
 &= m^2 + 4m - 2m - 8 \\
 &= m(m+4) - 2(m+4) \\
 &= (m+4)(m-2) \\
 \text{Put the value of } m, \\
 &= (2a-b+4)(2a-b-2)
 \end{aligned}$$

31. (B) ∴ Cost of painting the area of 1 sq cm = 13 paise

∴ Total surface area painted for ₹ 343.98

$$= \frac{343.98}{0.13}$$

$$= 2646 \text{ sq cm}$$

∴ Total Surface Area of cube = 2646

$$6a^2 = 2646$$

$$a^2 = 441$$

$$a = \sqrt{441} = 21 \text{ cm}$$

$$\begin{aligned}
 \therefore \text{Volume of the cube} &= (a)^3 \\
 &= (21)^3 \\
 &= 9261 \text{ cm}^3
 \end{aligned}$$

32. (C) Let, Breadth = x m

and Length = $(x+23)$ m

∴ Perimeter of the rectangle =

$$2(L+B)$$

$$206 = 2(x+23+x)$$

$$103 = 2x+23$$

$$80 = 2x \text{ or } x = 40$$

$$\begin{aligned}\therefore \text{Area of rectangle} &= x(x+23) \\ &= 40 \times 63 \\ &= 2520 \text{ sq m}\end{aligned}$$

$$\begin{aligned}33. \text{ (A) } \therefore 1 \text{ day work of 550 people} \\ &= \frac{1}{100} \text{ part}\end{aligned}$$

$$\therefore 10 \text{ days work of 550 people}$$

$$= \frac{10}{100} \text{ or } \frac{1}{10} \text{ part}$$

$$\therefore \text{Remaining work} = 1 - \frac{1}{10} = \frac{9}{10} \text{ part}$$

$$\therefore 50 \text{ more people join them.}$$

$$\therefore 1 \text{ day work of 600 people}$$

$$\begin{aligned}&= \frac{1}{100} \times \frac{600}{550} \\ &= \frac{6}{550}\end{aligned}$$

$$\therefore 600 \text{ people finish the remaining work}$$

$$\text{up} = \frac{9}{10} \times \frac{550}{6} \text{ days}$$

$$= \frac{165}{2} \text{ days or } 82\frac{1}{2} \text{ days}$$

$$34. \text{ (A) } \therefore \text{Two dice are thrown simultaneously.}$$

$$\begin{aligned}\therefore \text{Total favourable out comes} &= \{(2, 3) \\ &\quad (2, 6) (4, 3) (4, 6), (6, 3) (6, 6)\} \\ &= 6 \text{ out comes}\end{aligned}$$

$$\text{Total out comes} = 36$$

$$\text{Total favorable events} = 5$$

$$\begin{aligned}\therefore \text{Required probability} &= \frac{6}{36} \\ &= \frac{1}{6}\end{aligned}$$

$$35. \text{ (D) } 7A = 5B = 2C$$

$$\frac{7A}{70} = \frac{5B}{70} = \frac{2C}{70}$$

$$(\text{LCM of 7, 5 and 2} = 70)$$

$$\frac{A}{10} = \frac{B}{14} = \frac{C}{35}$$

$$\therefore A : B : C = 10 : 14 : 35$$

$$36. \text{ (D) } p(p^2 + 3p + 3) = p(p^2 + 2p + 1 + p + 2)$$

$$= p[(p+1)^2 + (p+2)]$$

$$\text{Put the value of } p,$$

$$= 99 [(100)^2 + 101]$$

$$= 99 [10000 + 101]$$

$$= 99 \times 10101 = 999999$$

$$37. \text{ (D) Let, Shyam got the marks} = x$$

$$\text{Ram got the marks} = x + 24$$

$$\text{According to question,}$$

$$x + 24 = 65\% \text{ of } (x + x + 24)$$

$$x + 24 = (2x + 24) \times \frac{65}{100}$$

$$100x + 2400 = 130x + 1560$$

$$30x = 840 \Rightarrow x = 28$$

$$\therefore \text{Their marks} = 52 \text{ and } 28$$

$$38. \text{ (A) Each interior angle} = 135^\circ$$

$$\frac{(n-2)180^\circ}{n} = 135^\circ$$

$$(n-2)4 = 3n$$

$$4n - 3n = 8$$

$$n = 8$$

$$39. \text{ (A) } 50\% \text{ of } (x-y) = 30\% \text{ of } (x+y)$$

$$(x-y) \times \frac{50}{100} = (x+y) \times \frac{30}{100}$$

$$\frac{x+y}{x-y} = \frac{50}{30} = \frac{5}{3}$$

$$\text{By Componendo and Dividendo rule,}$$

$$\frac{x}{y} = \frac{5+3}{5-3} = \frac{8}{2} = \frac{4}{1}$$

$$x = 4y \Rightarrow \frac{x}{4} = y$$

$$25\% \text{ of } x = y$$

$$40. \text{ (D) Discarded number}$$

$$= 10 \times 55 - 9 \times 50$$

$$= 550 - 450$$

$$= 100$$

$$41. \text{ (B) Let, boat's speed} = x \text{ km/h}$$

$$\text{Upstream,}$$

$$\text{Relative Speed} = (x-3) \text{ km/h}$$

$$\text{Time} = 6 \text{ hours}$$

$$\text{Distance} = \text{Speed} \times \text{Time}$$

$$d_1 = (x-3) \times 6 \quad \dots(1)$$

$$\text{Downstream,}$$

$$\text{Relative Speed} = (x+3) \text{ km/h}$$

$$\text{Time} = 4 \text{ hours}$$

$$\text{Distance} = \text{Speed} \times \text{Time}$$

$$d_2 = (x+3) \times 4 \quad \dots(2)$$

$$\therefore d_1 = d_2$$

$$(\text{given})$$

$$6(x-3) = 4(x+3)$$

$$6x - 18 = 4x + 12$$

$$2x = 30$$

$$\text{or } x = 15 \text{ km/h}$$

$$\therefore \text{required distance}$$

$$= (x+3) \times 4$$

$$= 18 \times 4 = 72 \text{ km}$$

$$42. \text{ (D) According to question,}$$

$$\text{Width of road} = \text{length of roller}$$

$$= 1 \text{ m}$$

$$\text{Road length}$$

$$= \text{number of rounds} \times \text{circumference}$$

$$= 750 \times 2\pi r$$

$$= 1500 \times \frac{22}{7} \times \frac{42}{100}$$

$$= 1980 \text{ m}$$

$$\therefore \text{Area of the road} = \text{length} \times \text{width}$$

$$= 1980 \times 1$$

$$= 1980 \text{ m}^2$$

$$43. \text{ (B) } \frac{x+b}{a-b} = \frac{x-b}{a+b}$$

$$\Rightarrow \frac{x+b}{x-b} = \frac{a-b}{a+b}$$

$$\text{Using componendo \& Dividendo rule,}$$

$$\frac{x}{b} = \frac{a}{-b} \Rightarrow x = -a$$

$$44. \text{ (C) } \therefore 1000 \text{ L} = 1 \text{ m}^3$$

$$\therefore 60 \text{ L} = \frac{1}{1000} \times 60 = \frac{6}{100} \text{ m}^3$$

$$\text{According to question,}$$

$$\frac{6}{100} \text{ m}^3 \text{ is poured in } = 1 \text{ min}$$

$$108 \text{ m}^3 \text{ water will pour in}$$

$$= \frac{108 \times 100}{6}$$

$$= 1800 \text{ min}$$

$$= 30 \text{ hours}$$

$$45. \text{ (D) According to question,}$$

$$\text{sum of angles of Pentagon}$$

$$= (5-2) \times 180^\circ$$

$$x + x + 20^\circ + x + 40^\circ + x + 60^\circ + x + 80^\circ$$

$$= 540^\circ$$

$$5x + 200^\circ = 540^\circ$$

$$x = 68^\circ$$

$$\begin{array}{r} 46. \text{ (B) } 2x^2 + 7x - 1 \overline{) 10x^4 + 17x^3 - 62x^2 + 30x - 3} \\ \underline{10x^4 + 35x^3 - 5x^2} \\ -18x^3 - 57x^2 + 30x - 3 \\ \underline{-18x^3 - 63x^2 + 9x} \\ 6x^2 + 21x - 3 \\ \underline{6x^2 + 21x - 3} \\ 0 \end{array}$$

$$\therefore \text{Quotient} = (5x^2 - 9x + 3)$$

$$47. \text{ (A) } x = 0$$

$$48. \text{ (A) Probability} = \frac{4}{52} = \frac{1}{13}$$

$$49. \text{ (B) } r_1 : r_2 = 2 : 3 \text{ and } h_1 : h_2 = 5 : 3$$

$$\therefore v_1 : v_2 = \pi r_1^2 h_1 : \pi r_2^2 h_2$$

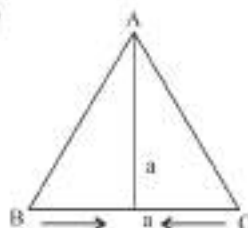
$$= r_1^2 h_1 : r_2^2 h_2$$

$$= \left(\frac{r_1}{r_2}\right)^2 \times \frac{h_1}{h_2}$$

$$= \frac{4}{9} \times \frac{5}{3}$$

$$= 20 : 27$$

50. (D)



$$\text{Area of } \Delta = \frac{1}{2} \times \text{base} \times \text{height}$$

$$50 = \frac{1}{2} \times 4a \times a$$

$$50 = 2a^2$$

$$25 = a^2 \text{ or } a = 5$$

$$\therefore \text{base} = 4a$$

$$= 20 \text{ m}$$

51. (C) 'avoid its enemies' is correct.
52. (A) Chameleons change colour when they are excited, angry or hungry.
53. (B) See the first para of the passage.
54. (C) The colour changes are determined by light and temperature.
55. (C) Almost half of them are found on the African island of Madagascar.
56. (C) 'neither' used as adverb.
57. (A) She asked me how much I had paid for that bug.
58. (B) 'to' is correct
59. (B) Two (Rhyth + mic)
60. (D) 'Recluse' is correct. 'Narcissist'—who think the world revolves around them 'Introvert' a shy, reticent person. 'veteran'—one who has had long experience in a particular field.
61. (D) Mr. Mohan is believed to be very rich.
62. (A) 'Accumulate' means acquire an increasing number or quantity. So option (A) is correct.
63. (B) 'Determined' is correct.
64. (B) Gloom (adj) is the opposite of the word 'glee' means-delight, pleasure i.e. great delight.
65. (C) No sooner takes than not then. so option (C) is correct.
66. (C) 'Economy' is correct.
67. (A) Generous (adj.) is the opposite of the word 'parsimonious' means 'economical/ frugal.
68. (C) 'Atheist' is correct. Philatelist means stamp collector. Rationalist means based on reason and Knowledge rather than on religious belief. 'Pagan' means-one who holding religious beliefs other than those of the main world religions.

69. (B) 'Snob' is correct. 'prim' means-stiffly formal and respectable; 'prig' means-one who behaves as if superior to other. 'Aristocrat' means-a person of high social rank.
70. (C) magnificent, is the mis-spelt word. Correct word-magnificent (adj.)-means- very good, excellent.
71. (C) Above board means legitimate, honest and open' so option (C) is correct.
72. (D) 'Absence without permission' is correct.
73. (B) 'at' is correct.
74. (D) 'Hangar' is correct. 'Hanger' means-one who hangs something. 'Runway' means 'a leveled strip of smooth ground along which aircraft take off and land; 'Airstrip' means 'a strip of ground set aside for the take off and landing of aircraft.
75. (A) Entrepreneur (n) means 'business-man' is correct spelling.
76. (B) Normal growth of the body is done by the pituitary gland. Its defective function can lead to dwarfism (too short) and gigantism (too long / big), while the thyroid gland is helpful in energy production in cell by oxidation. The adrenal gland regulates the actions related to sugar, salts and sexual development.
77. (C) Lithium is least reactive but the strongest reducing agent among all the alkali metals.
78. (B) Cell wall is present only in plant cell, while nucleus and cell membrane is the main part of the cell.
79. (B) Ringworm is a disease caused by fungi. While typhoid, cholera, diphtheria, etc. are bacterial diseases. Dengue, Chikungunya, measles, rubella etc. viruses borne and nematode is a plant disease.
80. (A) The atomic and ionic radii of alkali metals increase on moving down the group i.e., they increase in size while going from Li to Cs.
81. (D) Curcuma Longa is the botanical name of turmeric. While the botanical name of ginger is Zingiber Officinale. The botanical name of the clove is Syzygium Aromaticum. The botanical name of red chilli is Capsicum Annum.
82. (A) Out of the given options, Potassium is the most reactive metal. Potassium is placed above all the given metals in the reactivity series. The reactivity series is a list of metals arranged in the order of their decreasing activities.
83. (B) Convection is the method of heating of water. It is a method of heating liquid and gas while conduction is a method of heating solids and radiation is the method which does not require any medium such as solar radiation.
84. (D) The force exerted on the unit area is called pressure. The rate of change of velocity in an object is called acceleration. The product of mass and velocity is called the momentum of the object. Mass refers to the space enclosed by an object inside an object.
85. (C) Three persons P, Q and R draw an object towards them with equal force. In this case, the direction of motion of the object will be upward in vertical.
86. (A) Hertz is the unit of frequency. While the unit of dimension is meter, seconds of time, and unit of speed is meter/second.
87. (B) The force of attraction between different substances is called adhesive force while the force of attraction between molecules of the same substance is called cohesive force. Whereas the force of gravity is an attraction force that acts between any two matter, object or particles.
88. (C) Use of an electroscope or an electrometer is to find the electric charge. The heartbeat measuring instrument is called Cardiograph and the chymograph is a blood pressure measuring instrument.
89. (C) The heat used to convert ice into water is called latent heat of melting.
90. (D) All other than graphite are examples of compounds. A chemical combination of two or more elements in a certain proportion is called a compound.
91. (A) Tin is the major constituent of Pewter alloy. It is traditionally composed of 85–99% tin, mixed with copper, antimony, bismuth.
92. (D) Chromium (III) salts are used in the tanning of leather. Chromium is a steely-grey, lustrous, hard and brittle transition metal which is also used as an additive in stainless steel.
93. (C) Zinc is used in galvanisation process. Galvanization is the process of applying a protective zinc coating to steel or iron to prevent rusting.

94. (C) Stainless steel is a steel that is not affected by the atmosphere and organic and inorganic acids. Zinc is not an example of stainless steel. While all the above elements are its components.
95. (B) According to Rutherford, the positive charge in the atom is concentrated in a small part called the nucleus and the electrons rotate around the nucleus.
96. (A) The intensity of sound depends upon its amplitude. The more is the amplitude, the more will be its intensity.
97. (A) In the given image the value of incident angle will be 30 degree. The angle between the incident ray and the normal is known as the incident angle.
98. (B) The porters keep a round piece of cloth on their heads so that the contact area gets reduced resulting into lesser pressure.
99. (B) Lithium salts are used as a mood-stabilizing drug in the treatment of bipolar disorder in humans. Lithium is the lightest metal and the lightest solid element.
100. (C) Among all the non-metals, Bromine exists in the liquid state at room temperature. All the other non-metals are either solids or gases in nature.
101. (D) According to the Constitution of India the right to live/life comes under Article 21. Article 14 is related to the equality before the law, Article 15 prohibits discrimination on the basis of religion, race, caste, sex or place of birth. Article 20 is related to the right of freedom.
102. (D) The slogan of freedom, equality and fraternity is related to the French Revolution.
103. (A) Father of Green Revolution in India was Dr. M.S. Swaminathan while Varghese Kurien was related to the White Revolution. C.N.R. Rao is currently the head of the Scientific Advisory Council to the Prime Minister of India. Dr. A.P.J. Abdul Kalam was the former President of India and an eminent scientist.
104. (D) The Constitution of India has 395 Articles 22 parts and 12 Schedules. It is the highest law of India, which was passed on 26 November, 1949.
105. (D) NITI Aayog is not included in the list of constitutional bodies, while Finance Commission, Law Commission and Election Commission are included in the list of constitutional bodies.
106. (B) The monarchy came to an end with Nepal only after the interim constitution was enacted in 2007. The new constitution of Nepal came into force on 20 September, 2015.
107. (B) The Vice President is the ex-officio Chairman of Rajya Sabha.
108. (A) Dhondo Keshav Karve (D. K. Karve) founded India's first women's university SN TT Women's University in Mumbai.
109. (B) Hasrat Mohani, the poet of Urdu language, is the real originator of this slogan. This slogan was written by him in 1921.
110. (B) Bhagwati Sutra is the main book related to Jainism. Sutta Pitaka, Abhidhamma and Vinayapitaka are the major texts of Buddhism. While the texts of the Brahmin religion i.e. Hinduism are Ramayana, Mahabharata and Gita.
111. (C) There are a total of ten mandals in the Rigveda, 1028 are suktas and 10,580 are verses. Gayatri Mantra is described in the third mandala.
112. (C) In the year 1855, the Santhal people revolted in the Murshidabad district of Bengal and Bhagalpur districts of Bihar, oppressed by the local zamindars, Mahajan and British employees, known as Santhal Rebellion.
113. (A) The call for Direct Action Day or Direct Action Day was a violent movement launched by the Muslim League on 16 August, 1946 for a separate Islamic nation.
114. (A) The crust is the thinnest and outermost layer of the earth. It is on average 30 kilometers deep. The intermediate layer mantle is a very thick layer and the outer core is liquid and the inner core is in solid state. Whereas the air which surrounds the earth is in its place, it is called the atmosphere.
115. (D) Lakshadweep is an Indian archipelago located to the southwest of India in the Arabian Sea. Its capital is Kavaratti. It is the smallest among all union territories.
116. (D) Standard meridian of India $82^{\circ} 30'$ E. is five and a half hours ahead of Greenwich. It passes through Naini near Allahabad.
117. (B) Aphelion and Perihelion are the maximum distance and minimum distance of earth from the Sun. When the Earth is about 147 million km away from the Sun, the position of Perihelion and when it is 15.2 million km distance, then it is the position of Aphelion. The equinox is the state of being equal to day and night.
118. (D) The World Conservation Union, formerly International Union for the Conservation Health of Nature and Natural Resources (IUCN) has enlisted endangered plants and animals in the Red Data Book.
119. (D) In comparison to N and P the K fertilizers are least likely to affect the soil pH. Also note that among N P and K, Nitrogen is the main nutrient affecting soil pH. Nitrogen fertilizers can make soil more acidic as well as more alkaline.
120. (C) India's standard is 82.5° East of Greenwich, which means that India's standard time is 5 hours 30 minutes ahead of Greenwich, so when it is 12 noon at Greenwich it will be 5:30 in the evening in India.
121. (D) Jim Corbett National Park is the oldest national park in India. It is located in the Nainital district of Uttarakhand state. It was earlier known as the Hailey National Park.
122. (B) Bhakra Nangal Dam is situated on Sutlej River in Punjab. It supplies water to Punjab, Haryana and Delhi.
123. (A) Major Dhyan Chand is known as the Hockey Wizard while Milkha Singh is known as the Flying Sikh.
124. (B) British East India Company was founded on 31 December 1600.
125. (B) Judo is the national game of Japan. Jigoro Kano is known as the father of Judo.
126. (D) As, 'Contractor' takes the contract to build the 'Building'. Similarly, 'Cobbler' makes a 'Shoes'.
127. (A) As,
- | | | | | |
|-----|-----|-----|-----|-----|
| M | A | G | I | C |
| +1↓ | +2↓ | +3↓ | +4↓ | +5↓ |
| N | C | J | M | H |
- Similarly,
- | | | | | |
|-----|-----|-----|-----|-----|
| W | I | T | C | H |
| +1↓ | +2↓ | +3↓ | +4↓ | +5↓ |
| X | K | W | G | M |

