Which is used as war gas?

17TH GROUP ELEMENTS

Continued from 4th November..

Oxidising Power: Oxidising power of any substance is the net result of several contributing energy factors like
* Net enthalpy change in the reaction
* Standard electrode potential

- As number of covalent bonds increases covalent nature increases.
- Halogens are strong oxidising agents.
- Fluorine is the strongest oxidising agent even though chlorine has maximum electron affinity.
- The magnitude of the enthalpy change in the reaction, when halogen changes to a hydrated ion can be estimated by the application of BORN-HABER cycle.
- For oxidation to occur ΔH must be negative, greater the magnitude of negative ΔH greater is the oxidation capacity of the halogen.
- Due to low heat of dissociation of F_2 molecule and high hydration energy of F^- ion, fluorine acts as strong oxidising agent.
- A Halogen with lower atomic number oxidises a Halide ion of higher atomic number.
- Fluorine oxidises Chlorides to Chlorine, Bromides to Bromine and Iodides to Iodine.
  $F_2 + 2KCl \rightarrow Cl_2 + 2KF$
  $F_2 + 2KBr \rightarrow Br_2 + 2KF$
  $F_2 + 2KI \rightarrow I_2 + 2KF$
- Chlorine oxidises Bromides to Bromine and Iodides to Iodine.
  $Cl_2 + 2KBr \rightarrow Br_2 + 2KCl$
  $Cl_2 + 2KI \rightarrow I_2 + 2KCl$
- Bromine oxidises iodides to Iodine
  $Br_2 + 2KI \rightarrow I_2 + 2KBr$

Chemical Properties: Halogens are highly reactive elements they can react with metals as well as non-metals and other substances.The order of reactivity of Halogens is $F_2 >> Cl_2 > Br_2 > I_2$

Reaction with Water: Halogens are sparingly soluble in water because they are non-polar covalent molecules. The solubility of Halogens decrease from F_2 to I_2.

- Halogens are highly reactive elements, hence they decompose water. The action of Halogens on water decreases from F_2 to I_2.
- Fluorine decomposes water to liberate a gaseous mixture of $(O_2 + O_3)$
  $2H_2O + 2F_2 \rightarrow 4HF + O_2$
  $3H_2O + 3F_2 \rightarrow 6HF + O_3$
- Chlorine reacts with water to form HCl and HOCl. $(Cl_2 + H_2O \rightarrow HCl + HOCl)$
- Chlorine water contains HCl and HOCl
- Chlorine acts as a bleaching agent in the presence of water or moisture due to formation of HOCl.
- The bleaching action of chlorine in the presence of water or moisture is due to oxidation or liberation of nascent oxygen.
  $HOCl \rightarrow HCl + (O)$
- Bromine is slightly soluble in water forming a mixture of HBr and HOBr
- I_2 neither reacts nor dissolves in water due to positive free energy change (ΔG = +ve)
- The reaction of iodine with water is non-spontaneous. In fact, it can be oxidised by oxygen in acidic medium just the reverse of the reaction observed with flourine.

$$2F_{2(g)} + 2H_2O_{(l)} \rightarrow 4HF_{(aq)} + O_{2(g)}$$

$$4I^-_{(aq)} + 4H^+_{(aq)} + O_{2(g)} \rightarrow 2I_{2(g)} + 2H_2O_{(l)}$$

Reactivity towards oxygen (Oxides of Halogens) : Halogens form many oxides with oxygen but most of them are unstable. Fluorine forms two oxides OF_2 and O_2F_2. Out of which OF_2 is thermally stable at 298 K.

- These oxides are essentially oxygen fluorides because of the higher electronegativity of fluorine than oxygen. Both are strong fluorinating agents. O_2F_2 oxidises plutonium to PuF_6 and the reaction is used in removing plutonium as ores.

Chlorine oxides, Cl_2O, ClO_2, Cl_2O_6 and Cl_2O_7 ae highly reactive oxidising agents and tend to explode.

- ClO_2 is used as a bleaching agent for paper pulp and textiles and in water treatment.
- The bromine oxides, Br_2O, BrO_2, BrO_3 are the least stable halogen oxides.

I_2O_4, I_2O_5, I_2O_7 are insoluble solids and decompose on heating.

JEE MAIN Special

Reaction with Hydrogen (Hydrides or Hydrogen Hallides)

- All the Halogens directly combine with Hydrogen to form Hydrides.

a) $H_2 + F_2 \xrightarrow{23K} 2HF$ It is a fast reaction and takes place even in the dark and is highly exothermic

b) $H_2 + Cl_2 \xrightarrow{\text{Sunlight}} 2HCl$ it is slow in dark but fast in Sunlight

c) $H_2 + Br_2 \xrightarrow{\Delta} 2HBr$
It does not take place at room temperature. Takes place at 593 K in Sunlight.

d) $H_2 + I_2 \rightarrow 2HI$
It takes place in the presence of Pt as catalyst and at 713 K and is a reversible chang@Venkey99

- The reactivity of Halogens with Hydrogen decreases from F_2 to I_2.
- The stability of the hydrides decreases from HF to HI due to decrease in their dissociation energies. The stability order of hydrogen halides is HF > HCl > HBr > HI

Acidic Strength of Hydrogen Halides

- The order of acidic strengths of halides $HF < HCl < HBr < HI$.
- The stability of halides decrease down the group due to decrease of bond dissociation energy. The order of bond dissociation energy $HF > HCl > HBr > HI$
- B.P.of HF is greater than HI due to presence of inter molecular Hydrogen bonding.

Reaction with NH_3

- a) When excess fluorine reacts with NH_3 to form a stable NF_3 and HF.
  $3F_2 + NH_3 \rightarrow 3HF + NF_3$
  b) When limited fluorine reacts with NH_3 to form HF & N_2
  $2NH_3 + 3F_2 \rightarrow N_2 + 6HF$
- When excess chlorine reacts with ammonia to form an unstable explosive Nitrogen trichloride and HCl.
  $3Cl_2 + NH_3 \rightarrow 3HCl + NCl_3$
- Chlorine reacts with excess ammonia to give NH_4Cl liberating Nitrogen.
  $3Cl_2 + 8NH_3 \rightarrow 6NH_4Cl + N_2$

Reaction with Alkalies: Fluorine reacts with cold and dil. NaOH to form NaF, H_2O & OF_2.
$2F_2 + 2NaOH \rightarrow 2NaF + H_2O + OF_2$

- Fluorine reacts with hot and conc. NaOH liberating oxygen gas
  $2F_2 + 4NaOH \rightarrow 4NaF + 2H_2O + O_2$
- Cl_2, Br_2 and I_2 react with cold and dil. NaOH to form halide and hypo halites. The oxidation number of halogen changes from 0 to -1& +1.
  $Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$
  $Br_2 + 2NaOH \rightarrow NaBr + NaOBr + H_2O$
  $I_2 + 2NaOH \rightarrow NaI + NaOI + H_2O$
- Cl_2, Br_2 and I_2 react with hot and conc. NaOH to form halide and halates. The oxidation state of halogen changes from 0 to -1 and + 5.
  $3Cl_2 + 6NaOH \rightarrow 5NaCl + NaClO_3 + 3H_2O$
  $3Br_2 + 6NaOH \rightarrow 5NaBr + NaBrO_3 + 3H_2O$
  $3I_2 + 6NaOH \rightarrow 5NaI + NaIO_3 + 3H_2O$

Reaction with Metals: Metals reacts with halogens forming metal halides.
$2M + nX_2 \rightarrow 2MX_n$
F_2 reacts with even noble metals like Au,Pt,etc.

- The order of the ionic character of the halides $MF > MCl > MBr > MI$ where M is a monovalent metal. Halides in higher oxidation state will be more covalent than the one in lower oxidation state.

Chlorine		Occurence
Carnallite	-	KCl. $MgCl_2$. $6H_2O$
Horn Silver	-	AgCl
Sylvine	-	KCl

Sea water contains 2.5% Sodium Chloride by weight

Preparation: Chlorine was first prepared by Scheele.

- Chlorine can be prepared by the oxidation of HCl with MnO_2
  $4HCl + MnO_2 \rightarrow MnCl_2 + 2H_2O + Cl_2$
- Chlorine is prepared when a mixture of common salt and concentrated H_2SO_4 is used in place of HCl.
  $4NaCl + MnO_2 + 4H_2SO_4 \rightarrow MnCl_2 + 4NaHSO_4 + 2H_2O + Cl_2$
  By the reaction of HCl on potassium permanganate.
  $2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$

Deacon's process : By oxidation of hydrogen chloride gas by atmospheric oxygen in the presence of $CuCl_2$ at 723 K.

$$4HCl + O_2 \xrightarrow{CuCl_2} 2Cl_2 + 2H_2O$$

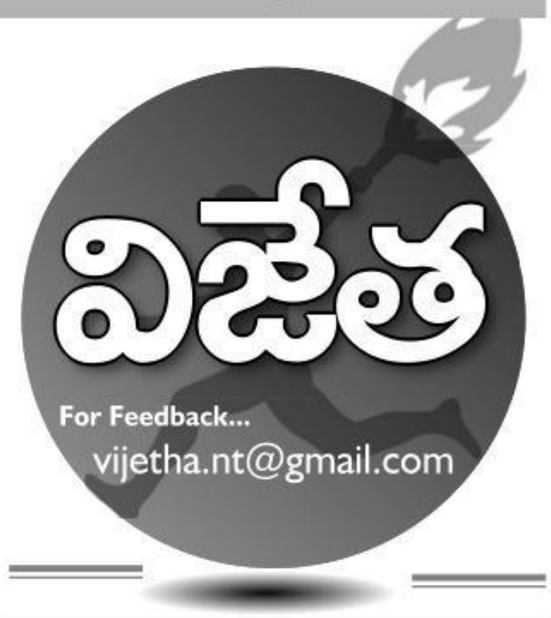
- In Nelson's cell method Chlorine is manufactured by the electrolysis of Brine or an aqueous solution of sodium chloride.
- In Nelson's cell, a perforated steel vessel which act as cathode and graphite rod acts as anode.
- A perforated steel cathode is used in Nelson's cell to prevent the mixing up of Cl_2 and NaOH
- In Nelson's cell the product at anode is Cl_2 and the products at cathode is H_2, NaOH.
- In Nelson's cell for the manufacture of Cl_2 the valuable byproducts are NaOH and H_2.
- Cl_2 is also prepared by the electrolysis of fused NaCl in Down's process.
- **Properties:** it is a greenish yellow gas with pungent and suffocating odour.
- Chlorine reacts with dry slaked lime to form bleaching powder
  $Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$
- Chlorine forms addition compounds with SO_2, CO and NO.
  $SO_2 + Cl_2 \rightarrow SO_2Cl_2$
  $CO + Cl_2 \rightarrow COCl_2$
  $2NO + Cl_2 \rightarrow 2NOCl$
- Reaction with metals :
  $2Al + 3Cl_2 \rightarrow 2AlCl_3$
  $2Na + Cl_2 \rightarrow 2NaCl$
- **a)** Copper reacts with chlorine to give copper (II) chloride $Cu + Cl_2 \rightarrow CuCl_2$
  b) Iron reacts with chlorine to form ferric chloride $2Fe + 3Cl_2 \rightarrow 2FeCl_3$
- It has great affinity for hydrogen. It reacts with compounds containing hydrogen to form HCl.
  $H_2 + Cl_2 \rightarrow 2HCl$
  $H_2S + Cl_2 \rightarrow 2HCl + S$
  $C_{10}H_{16} + 8Cl_2 \rightarrow 16HCl + 10C$

Reaction with non metals

$H_2 + Cl_2 \xrightarrow{\text{sunlight}} 2HCl$
$P_4 + 6Cl_2 \xrightarrow{\Delta} 4PCl_3$
$P_4 + 10Cl_2 \xrightarrow{\Delta} 4PCl_5$
$2S + Cl_2 \xrightarrow{\Delta} S_2Cl_2$

Reaction with hydrocarbons

a) $CH_4 + Cl_2 \xrightarrow{h\nu} CH_3Cl + HCl$



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the final product is CCl_4

b) $CH_2 = CH_2 + Cl_2 \xrightarrow{\text{at room temp}} CH_2Cl - CH_2Cl$

c) $CH \equiv CH + Cl_2 \xrightarrow[\text{in } CCl_4]{\text{at room temp}} CHCl = CHCl$

$\xrightarrow[+Cl_2]{\text{at room temp in } CCl_4} CHCl_2 - CHCl_2$

d) $C_6H_6 + Cl_2 \xrightarrow[\Delta]{AlCl_3/FeCl_3} C_6H_5Cl + HCl$

- Chlorine acts as an oxidising agent .
  $H_2S + Cl_2 \rightarrow 2HCl + S$
  $Na_2S_2O_3 + Cl_2 + H_2O \rightarrow Na_2SO_4 + S + 2HCl$
- Chlorine is used as a bleaching agent in paper and textile industry.
- Chlorine is used for the sterilization of drinking water.
- It is used in the extraction of metals like gold and platinum.
- Chlorine water on long standing loses its yellow colour due to the formation of HCl and HOCl. HOCl gives nascent oxygen which is responsible for oxidising and bleaching properties of chlorine.
  $Cl_2 + H_2O \rightarrow 2HCl + (O)$
  Coloured substabce + O → colourless substance
  $2FeSO_4 + H_2SO_4 + Cl_2 \rightarrow Fe_2(SO_4)_3 + 2HCl$
  $Na_2SO_3 + Cl_2 + H_2O \rightarrow Na_2SO_4 + 2HCl$
  $SO_2 + 2H_2O + Cl_2 \rightarrow H_2SO_4 + 2HCl$
  $I_2 + 6H_2O + 5Cl_2 \rightarrow 2HIO_3 + 10HCl$
- $COCl_2$ is called phosgene. It is poisonous gas.
- $CCl_3 . NO_2$ is called tear gas.
- Cl-C_2H_4-S-C_2H_4-Cl or $(C_2H_4Cl)_2$ S is called Mustard gas. It is used as war gas.
- Dichloro diphenyl trichloro ethane is known as DDT. It is a fungicide.
- It bleaches wood pulp , rayon and cotton .

Hydrochloric Acid

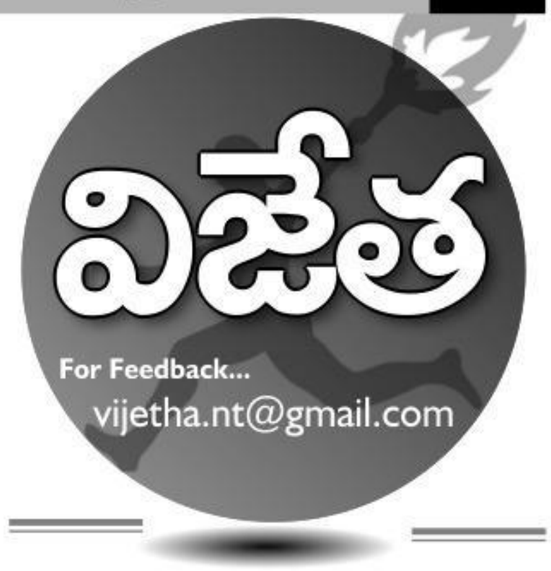
Preparation: By heating common salt with concentrated sulphuric acid,Glauber prepared HCl

- Davy showed that it is a compound of hydrogen and chlorine
- HCl can be prepared by heating NaCl with Conc. H_2SO_4
  $NaCl + H_2SO_4 \xrightarrow{420K} NaHSO_4 + HCl$
  $NaHSO_4 + NaCl \xrightarrow{823K} Na_2SO_4 + HCl$
- HCl gas can be dried by passing through Conc. H_2SO_4

Properties: HCl is colourless and pungent smelling gas.

- HCl can be easily liquefied to colourless liquid (b.p = 189K) and can be easily freezed to white crystalline solid {F.P = 159 K)
- HCl is Highly soluble in water whose $K_a = 10^7$
  $HCl_{(g)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + Cl^-_{(aq)}$
- High K_a value of HCl indicates that HCl is strong acid in water
- HCl reacts with NH_3 and gives white fumes of NH_4Cl, $NH_3 + HCl \rightarrow NH_4Cl$

Which are divisible by 9?



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PROGRESSIONS

General from of an arithmetic progression (AP): *a, a+ d, a+ 2d, a +3d...* where '*a*' is the first term and '*d*' is called the common difference.

Example: 3, 7, 12, 17.....,.....

n^{th} term of an AP: In an arithmetic progression first term ***a*** and common differences ***d***, the n^{th} term (or the general term) is given by

$\mathbf{a_n = a + (n-1)d}$

Sum of the first n terms of an AP: The sum of the first *n* terms of an AP is given by

$\mathbf{Sn = \frac{n}{2}[2a + (n-1)d]}$.

If the first and last term are given and the common difference is not given then

$\mathbf{Sn = \frac{n}{2}[a + a_n]}$

General from of GP: *a, ar, ar^2,.....* where '*a*' is the first term and '*r*' is called the common ratio.

Example: 5, 25, 125, 625.....

n^{th} term of an GP is $\mathbf{a_n = ar^{n-1}}$

In solving the problem.....

Let the three terms of A.P. as a − d, a, a + d **Let the four terms of A.P. as** a − 3d, a − d, a + d, a + 3d.

Let the five terms of A.P. as a − 2d, a − d, a, a + d, a + 2d.

Let the 3 terms of GP are $\frac{a}{r}$, a, ar.

Let the 5 terms of GP are $\frac{a}{r^2}, \frac{a}{r}$, a, ar, ar^2.

1 MARK QUESTIONS

1. Write any 2 examples where we will you use arithmetic progression in your daily life?

Sol: 1.Taxi fair for First kilometer is Rs. 25 and after each kilometer is Rs.20

2. Digging a well of $1\frac{1}{2}$ meter as diameter, first meter cost is Rs.250 after that each meter is Rs. 200.

2. Check which terms of the A.P., 92, 88, 84, ... is 0?

Sol: The given AP: 92, 88, 84,.....,0..

First term ***a*** = 92, common difference ***d*** = 9?

Let us suppose the last term = 0

$\mathbf{a_n = a + (n-1)\,d}$ =>0 = 92 + (n—1)(—4)

=>0 = 92 —4n + 4 =>0 = 96 —4n

=>n = $\frac{96}{4}$ = 24 which is rational number

∴ 0 is the term of the given AP.

3. Find the 9th term from the end of the AP: 5,9, 13, ... 185?

Sol: Given A.P. can be taken as 5, 9, 13.....185. this A.P. can be written as 185, 181, ...13. 9, 5.

Where a = 185, d = −4 ,

$a_9 = 185 + (9-1)(-4)$

=> $a_9 = 185 + (8)(-4)$

=> $a_9 = 185 - 32 = 153$

9^{th} term from the end of the given AP is 153.3

4. Find '*a* so that *a*, *a* + 2, *a* + 6 are consecutive terms of geometric progression.

Sol: If *a* *a* + 2, *a* + 6 are three consecutive terms of GP then $\frac{a_2}{a_1} = \frac{a_3}{a_2} \Rightarrow \frac{a+2}{a} = \frac{a+6}{a+2}$

=>(a +2)(a + 2) = (a + 6)a

=> $a^2 + 4a + 4 = a^2 + 6a$

=> $a^2 + 4x + 4 - a^2 - 6a = 0$

=>−2a + 4 =0 => a =2

5. Which term of the GP: $\sqrt{3}$, 3, $3\sqrt{3}$..... is 729?

Sol: Given a =$\sqrt{3}$, r= $\frac{3}{\sqrt{3}} = \frac{\sqrt{3}\sqrt{3}}{\sqrt{3}} = \sqrt{3}$

Let nth term be $a_n = 729$

Then $729 = \sqrt{3}\,(\sqrt{3})^{n-1} = 3^6$

=> $(\sqrt{3})^n = 3^6$ => $\frac{n}{2} = 6 \Rightarrow n = 12$ in the given G.P. is $\sqrt{3}$, 3, $3\sqrt{3}$.....12^{th} term 729.

10th Class Special

6. If the first term of AP is 'a' and last term is known then which formula is used to find the sum of n terms of AP? Explain the terms involving in it?

Sol: If the first term of AP is 'a' and last term is 'a_n' then sum of n terms is $S_n = \frac{n}{2}[a + a_n]$

where $a_n = a + (n-1)\,d$,

d = common difference,

n = number of terms in the given sequence,

S_n = sum of n terms

7. Geetha said that "If a, b, c are three consecutive terms of in AP then the value of (a – 2b) = c. Do you agree with the statement. Justify your answer?

Sol: If a, b, c are in A.P. then b−a = c−b => 2b = a + c => a− 2b = −c. so I cannot agree with the 'Geetha's statement that a, b, c are three terms of A.P. then a − 2b = c, we have a − 2b = −c

8. In a AP 6^{th} term is 60 and 15^{th} term is 24 then find common difference?

Sol: $a_6 = a + (6-1)\,d = 60$

=> $a_5 = a + 5d = 60$ -------(1)

$a_{15} = a + (15-1)\,d = 24$

=> $a_{15} = a + 14\,d = 24$ -------- (2)

solving (1) and (2) 9d =−36 => d = −4

9. The 5^{th} term of an AP is 17 and 2^{nd} term is 11 then find its 7^{th} term?

Sol: $a_5 = a + 4d = 17$ _ (1)

$a_2 = a + d = 11$ _ (2) solving (1) and (2)

3d = 6 => d = 2 then a + 2 = 11 => a = 9

$a_7 = a + 6d = 9 + 6(2) = 9 + 12 = 21$

10.Find the 25^{th} term of an AP whose 9^{th} term is 6 and common difference is $\frac{5}{4}$.

Sol: d = $\frac{5}{4}$, $a_9 = a + 8d = 6$

=> $a + 8(\frac{5}{4}) = 6 \Rightarrow a + 10 = 6 \Rightarrow a = -4$,

$a_{25} = -4 + 24(\frac{5}{4}) = -4 + 30 = 26$.

11.The seventeenth term of AP exceeds its 10^{th} term by 7. Find the common difference.

Sol: According to the sum $a_{17} = a_{10} + 7$

=> a + 16d = a + 9d + 7

=> 16d −9d =7 => 7d = 7 => d =1.

2 MARK QUESTIONS

1. Find the number of terms between 100 and 1000 which are divisible by 9?

Sol: The numbers between100 and1000 which are divisible by 9 are

108, 117,.....999

we know that $a_n = a + (n-1)d$

=> 999 = 108 + (n−1)9

=> 999 −108 = (n−1)9

=> 891 = (n−1)9

=> $\frac{891}{9}$ = n−1 => 99 = n−1 => n = 100

2. The sum of first 30 positive integers divisible by 6 is

Sol: First 30 positive integers which are divisible by 6 are 6, 12, 18, ...180 are in AP where a = 6, d = 6, n = 40, *l*= 180

their sum is 6 + 12 + 18 + ... + 180

$S_n = \frac{n}{2}[a + l] = S_{40} = \frac{30}{2}[6 + 180]$

=> 15 (186) = 2790

3. The product of 5 terms in GP is 1024 then the middle term is?

Sol: Let the 5 terms of GP are $\frac{a}{r^2}, \frac{a}{r}$, a, ar, ar^2

then their product is $\frac{a}{r^2} \times \frac{a}{r} \times a \times ar \times ar^2$

= 1024 =>r^5 = 1024 => $2^{10} = (2^2)^5$

=> $r^5 = 4^5$ => r = 4 (∵ r is the middle term)

4. Between the numbers of an A.P. 2 and 20 there are 8 mean terms are inserted. Find their sum.

Sol: If 2, A_1, A_2, ... A_n, 20 is an AP where a = 2 b = 20 n = 8 then

sum of the means = $\frac{n}{2}(a + b)$

= $\frac{8}{2}(2 + 20) = 4 \times 22 = 88$

5. If the first term of a G.P. is 5 and the sum of first three terms is $\frac{31}{5}$, then the common ratio is?

Sol: Let a, ar, ar^2 three terms of GP and a =5 Given that $a + ar + ar^2 = \frac{31}{5}$

=> $5 + 5r + 5r^2 = \frac{31}{5} \Rightarrow 25 + 25r + 25r^2 = 31$

=> $25r^2 + 25r + 25 - 31 = 0$

=> $25r^2 + 25r - 6 = 0 \Rightarrow (5r-1)(5r+6) = 0$

=> r = $\frac{1}{5}$ or r = $\frac{-6}{5}$

6. Find the 100^{th} term of the series 1 + 3 + 7 + 15..... .

Sol: Given the series is

1 + 3 + 5 + 7+..... + a_n is of the form

$2^n - 1$ (∵$2^1 - 1 = 1$, $2^2 - 1 = 3$, $2^3 - 1 = 7$, $2^4 - 1 = 15$ ..... so on)

100^{th} term is $2^{100} - 1$

7. Find the sum of log3 + log9 + log27 + log81.

Sol: log3 + log9 + log27 + log81

= $log_3^1 + log_3^2 + log_3^3 + log_3^4$

= 1log3 + 2 log3 + 3 log3 + 4 log3

= (1 + 2 + 3 + 4) log3 = 10 log3

8. Find the 20^{th} term of the series $2 \times 4 + 4 \times 6 + 6 \times 8 + ...$ n terms.

Sol: n^{th} term of $2 \times 4 + 4 \times 6 + 6 \times 8 + ...$ n terms

a_n = (2 × 4 × 6....) (4 × 6 × 8...)

= [2 + (n−1)(2)] [4 + (n−1)(2)]

= 2n (2n + 2) = 2(20) (2×20 + 2)

= 40(42) = 1680.

9. If 8 times the 8^{th} term of AP is equal to 15 times the 15^{th} term of AP, then find the 23^{rd} term of the same AP.

Sol: According to the sum

8 a_8 = 15 a_{15} => 8(a + 7d) = 15(a + 14d)

=> 8a + 56d = 15a + 210d

=> −7a −154d = 0 => a + 22d = 0

∴0 is the 23^{rd} term of the given A.P.

10. Two APs have the same common difference, the difference between their 100^{th} term is 100, what is the difference between their 1000^{th} terms?

Sol: Let the 100^{th} term of two AP are $a_1 + (100-1)d$, $a_2 + (100-1)d$

Difference between 100^{th} terms

= $a_1 + 99d - a_2 - 99d = a_1 - a_2 = 100$

Difference between 1000^{th} term

= $a_1 + 999d - a_2 - 999d = a_1 - a_2 = 100$

∴Difference between 1000^{th} term is also 100.

4 MARK QUESTIONS

1. If the 4^{th} term of a GP is 80 and 8^{th} term1280 then find the n^{th} term.

Sol: 4^{th} term of GP $a_4 = ar^3 = 80$ ---(1)

$a_8 = ar^7 = 1280$ ---(2),

divide equation (2) with (1)

$\frac{ar^7}{ar^3}$ $\frac{1280}{80}$ => $r^4 = 16$ => r = 2

substituting r value in (1)

$a(2^3) = 80 \Rightarrow a = \frac{80}{8} = 10$

nth term = $a_n = ar^{n-1}$

=> $a_n = 10(2)^{n-1} \Rightarrow a_n = 5(2)^n$

2. Find the sum of all three digit numbers which are divisible by 7?

Sol: The smallest, largest 3 digit numbers which is divisible by 7are105 and 994.

The sequence of the 3 digit numbers which are divisible by 7 are 105, 112, 119,..... 994

this is an AP where a = 105, d = 7 and

$a_n = 994$, so $a_n = 994 = 105 + (n-1)7$

=> 7(n−1) = 994 – 105 = 889

=> (n−1) = $\frac{889}{7}$ => n −1 = 127 => n = 128

now $S_{128} = \frac{128}{2}[2(105) + (128 - 1)7]$

=> 64 (210 + 127 × 7) = 70336

∴ Sum of all three digit numbers which are divisible by 7 is 70336.

3. If 18^{th} term and 11^{th} terms of an AP are in the ratio 3 : 2 then find the ratio of its 29^{th} term and 5^{th} term.

Sol: $\frac{a_{18}}{a_{11}} = \frac{3}{2} \Rightarrow \frac{a+(18-1)d}{a+(11-1)d} = \frac{3}{2}$

=> $\frac{a+17d}{a+10d} = \frac{3}{2} \Rightarrow 2a + 34d = 3a + 30d$

=> a = 4d-------- (1)

now $\frac{a_{29}}{a_5} = \frac{a+(29-1)d}{a+(5-1)d}$

=> $\frac{a+28d}{a+4d} = \frac{4d+28d}{4d+4d} = \frac{32d}{8d} = \frac{4}{1}$

=> $\frac{a_{29}}{a_5} = \frac{4}{1}$

∴the ratio of its 29^{th} term and 5^{th} terms 4:1