GYAN-VIGYAN SARITA: शिक्षा

A non-remunerative, non-commercial and non-political initiative to Democratize Education as a Personal Social Responsibility (PSR) 2nd Quarterly e-Bulletin No: 02 dt. 1st Jan'17: **Special Issue on Education of Unprivileged**





Contents:

- Editorial (संपादकीय झाबुआ : एक झलक)
- Coordinators Views : There Is Always A Way
- Online Mentoring : A Pictorial Perspective
- Time to Change Ourselves with Digitalization of India Sandhya Tanwar \geq
- Education of Unprivileged Children Prof. G.L. Asawa \geq
- **Demonetization Shuchi Maitra** \triangleright
- Education for the Unprivileged Subhash Chawla \triangleright
- Online Mentoring : A Vision Shailendra Parolkar \triangleright
- भौतिकशास्त्र : जिला झाबआ के सन्दर्भ में महेंद्र कमार खराना \triangleright
- <u>गणित एक कला : अधिगम सन्दर्भ में हरीश कण्डल</u> \triangleright
- Online Teaching Classes : A Boon for the Needy Children Smt. Kiran Shrivastava \geq
- Growing with Concepts:
 - Mathematics : Coordinate Geometry Srtaright Lines Prof. S,B,Dhar
 - Physics: Mechanics Part IV Flid Mechanics S.K. Joshi
 - Chemistry : (....Contd.) Organic Chemistry : Basic Principles and Techniques Kumud Bala
- Quizzes:
 - <u>Quizdom Jan'17 Phanindra Ivatury, QUIZ HOST</u> <u>Crossword Puzzle Straight Line Prof. S.B. Dhar</u>

 - Science Quiz Kumud Bala
 - Word Puzzle On Jhabua Prof. S.B. Dhar
- About Us
- Invitation For Contribution of Articles

Editor-शिक्षा e-Bulletin : Dr SB Dhar

Coordinator-ज्ञान विज्ञान सरिता : Dr Subhash Joshi

Graphics Designer: Devika Mathur

Disclaimer : Views expressed in this bulletin are author's view and ज्ञान विज्ञान सरिता, Publishers of this bulletin, are not responsible for its correctness or validity

Rights of Publication

Core Committee of ज्ञान विज्ञान सरिता reserves right of moderation or publication of a contents of this e-Bulletin

Address: #2487, Betina, Mahagun Moderne, Sector-78, NOIDA, Uttar Pradesh, PIN: 201309, (INDIA).

e-Bulletin – Eco-friendly: It is a considered decision to make this communiqué an e-Bulletin, and thus save paper. May please like to share it, but <u>please do not print it</u>, unless it is a must.

Our Website: http://gyanvigyansarita.in/; e-Mail: subhashjoshi2107@gmail.com

First they will ignore you, then they laugh at you, then they fight you, then (truth would prevail)

Mahatma Gandhi



... start, without loosing time, with what is available.



झाबुआ : एक झलक

संपादकीय

e

२०११ की जनगणना के आधार पर झाबुआ का क्षेत्रफल ३७८२ वर्ग किलोमीटर, आबादी १०२४०९१, इनमें पुरुष ५१४८३० महिला ५०९२६१ और ६ वर्ष से नीचे के बच्चे २०७९३१ हैं. इसकी आबादी का घनत्व २८५ प्रति वर्ग किलोमीटर, विकास दर लगभग ३१ प्रतिशत, और लिंग अनुपात ९८९ महिलाएं प्रति १००० पुरुष है.

दक्षिण एशिया का देश भारत राज्यों का एक संघ है. इसमें २९ राज्य और ७ केंद्र शासित प्रदेश हैं. मध्यप्रदेश इन्हीं २९ राज्यों में से एक है. मध्यप्रदेश में कुल ५१ जिले हैं. झाबुआ इन्ही ५१ जिलों में से एक है. यह मध्यप्रदेश के पश्चिमी हिस्से का एक जिला है. इसकी सीमायें गुजरात के पंचमहल और बड़ौदा, राजस्थान के बंसवारा, और मध्यप्रदेश के अलीराजपुर, धार और रतलाम जिलों से घिरी हैं.

झाबुआ जिले की गणना सूखाग्रस्त जिलों में होती है. यह एक आदिवासी बाहुल्य जिला है. यहां बांस की चीजें बहुलता से बनती हैं. यहां की प्रमुख जनजातियां भील और भिलाला हैं. यहां की सामान्य बोलचाल की भाषा बरेली राठवी है. यह भीलों की भाषा है. करीब ६४००० लोग इसे बोलते हैं. यह भाषा देवनागरी लिपि में लिखी जाती है. सरकारी कामकाज की भाषा हिंदी है.

पुरुषों में साक्षरता लगभग ५४ प्रतिशत और महिलाओं में ३४ प्रतिशत है. यहां की भूमि ब्लैक कॉटन स्वायल है. यह सफ़ेद सोना भी कहलाती है. माही और नर्मदा यहां की प्रमुख नदियां हैं.

ब्रिटिश राज में झाबुआ, मध्य भारत के एक राजसी राज्य की राजधानी भोपावर एजेंसी में था. १९४७ में स्वतंत्रता के बाद झाबुआ, नव निर्मित मध्यभारत राज्य का हिस्सा बना. इसका १९५६ में मध्यप्रदेश में विलय हुआ. मई १९४८ में जब मध्य भारत बना, तब झाबुआ जिला अस्तित्व में आया. उस समय यह जिला अलीराजपुर, जोबट, कठिवाडा, माठवार, और पेटलावद परगनों को मिलाकर बना था.

झाबुआ की स्थापना १५८४ में केशवदास राठौर ने की थी. १६१८ में यह मुग़ल सल्तनत में मिल गया. १६४२ में शाहजहां ने केशवदास के भतीजे को फिर से राज्य सौंप दिया. भावरा जो एक समय झाबुआ का हिस्सा था. वहां पर चंद्रशेखर आजाद ने अपना प्रारंभिक जीवन बिताया था. उनके पिता श्री सीताराम तिवारी अलीराजपुर में कार्यरत थे.

झाबुआ आदिवासी बाहुल्य जिला होने के बावजूद बर्तमान समय में शिक्षा के क्षेत्र में विकास कर रहा है. यहां विकास अब दिखाई दे रहा है. केंद्रीय विद्यालय, जवाहर नवोदय विद्यालय, राजकीय विद्यालय, प्राइवेट कॉलेज, लॉ कॉलेज, इंजीनियरिंग कॉलेज आदि की उपस्थिति प्रगति की निशानी है. गेल इंडिया लिमिटेड ने झाबुआ को अंतराष्ट्रीय नक्ष्शे पर ला खड़ा किया है. इसने सभी तीनों प्राकृतिक गैस पाइप लाइन्स झाबुआ और पेटलावद तहसील के ४५ गांव से होकर गुजारी हैं.

आदिवासी बाहुल्य क्षेत्रों में विकास के लिए आवश्यक है कि यहां वह शिक्षा दी जाये जिससे निवासियों के आर्थिक विकास में मदद मिले और साथ ही साथ उनकी सांस्कृतिक पहचान बनी रहे. यहां के मूल निवासी भीलों से हमें प्राकृतिक संसाधनों के उपयोग की सीख मिलती है. वे जल को जीवन का मुख्य तत्व मानते हैं. वे जल का जरुरत के अनुसार ही उपयोग करते हैं. कोई भी आदिवासी प्राकृतिक संसाधनों का दोहन नहीं करता है वल्कि उपयोग के साथ साथ उनका संरक्षण भी करता है.

This editorial provides a perspective of district Jhabua, where efforts are being made by district administration to intensify the quality of education in its endeavour to harness potential of this tribal population, by welcoming voluntary participation of those who espouse the cause.

--00---

Page 5 of 47 2nd Quarterly e-Bulletin: Gyan- Vigyan Sarita: शिक्षा <u>http://www.gyanvigyansarita.in/</u>



Coordinator's Views

There is Always a Way

'However difficult life may seem, there is always something you can do and succeed'. This quote apparently looks from a persons who was born with silver spoon in his mouth and had never tasted failures, setbacks, handicaps and opportunities coming his way. This is a partial truth.

There was a boy born on 8th January 1942, during the period Word War-II, in Britain to parents, father being a man of medicine and mother a student of having studied philosophy, politics and economics, both educated in University of Oxford. The family valued education highly. Despite desire of father to pursue education the child was inclined to study mathematics and physics. He was an unconventional scholar and enjoyed in school making scientific models out of trash, which prompted his colleagues to call him Einstein. During graduation he started showing signs of a dare devil person. At this stage he decided to pursue his higher studies Theoretical Physics and pursued it as his doctoral work at Cambridge University.

During final year at Oxford he experienced increasing clumsiness, difficulties in rowing, and his speech was getting slightly slurred. Later, his father, who was a medical practitioner, noticed the changes and at the age of 21 years, in 1963, he was diagnosed Amyotrophic Lateral Sclerosis (ALS). In common parlance it is called motor neuron disease which gradually paralyses the body; then doctors estimated his life expectancy of Two years. This created a question mark on his career graph and fulfillment of his dream. Nevertheless, the boy has survived more than half-a-century of motor-neuron degradation and shall be turning 75 years on 8th Januray'17. He is looked upon as a celebrity icon of passion, vision and determination whose quote has been cited at the beginning. It would be no exaggeration to call this person a successor of Newton and Einstein.

His inabilities are compensated by computer based communication system, developed by top computer companies. The system responds to his acumen through his eyes ball movements and a few characters that he can type with one finger. It convert these inputs into speech, articles and emails to connect him with rest of the world, which derives benefit from of cognitive supremacy to explore cosmos. He has been felicitated with numerous top level awards. Nevertheless he maintains humility to say "I have received excellent medical attention in Britain, and I felt it was important to set the record straight. I believe in universal health care, and I am not afraid to say so". Looking at the man one would be decline to believe that he is the person who has accepted the mantle of role model for disabled people, lecturing and participating in fundraising activities. The person is a living legend, Stephen William Hawking who is popularly known as **Stephen Hawking**. He is an excellent example of **a person living Personal** Social Responsibility.

Story of Stephen, is an exceptional case of terminal disability to а person who was born and brought in an up intellectual environment. Human civilization has had many such persons who grew



against all odds to achieve their dream. *Each of those exceptions had accepted challenge of their destiny to pursue their inspiration, and in their pursuit of excellence education played a vital role.*

Disabilities are not always physical, it has many dimensions, which deprive a person to avail opportunities. Some are unprivileged financially, some due to geographical constraints, while some due to prolonged sickness. There are some children who live in a social environment where living is all about meeting day-today needs without any vision and an opportunity to look beyond. Children born in such disabilities are deprived of fragrance and flavour of education. Such children consider education as a privilege of alien. Learning is confined to survival in their tribe, or at most upto serving some privileged, and remaining at their mercy.

Opportunities of survival and growth to privileged children are guaranteed by their environment, irrespective of their competence. This created a socio-political division of children. A few unprivileged children, who as a matter of chance are able to cross a threshold of education, are able to avail opportunities of growth in system of equality among un-equals. Propriety and manner in which a system extends certain privileges to unprivileged children is a subject matter of socio-political debate; instead it is considered appropriate to leap over the debate and address that which is intended.

An integrated and complex society in its present form requires two kinds of skill. Professional skills are acquired through academics. The other is inter-personal skills which are inculcated through socialization involving caring and sharing. Both of the skills go hand-in-hand in making a man complete who can contribute into socio-economic development and coexistence so as to maintain *unity in diversity a law of nature*.

Unprivileged children develop a high degree of interpersonal skill, a necessity of their coexistence. Privileged children, on the contrary, tend to be possessive and selfcentric. It is visible from trajectory social, financial and other kind of crimes which are becoming increasingly hightech and high-profile and are aimed at meeting one's own end. *This is a kind of uncalled for aberration in personalities of educated persons. This aberration is attributed to severe commercialization and protectionism in education of privileged children.*

Light liberates a person from darkness; knowledge liberates a person from ignorance;. Confucius about 500 B.C. had said "We may learn wisdom: first by reflection, the noblest: second by imitation, the simplest; and third by experience, the bitterest." Accordingly, ancient scholars perpetuated their school of thought through their disciples better known as गुरु शिष्य परंपरा in ancient Indian culture. Buddha, was a theological contemporary of Confucius. A little later, one of the most scholarly and scientific school was established by Socrates. History of education cites many scholars who tried to perpetuate learning of others, out of bitter experiences of others and their own, through a systematic process called education. This pursuit was driven by passion and was not commercialized. Still in Indian classical art, music and dance, the cult is prevalent as घराना. But, these systems suffer from a limitation of close confinement to the whims and fancies of

गुरु/उस्ताद towards शिष्य/शागिर्द and aspiring learners.

It is Seventy years since Independence. *While, this article is being written there is news report stating that GOI has taken up to reform education by incorporating learning*



outcomes in RTE ACT. Late is better than never. In a country having wide diversity, large gap between privileged unprivileged, and education for privileged the in commercial ventures have there been numerous reports on

credibility of educational initiatives. Most of these institutions claim accreditation from prestigious bodies. Such a scenario leads to an obvious anxiety on success of linking learning outcome with RTE. Moreover, RTE is not an end, but, it is a means to eradicate disparity in opportunities of growth through education. **No government**, **organization, institution or individual can reform**

education singularly, howsoever desperate and passionate it may be.

Education is a long drawn process. Unprivileged students find it difficult to sustain education. They have valid reasons of their health conditions, their socio-economic lifestyle which demands them to work during harvesting, hat-days and other socio-cultural engagements. Yardstick of International schools for privileged cannot be imposed upon them. Moreover, state-of-the-art, of the education is far ahead of the status-quo of the unprivileged children. Thus an initiative to educate these **target students is confronted with catch 99 situation to prioritise their compulsions of survival and perseverance vis-à-vis education to catch up with the dreams.**

Sarthak Prayash about 5 years ago provided space for this endeavour, in their programs of promoting education of unprivileged children. It created in an opportunity to mentor students, from unprivileged families, of class 8th pass and groom in them competence to compete. This was considered an essential intervention so as to change profile of target children; this is where most of the educational initiatives including those under RTE stop at. Satisfactory experience of mentoring, through chalk-n-talk, such children in a non-remunerative, non-commercial and commercial manner, with a sense of Personal Social Responsibility (PSR), for about four years, was an encouragement to upgrade the mission to Online Mentoring. In May'16, Sarthak Pravash started a Online Learning Center (OLC) at Vasundhara, Ghaziabad Distt. It aims at starting OLC at Chakhutiya, a hilly village in Uttarakhand which suffers from numerous problems viz. low population density, poor infrastructure, non-availability of teachers and long and rough terrain to reach schools.

Experience of Online Mentoring, despite many odds, was a motivation to reach out to those students who are inaccessible. Moreover, there was a news on 3^{rd} May'206

that about 38 students, out of 150, cracking IIT-Main 2016 in first attempt from Jhabua, a



tribal districts of Madhya Pradesh. Motivational support for this breakthrough came from *Shri Anurag Choudhary, IAS, CEO, Jhila Panchayat, who himself is an IITian*. This year efforts are being made to motivate about 500 students to appear the most prestigious examination, with a hope that 40% of them would clear it. Without losing time

communication was established with the CEO to congratulate for the ice-breaking success and to complement their efforts through Online Mentoring. There was a welcoming response which made it possible to start Online Mentoring with a vision that model shall be taken to block level in the district. In this backward and isolated place there are issues of getting technical support, IT equipment and Internet connection of requisite speed and reliability. Despite, Online mentoring of mathematics has started on regular basis for class 9th students. Efforts are on for streamlining Online Mentoring for Physics for class 9th and in parallel for the two subjects for class 11th. As a considered opinion, mentoring for class 10th and 12th shall be need based, at the discretion of respective teachers; this is in wake of the fact these classes are at the brink of board examination. At that stage any fresh intervention might distract students and may cause loss of their momentum of preparations.

During a recent visit to Jhabua for restart of the Online Mentoring there was an encouraging response of Shri Ashish Saxena, IAS, DM, to integrate more elite person in this selfless initiative, and thus utilizing capability of internet technology, to start Online Mentoring at all schools and hostels in the district. Taking a step further, a vision has been laid to start a focused Online Mentoring for students selected through proper screening. Accordingly, a proposal has been formulated as **JHABUA TALENT NURTUTING INITIATIVE (JTNI)** and is under consideration with the District Administration.

Democracy gives right and freedom to think and act. Exercise of such freedom is clubbed with a responsibility to ensure that its exercise does not jeopardize essence of freedom of others, especially innocents. In view of this it is considered to normalize and stabilize the Online Mentoring in its full bloom at Jhabua district, which has proactively volunteered to embrace this unconventional initiative in a big way. It is envisaged that exercise of patience, in a focused manner, during stabilization of the model would help this endeavour to reach a potential where it would start motivation to Democratize of Education with the sense of PSR, a model through which elite and accomplished persons collectively complement each other selflessly. *This model is seen as a necessity in view of the fact: a) educated*

and competent teachers are migrating to bigger town in search of growth opportunities, **b**) teaching in schools has become least lucrative career option, **c**) qualified and passionate teachers have their own compulsions go out of comfort zone, **d**) kind of connect between students and mentors that Online Mentoring provides cannot be replaced by Online Videos, and **e**) this model is not monopolistic, it integrates local teachers as coordinators to bridge the learning gap and in the process aimed at transferring Online Mentoring capability, to be able to perpetuate the model.

Peculiarity of this selfless endeavour is that it believe in managing the initiative in a corporate like manner, with a commitment like an entrepreneur, dedication of a teacher and desperation of learner from all, be it motivator, mentor, promoters, facilitators. Further, unlike philanthropic initiatives it believes in mentoring target students without any allurement but for an assurance of a valued based quality learning. Translating this philosophy into action is tough and requires enormous perseverance rather than being pessimistically complacent about helplessness.

In any system each of the player has a role and responsibility, and these are executed in a frame work. Thus, grooming of unprivileged children as a system is likely to fall in line with a stereotyped approach which takes a brilliant start and decays exponentially a passage of time. This initiative requires engagement with a passion and a sense of PSR to : a) creating thrill of learning among unprivileged, b) facilitating them at the toddler stage, c) making them dream and, d) keep them motivated to strive to achieve their dream. Gratefully it is acknowledged that Sarthak Pravash, as an NGO and district administration at Jhabua provided an opportunity to pursue this passion in their domain. There may be many more such initiatives, which are unknown. It is need of the time and the cause to weave together, every such initiative and likeminded person. This would create an environment conducive for them to be able to collectively complement each other. This would carve a path to establish that there is always a way as lived by Stephen Hawking. It is envisioned that each one associated in this model will have a satisfaction of contributing out of box and at the end of it leave a legacy for their beloved descendants to feel proud of their predecessors.

-00-

If your actions inspire others to dream more, learn more, do more and become more, you are a leader.

John Quincy Adams

TIME TO CHANGE OURSELVES WITH DIGITALIZATION OF INDIA Sandhya Tanwar

Basic education of a child starts from home. Kids imitate what they see around their environment. For them, their parents and siblings are their first role models. Like, I always wanted to be like my father, the way he used to do hard-work for his business, the courage and stamina he had to tackle all criticalities of life, the way he used to create happiness wherever he goes etc. This place is actually too short to write about him and his greatness.

It is really important that we create good surroundings around kids, set good examples for them, because their brain will automatically be molded by such happenings around them.

I was never forced or scolded for scoring good marks in my childhood. Choosing a career of my own choice, was my choice. Doing and changing jobs in a place of my choice, was my choice. I am so very thankful to God and my parents for making me fortunate enough to get what all is required to live a better life. I have realized that education is must for everybody and particularly for girls. I have chosen the best path of my life, because I had gathered wisdom to perceive things with a very powerful tool called - education. While looking at the unprivileged children on streets, a thought always came to my mind that every child should get atleast elementary education. Maturity comes with age, but perceiving things more wisely and taking a correct decision will come only with the education.

Unfortunately, due to poverty, they remain deprived of basic education. They are forced to become an earning source for their family and become child labourers. There are strict laws around prohibition of child labour, but is this really prohibited in our country. I still see small kids selling flowers on traffic signals, serving tea at tea stalls etc. This is the real problem area, government make laws for providing basic education to all children like shiksha sahyog yojana, sarva shiksha abhiyan, kanya saaksharta protsahan yojna etc. But because parents of these kids are also uneducated, they remain unaware of such benefits. This is where, we, the literate people have to play our roles in guiding them to make them available of their rights to avail such benefits. We should take this as our responsibility for developing a better society and ultimately a better world. Imagine a world, where nobody is illiterate, will that not be a place where there would be less number of crimes and more happiness. This is because there would be no need to do crime as everybody would be in a position to earn their livelihood happily.

Till now, the rich were becoming richer and the poor were becoming poorer. But the air has changed its direction, and now, I hope, with this new concept of demonetization, we will be heading towards a better digital India, where hard earned money will be recognized and black money holders will be penalized. With the digitalization, it has become imperative that everybody gets educated as to how to use internet. Internet is the power of knowledge and with this, one can learn anything and everything available under the sun. The only thing which is required is to make such resources available to these unprivileged children so that they can live an enhanced life. In this rapidly changing technological world, if these kids are left behind, they will never be able to match-up the speed of growing digitization world. It is our duty to take a pledge to educate such unprivileged children.

It is commonly said that books are one's best friends. So let's give good friends (in form of educational books) to such children and provide them the ability and capability to read those books. This will surely make a remarkable change in their lives. Life without education is like fish without water, which cannot survive for longer if it's taken out of water. Let's provide water (i.e. education) to these small cute fishes (unprivileged kids) so as to enable them to lead a better life.



Author is based out of Delhi, and is a Law Graduate and Associate Member of the Institute of Company Secretaries of India.

e-Mail: sandhyatanwar@gmail.com

-00-

EDUCATION OF UNPRIVILEGED CHILDREN

Prof. G.L. Asawa

I am indebted to my parents for living, but to my teacher for living well.

- Alexander the Great

Education can be defined as the process of training of one's head as well as heart so that one equips oneself to effectively deal with different circumstances, people, and challenges that one comes across in one's life, seeks knowledge, information, and skills required for fulfilling one's need, contributes to the well-being of the society with modesty while keeping himself happy as well as contended, besides being able to earn enough for oneself and one's dependents. In addition, education encompasses many other things that can, probably, never be listed in totality. Literacy alone, however, is no education.

Future of a country lies in proper education of its young population. In 2009, Government of India enacted the Right to Education (RTE) act which made education a fundamental right of every child in the age group of 6 to 14 and, thus, paved the way for more learning opportunities at secondary and higher levels. As a result, under Sarva Shiksha Abhiyan, huge investments have been made and 99% of India's rural population has a primary school within about a km. This has resulted in about 95% enrolment level since 2009 and, simultaneously, 55% decline in dropout rate between 2005 and 2014 in the age group 6-14. However, there are still major problems in the implementation of the Act as there are still about 6 million out-of-school children and school completion rates remain abysmal due to the quality of education imparted and other reasons. Very large majority of these out-of-school children belong to the Scheduled Castes, Scheduled Tribes, and BPL families. There is no equity as there is considerable difference between urban and rural education. The same is true for the education received by the rich and the poor.

According to a 2015 Brookings Institute report on primary education in India, 29 per cent of children drop out before completing five years of primary school, and 43 per cent before finishing middle school. High school completion, according to the report, is only 42 per cent. According to the Ministry of Human Resource Development (MHRD), the national dropout rate at the primary level was 4.34 per cent in 2014-15, and it was even higher at the secondary level, at 17.86 per cent. This is, obviously, due to poverty (post-class V, child becomes suitable for earning for the BPL families),

availability and accessibility of schools (post-class V and, especially, for girls as it may be unsafe to send them to schools located at far distances), migration of families, child marriage, lack of school infrastructure such as drinking water and toilets, shortage of trained quality teachers, erratic distribution of learning material (in the form of books/charts etc.) etc. Quality and role of a teacher (like beating students, chatting with colleagues during class hours, asking the students to do personal work, shirking his own duty, sending proxy teachers, sub-contracting one's own appointment as a teacher etc.) contribute a lot in increasing the number of drop-outs. Further, the appointment of untrained teachers, their long distance postings, lack of motivation among teachers, poor accommodation facilities for the teachers, political pressures are the factors responsible for the increased drop-outs. A good teacher is often distracted from teaching because of many non-teaching duties like conducting various kinds of surveys, election duty, census duty, voter identity card duty, opening bank accounts, Aadhar card registration, and managing mid-day meals etc. Number of drop-outs can be reduced by counselling the students and parents (especially the parents of the first generation students), ensuring social inclusiveness with regard to girls and SC/ST children, sensitizing the teachers, removing all the obstacles as listed and not listed above etc. Barring some exceptions, education imparted in such schools is such that it merely makes the students only literate without much attempt to train the head and

About 70 per cent of India's students study in the government schools. Therefore, the first steps should be towards improving infrastructure, teacher quality (through proper training and monitoring their performance besides freeing them from non-teaching duties and providing them with honourable compensation package etc.) and targeted learning for children from disadvantaged and unprivileged groups.

The governmental efforts are being supplemented by various NGOs such as CRY, Smile Foundation etc. and still more efforts are needed, especially, for the unprivileged (among SC/STs, OBCs, dalits, BPL families etc.) children. GOI's ambitious plans to provide proper house to all include construction of housing complexes in all parts of a town/city. If there is no suitable school in the vicinity of that complex for the children of such families who would be residing in those complexes, the complex itself may have the

provision of at least a school for primary and middle school level education.

Prevalent situation regarding the education of the unprivileged children is quite grim. Any effort to meet this challenge shall confront scarcity of the trained and passionate teachers. Requirement of such teachers is astronomic in scale considering the size, spread and terrain of our country. In a scenario when India is on its chosen path to be digital, use of the information technology to connect the students with dedicated teachers through Online Classes is an ideal option. One can create an environment where retired persons can be encouraged to complement in teaching from the comfortable environs of their place of stay and, simultaneously, to multiple locations which are otherwise inaccessible. This will enable the senior citizens to extend their grand-parenting role outside their family as well, thus, fulfilling their social responsibility of caring and sharing. Further, such persons would also contribute towards capability transfer to teachers at school. The proposition is useful from the points of view of the health and longevity of the senior citizens especially the ones who, because of the prevailing circumstances (like children and grand-children living separately in bigger towns or overseas for reasons of career or education prospects) are not living with their children and grand-children under one roof. This kind of movement can be joined by passionate (towards the education of unprivileged children) working professionals in creating IT enabled classes (which are, otherwise also, being created under Digital India programme) as well. The supporting incremental cost of IT upgradation to ambitious and passionate persons coming forward to contribute towards educating unprivileged children is marginal as compared to the gains of this drive.

Education is the passport to the future, for tomorrow belongs to those who prepare for it today

Malcolm X



Author He is currently Research Adviser at SVNIT, Surat. . He was formerly Professor and Head of the Deptt. of Civil Engg, IIT Roorke. During his illustrious career he was engaged in multiple national and international assignments on hydraulic engineering and water resources.

e-Mail ID: gl.asawa46@gmail.com

-00-

GROWING WITH CONCEPTS

Concepts of an expert are not like a static foundation of a huge structure; rather it is like blood flowing in a vibrant mind.

During growing into an expert, each one must have used best of the books available on subject and received guidance of best of the teachers. Authors might have had limitations to take every concept thread bare from first principle and so also must be the constraint of teacher while mentoring a class with a diversity of inquisitiveness and focus. As a result, there are instances when on a certain concept a discomfort remains. The only remedy is to live with the conceptual problem and continue to visualize it thread bare till it goes to bottom of heart and that is an **ingenious illustration**.

In this column an effort is being made to take one topic on Mathematics, Physics and Chemistry in each e-Bulletin and provide its illustration from First Principle. We invite all experts in these subjects to please mail us their ingenious illustrations and it would be our pleasure to include it in the column.

We hope this repository of ingenious illustrations, built over a period of time, would be helpful to ignite minds of children, particularly to aspiring unprivileged students, that we target in this initiative, and in general to all, as a free educational web resource.

This e-Bulletin covers – a) <u>Mathematics</u>, b) <u>Physics</u>, and c) <u>Chemistry</u>. This is just a beginning in this direction. These articles are not replacement of text books and reference books. These books provide a large number of solved examples, problems and objective questions, necessary to make the concepts intuitive, a journey of educational enlightenment.

This column in next Supplementary e-Bulletin due on 1st Febroary'17 shall contain' Basic Calculus' in Mathematics, 'Heat' in Physics and 'Mole Concepts' in Chemistry.

DEMONETIZATION

Shuchi Maitra

Announcement of PM on demonetisation of Rs. 500 and Rs. 1000 currency notes has created a lot of buzz and has become most talked about matter irrespective of age group, business or social segment. This move has got praisers who are welcoming this move and on the other side critics who are finding it hard to accept this change.

So what exactly Demonetisation mean and has this been done before?

Demonetisation is the act of stripping a currency unit of its status as legal tender. Historically, previous Indian governments had demonetised bank notes. In January 1946, banknotes of 1,000 and 10,000 rupees were withdrawn and new notes of 1,000, 5,000 and 10,000 rupees were introduced in 1954. The Janata Party coalition government had again demonetised banknotes of 1,000, 5,000 and 10,000 rupees on 16 January 1978.

Demonetisation is not a new concept for the world as well. There were other nations too that have tried changing their currency in the past. Some of them are Ghana ,Nigeria, Soviet Union, Mayanmar, North Korea.

There are multiple reasons why nations demonetize their local units of currency. Some reasons include to combat inflation, to combat corruption, and to discourage a cash system. The Question that arises is why demonetization was required at this point of time. There are certain Pros and Cons of it.

Pros

Although everyone has their own view point on demonetization however one of the important benefits of it is to drastically impact corrupt practices.

• **Decline in the black money:** One of the main reason for announcement of demonetization by our Prime

mister is to put curb on the black money. Hoarders of Cash are having difficult time as they will not be able to exchange much as they have fear of being penalized by tax authorities.

- Flush out the fake currency existing in the system: For time being all fake notes will be out of the economy for atleast sometime
- **Indirect attack on the terrorism:** These activities will not sustain without the money.
- Move towards a cashless economy: It offers saving on cost of generation, maintaining and handling currency. In addition it adds to traceability of transactions. An important tool of audit and investigation to monitor any kind of misappropriation. Moreover, it creates a psychological restraint on any such temptations.

Cons

There is no doubt that the rate of growth of GDP in the near term will be affected. Around 80 percent of our GDP is contributed by small businesses and demonetisation has affected the liquidity of these businesses in the short term and will remain impacted till all the abrogated notes are replaced. A sudden move like the present one will create uncertainty in the minds of the investors, especially global investors who abhor uncertainty.

Conclusion

There is big speculation on the result of this move however to know actual impact in long run we need to wait and watch. Temporarily there seem to be a spike in the number of digital cashless transaction. But, in next few months the availability of cash will improve and it is to be seen if the momentum of digital transaction is maintained.



Author is a Chartered Accountant by profession with experience of more than a decade and heads the domestic and foreign financial outsourcing department in International Business Advisors Private Limited.

e-Mail ID: grovershuchi21@gmail.com

-00-

A hero is someone who understands the responsibility that comes with his Freedom

Bob Dylan

EDUCATION FOR THE UNPRIVILEGED

Subhash Chawla

There is no denying the fact that the education is birth right of every one. This fact assumes greater importance for those who have not been able to exercise their right to education for their being in the unprivileged class of society and also those who find themselves helpless to educate their children because of many known constraints including poverty.

Education has two stages. One is basic education, and the other is the higher education. As regards basic education, RTE provides for free education to all. Nevertheless ground realities on free education are not commensurate to provisions made by the government . There are always reasons and deficiencies that can be attributed to insufficiency of resources, availability of teachers and infrastructure at schools for unprivileged children unable to attract and retain passionate teachers, migration of educated youth to commercial sectors for a better return and so on so forth. Eventually basic education remains a victim of socioeconomic environment.

As a result of degradation of quality of basic education entrants for higher education are from lower middle class and above, who have tasted benefits of academic degree. Such parents tend to protect and promote acquiring degree by their children by straining their resources to any extent. Eventually there is a race towards commercialization of educational institutes and reap benefits of the same by all the stake holders. This make plight of unprivileged children more retarding as much as essence of education is drifting from competence building to earning potential.

Education in a society is source of energy like blood flowing in a living body. The education has to come out of commercial perspective to become competence building drive. Making students industry ready is last part of education to those who have acquired competence to observe problems, analyze them, think of possible remedies and choose the remedy which is beneficial to the most, feasible and sustainable. Human beings are special creation of GOD to be able to do this, while living for themselves. It, therefore, demands from the section of society which are self-sufficient to evolve result oriented stragies and work towards betterment of education especially for the unprivileged. There are many organizations which are contributing to this cause. One that I had personally experienced is Gyan Vigyan Sarita. Though, it is an infant initiative by a small set of passionate persons visualizing pain of the state of education, I had benefit of knowing my friend, for about Four decades, whose pursuit, knowledge and research for the cause has gone into its making. The essence of its existence is not the resources but, a sense of walking the talk, to the full of honesty and sense of commitment. It practices quote of John F. Kennedy - " don't ask what nation gives you; ask what you give to the nation". Unless everyone feels onus towards state of happening, there cannot be any change. Responsibility of such self-realization rests most on elite section of society.

They have taken this initiative to be their personal responsibility, a true humanitarian religion, to reach out to unprivileged children and mentor them in the truest spirit of education. Pro-action of schools, organizations and individuals to facilitate, promote and enable such a mission, beyond personal preferences and boundaries, is an encouraging signal. This initiative is being mooted and managed with insignificant resources at their command. Their commitment, dedication and perseverance are inspiring. This is without prejudice to many more such initiatives, and their ignorance is confessed with all humility.

In an endeavour to be good to others, there is no competition; all that it demands is only honesty of purpose. More of such people, groups and organization, who espouse for upliftment of unprivileged beyond self, need to come forward and work together to complement capability and constraints of each other; playing jig-saw puzzle in real life, in the spirit of वस्धिव कुटुम्बम.



Author is an Electrical Engineer, who took voluntary retirement as Superintending Engineer, MPEB, at the age of 54 years in the year 2000 in pursuit of his spiritual journey, after completing his family and professional responsibilities. He utilizes a part of his time and energy in social interaction on spirituality and upliftment of values in life.

e-Mail ID: chawlasjabalpur@gmail.com

Happiness is when what you think, what you say and what you are in harmony

-Mahatma Gandhi

ONLINE MENTORING : A VISION

Shailendra Parolkar



There are a lot of successful people in this world who have benefitted from some guidance and mentoring in their early development days and therefore were able to

choose the right path for themselves. They all want to give back but don't know how. They either don't have the time or cannot reach those who need help. I was one of these people until a few months back when Dr. Subhash Joshi contacted knowledge from that dedicated teacher who is so willing to impart the knowledge but has no way to reach the students physically.

There may be initial infrastructure and training issues with online mentoring but we have to understand that we are all surrounded with advanced technology in today's world and we have to embrace it if we want to enjoy the benefits it offers. Internet holds a tremendous wealth of knowledge and the technology provides wonderful collaboration tools with no barriers if there is a willingness to learn and teach. This online mentoring initiative is currently in its infancy and we are trying to understand the challenges and solve them in

me and told me about his wonderful initiative to mentor under privileged children online. I was extremely excited by this opportunity



because I have been teaching high school students Physics and Mathematics for the last few years in my spare time and this was the perfect opportunity for me do something I am passionate about and help the children who need guidance simultaneously. Most people at my age have grown up with traditional class room teaching and think that online classes are no match for that. I would leave that up to debate and say that it depends on various factors. There is no substitute for a physical classroom teaching with a wonderful teacher who can engage the students and generate interest in them for the subject, however, what if that is not the case? What if the teacher is not physically available to mentor the students? Online mentoring gives students, from multiple locations, an opportunity to come together and receive

famousquotes. prepare students for premier joining institutes of higher science, education in technology and other fields but they all come with price а not everybody can afford. Online Mentoring is an incredible way of order to develop it into a full grown model which can support thousands of bright students across the country who are eager to learn and teachers across the world who are willing to bestow their knowledge. There are a lot of coaching institutes which

"Education is the mOsT POwErful Weapon wHiCH you can use to ChAngE the World.

investing in today's youth who has the talent and the will. All they need is a guiding hand to show them the right direction. It will also develop tomorrow's citizens with a sense of responsibility towards their community and can propagate this initiative from generations to generations



Author is an IIT Kharagpur Alumunus'88 and presently IT expert in international plane and is presently at Texas, USA. In his spare time he voluntarily mentors unprivileged students, an initiative of Gyan Vigyan Sarita, in Physics and freely support the initiative with his resources in respect of study material and question banks. He comes from a humble background, and had successfully competed for IIT entrance test to achieve his dreams

e-Mail ID: shailendra.parolkar@gmail.com

-00-

भौतिकशास्त्र : जिला झाबुआ के सन्दर्भ में

महेंद्र कुमार खुराना

एक विषय के रूप में भौतिक शास्त्र विज्ञानं शाखा का सबसे अहम् विषय माना जाता है | अपने 21 वर्ष के व्याख्याता के रूप में अपने करियर की सुरुवात सुदूर ग्रामीण संस्थाओं के साथ-साथ वर्तमान मैं जिला उत्कृष्ट विद्यालय में पदस्थ होकर हर सत्र में क़रीब 90 प्रतिशत आदिवासी समुदाय के बच्चों के बीच भौतिक शास्त्र को पढ़ाने का अन्भव एक अलग ही अन्भूति करवाता है |

इन बच्चों के साथ भौतिक शास्त्र को सरलीकृत कर दैनिक जीवन के उदाहरणों से जोड़कर पढने से काफी आशातीत परिणाम प्राप्त हुए है | प्रारंभिक वर्षों में विज्ञान विषय लेने वाले छात्र-छात्राओं की संख्या बहुत कम रहती थी | परंतु विज्ञान विषय प्रोत्साहन की शासन की विविध नीतियों के फलस्वरूप आज जिले के प्रायः हर हायर सेकेंडरी स्कूल में अधिकाँश बच्चे विज्ञानं की गणित या जीव-विज्ञान संकाय के अध्यनरत विद्यार्थी हैं | 12 वी कक्षा उत्तीर्ण करने के उपरांत आदिवासी समुदाय के अधिकांश छात्र-छात्राएं उच्च अध्ययन हेतु इंजीनियरिंग कॉलेज , विविध ग्रेजुएशन कोर्सेज B.H.M.S, B.A.M.S, नर्सिंग आदि कोर्सेज को नियमित रूप से ज्वाइन करते हैं |

पछले 2 वर्षों से जिला प्रशासन के विविध JEE तथा NEET की बहुआयामी कोचिंग के अच्छे परिणाम भी देल्हने को मिले हैं, तथा विगत दो सालों 2-014-2015 तथा 2015-2016 मैं बच्चों ने IIT तथा मेडिकल कॉलेज में भी प्रवेश पाया हैं |

एक शिक्षक के नाते इन बच्चों में मैंने विषय को समझने की ललक, स्कूल परिवेश तथा सभी शिक्षकों के प्रति सम्मान भाव, तथा सबसे बड़ा पहलू अपनी सांकृतिक जागों से निकटता गहरे में महसूस की है |

अपने संपूर्ण करियर को इन बच्चों के साथ निभाते हुए मुझे सदैव आत्म संतोष का अनुभव होता है |



Author is a Lecturer of Physics at Govt. School of Excellence, Jhabua, with 21 Years of teaching experience. He is M.Sc. (Phy), M.Phil, (B.Ed.). In addition to his teaching work, he is supporting the Online Mentoring initiative at the school as Coordinator for sessions of Physics

--00--

We are to admit no more causes of natural things than such are both true and sufficient to explain their appearances

- Isaac Newton

Contents

गणित एक कला : अधिगम सन्दर्भ में

हरीश कुण्डल

भारत की सभ्यता एवं संकृति अतिप्राचीन और समृद्ध है | गणित भी इस महान विरासत का एक अभिन्न अंग है | इस तथ्य की पुष्टि इस बात से होती है कि विश्व को शून्य भारत ने दिया | गणित हमारे जीवन के लिए बहुउपयोगी है, क्योंकि प्रत्येक व्यावहारिक समस्या का समाधान गणित ने दिया है | इसकी उपयोगिता के आधार पर हम सबका प्रयास हों चाहिए कि हमारे विद्यार्थी गणित मैं बहुत पारंगत हों, लेकिन प्रायः देखने आया है की विद्यार्थी गणित में महसूस करते है आ अपनेपन को सर्वाधिक असहज महसूस करते है | मेरे अनुसार इसकी वजह यह है कि गणित विषय कक्षाओं मैं सैद्धांतिक रूप में पढ़ाया जाता है, जबकि इसे व्यावहारिक तौर तरीके से पढना चाहिए | मसलन यदि 2 और 4 का लघुत्तम समापवर्त्य 4 है जो हर विद्यार्थियों द्वारा ज्ञात तो कर लिया जाता है, किन्तु इसके अवधारणा से वे सदा अपरिचित होते है | इससे गणित विषय के व्यवहारिओ होने की पुष्टि होती है, ऐसे गणित में कई उदहारण है जिन्हें यहाँ समेटना संभव नहीं है |

प्रत्येक समस्या का समाधान प्रस्तुत करने वाला विषय वर्तमान मैं स्वयं अधिगम की दृष्टि से विद्यार्थियों के लिए समस्या के रूप मैं उभर कर आ रहा है। इस समस्या के निराकरण हेतु निम्न उपाय कारगर हो सकते हैं:

- 1. विषय के पाठ्यक्रम के प्रत्येक अंश को व्यावहारिक क्रिया-कलापों से जोड़ना,
- 2. विद्यार्थियों की सहभागिता से क्रियाकलापों को मूर्तरूप देना,
- दैनिक क्रियाकलापों से गणित का सम्बन्ध स्थापित करना (उदहारण के रूप में बाजार से की जाने वाली खरीदी को एकिक नियम से जोड़ना)
- 4. अधिक से अधिक समस्याओं को गणित के पाठ्यक्रम से जोड़कर हल करना,
- 5. शिक्षकों का उद्देश्य पाठ्यक्रम पुअर करना ना होकर विद्यार्थियों को अधिगम तक पहूँचाना होना चाहिए |

उपरोक्त उपाय कक्षागत गणित अधिगम को न केवल रोचक बनायेंगे वरन अधिगम वातावरण की शुष्कता को भी काम करेंगे । इस प्रयास में तकनिकी का उपयोग भी अधिगम में सहायक हो सकता है, विशेषकर ग्रामीण अंचलों में इसका लाभ विद्यार्थियों को मिला सकता है । ऐसा एक निःशुल्क रूप से स्वयंसेवी प्रयास जो व्यक्तिगत सामाजिक जिम्मेदारी अनुभव करते हुए कुछ नॉएडा (राष्ट्रीय राजधानी क्षेत्र) स्थित संभ्रांत व्यक्तियों द्वारा निजी स्तर चलाया जा रहा है । इस प्रयास में कुछ प्रबुद्ध जन, सूचना-प्रौद्योगिकी का सहारा लेकर इन्टरनेट के माध्यम से, हमारी शाला के विद्यार्थियों को गणित और भौतिक शास्त्र को समझने के प्रयास में नियमित रूप से मार्गदर्शन करने हेतु तत्पर एवं उपलब्ध रहते है । इस प्रयास में, जिला प्रशासन के प्रोत्साहन से, हमारी शाला, शासकीय उतृष्ट उच्चतर माध्यमिक विद्यालय, झाबुआ एक कड़ी बन गयी है, जो इन ग्रामीण और आदिवासी अंचल के विद्यार्थियों के लिए एक मील का पत्थर साबित हो सकता है ।



Author is Senior Lecturer of Mathematics, at Govt. School of Excellence, Jhabua. In addition to his assignments in school he has volunteered to be Principal Coordinator for Online Mentoring initiative at the school.

e-Mail ID: harishkundal1973@gmail.com

-00-

ON LINE TEACHING CLASSES : A BOON FOR THE NEEDY CHILDRN

Smt. Kiran Shrivastava

On Line Classes are is a new idea to teach children in backward and unapproachable places. On line teaching play on important role for the student who are unprivileged children, at the same time those persons who have a liking for teaching but unable to move out of their homes can participate in such classes. It thus helps to compensate non-availability of teachers in backward places to see that children at such places are not left behind

Students such they make a dream or an aim of life such as to become a Doctor or an Engineer is like making a plan for future. Making such 'Goal Setting' and reaching it requires working step-by-step and it can not be achieved suddenly just after dreaming. This is a journey in education and to make an achievement one has to have a long=term vision, motivation and guidance of experts in subjects needed for it.

There is no substitute to direct class-room teaching. But, Online classes is a resource through which students who live in villages and small cities get an opportunity to discover their abilities and raise confidence to make a goal and work to achieve, by deriving inspiration and guidance from persons from outside. There is no substitute to direct class-room teaching. Through Online classes teaching to students sitting in different class-rooms or places can be done at a time by one teacher. Presence of local teacher in the class helps to tell the Online Teacher about difficulties of students and explain students in their local language. In the process, local teachers also get an opportunity to develop a capability and continue the chain to connect more schools.

Student, in schools, who get benefit of Online classes need not go to big educational institutes to fulfill their dreams. Such students without leaving their school and home can learn and prepare for competitive examinations. In Online classes using internet and computer class-room and teacher are connected. At class-room, computer screen is enlarged using a projector so that all students sitting in the class room can view what is being taught. Additional speakers connected to computer help students to listen r=to voice of Online Teacher. Microphone of computer is helpful for students and local teacher to ask question, put up their difficulties and even reply to the Online teacher. Thus the Online classes give an opportunity of direct interaction which makes this experience different from video lectures or telecasting of such videos. Now-a-days lot of good teaching material is available on internet, books, CDs and videos some is free and some are on payment of charges. It provides lots of tips to problems solving. But, the real challenge arises when students come across difficulties to understand them, and he is left with no choice but to mug up.

It is generally seen that students in remote and small places experience difficulties and unable to solve them with the available local help and guidance. Through Online classes learned professors and teachers from IITs and reputed institutions, retired teachers, engineers, and doctors can help to create curiosity among students, who never have an opportunity to even see such persons. These experts can help students to understand concepts and solve problems.

Recently a new voluntary initiative of Online Mentoring has started at Jhabua where persons from IITs, sitting at Delhi, are trying to develop students right from concept building and help them to solve problems. Local subject teachers are coordinating each session of mentoring. This new initiative has created a lot of hope and excitement among students and teachers. This initiative is also receiving lot of encouragement of district administration. This opportunity creates an optimism towards educational development of Jhabua, a tribal district in Madhya Pradesh.



Author is Head Mistress, at Govt. Girls Higher Secondary School, Jhabua. She is M.S.c (Zoology), MA (English-Literature) and B.Ed. She has a teaching Experience of 24 years.

-00-

GROWING WITH CONCEPTS - Mathematics

COORDINATE GEOMETRY: STRAIGHT LINE

Prof. SB DHAR

INTRODUCTION

Rene Descartes (1596-1650) was a French Mathematician who is credited as the father of Analytical Geometry, bridge between Algebra and Euclid Geometry. This Analytical Geometry is called in plane language, Coordinate Geometry.

He used two mutually perpendicular lines to divide the plane into four equal parts. He named the horizontal line as **x-axis (abscissa)** and the vertical line as **y-axis (ordinate)**.

Example:1



Example:2

The parts of the plane divided by these lines in four equal parts were named as 1st Quadrant, 2nd Quadrant, 3rd Quadrant and 4th Quadrant, respectively in anticlockwise direction starting from the right side.

2nd *4 Quadrant *2 '1	1st Quadrant
* 5 ·4 ·3 ·2 ·1 0	·' ·2 ·3 ·4 ·5
3rd -2 Quadrant 4	4th Quadrant

The intersection point of the **abscissa** and the **ordinate** was called **Origin**. This is the most important point on the plane because all the journeys to fix the points on the plane start from the origin.

The right side on the x-axis from the origin was assumed to be the Positive side (+), the Left side on the x-axis, the Negative side (-), the up side on the y-axis as Positive (+) and the downward on the y-axis as Negative side (-).

To denote a point on the plane, two things are required: One the distance on x-axis with directional sign (+ or -)and the other one the distance along y-axis with directional sign. **This ordered pair is called coordinates of the point and represented as (x, y)**. **x** is called the abscissa part and **y** is called the ordinate part of the point. This is an ordered pair because the first part is always a distance on x-axis and the second a distance on y-axis. If some part is not there, it is denoted by zero (o).

Example:3

The point **P** (6, 0) is on x-axis. It is on the right side of the origin. P covers +6 units distance on x-axis and 0 units distance on y-axis.



Example:4

The point **P** (**0**, **3**) is on y-axis. It is on the upper side of origin. The distance covered on x-axis is 0 and the distance on y-axis is +3 units above the origin.



OX is (+) side, OX' is (-) side. OY is (+) side and OY' is (-) side.

Example:5

Points in different Quadrants with different signs show their positions.

	(-	2,3			(2,3)		
	(-3	-2)			(3	-2)	
Ш							IV

Example:6

The signs of abscissa and the ordinates of the points in the corresponding Quadrants are shown below:

Ist Q (+, +);
$$2^{nd}$$
 Q (-, +); 3^{rd} Q(-, -); 4^{th} Q(+, -)

$$x \xrightarrow{(-,+)}{(+,+)} x$$

SECTION FORMULAE

If the coordinates of the points A is (x_1, y_1) and B (x_2, y_2) then the coordinates of the point P dividing the line segment AB into the ratio m:n is given by

$$\left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right).$$

Here the point P lies inside the line segment AB. It is also called internal division.

If the point of division P is outside the line segment AB i.e. P is dividing externally, then n becomes negative and the coordinates of point P becomes as below:

$$\left(\frac{mx_2-nx_1}{m-n},\frac{my_2-ny_1}{m-n}\right).$$

DISTANCE BETWEEN TWO POINTS

Distance between two points $A(x_1, y_1)$ and $B(x_2, y_2)$ is given by

AB =
$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
.

The distance is always positive (+).

AREA OF A TRIANGLE

Shoelace formula Or Gauss formula



The area of the triangle ABC

$$=\frac{1}{2}[x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)]$$

$$= \frac{1}{2} \begin{bmatrix} x_1 & x_2 & x_3 & x_1 \\ y_1 & y_2 & y_3 & y_1 \end{bmatrix}$$
$$= \frac{1}{2} \begin{bmatrix} x_1 y_2 + x_2 y_3 + x_3 y_1 - x_2 y_1 - x_3 y_2 - x_1 y_3 \end{bmatrix}$$
$$= \frac{1}{2} \begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$$

AREA OF A QUADRILATERAL



Area of a quadrilateral with vertices $A(x_1, y_1)$, $B(x_2, y_2)$, $C(x_3, y_3)$, $D(x_4, y_4)$ in continuation is given by

$$= \frac{1}{2} \begin{bmatrix} x_1 & x_2 & x_3 & x_4 & x_1 \\ y_1 & y_2 & y_3 & y_4 & y_1 \end{bmatrix}$$
$$= \frac{1}{2} \begin{bmatrix} x_1 y_2 + x_2 y_3 + x_3 y_4 + x_4 y_1 - x_2 y_1 - x_3 y_2 - x_4 y_3 - x_1 y_4 \end{bmatrix}$$

SLOPE OF A LINE

The slope of a line is defined as the ratio of the rise and the run of the point on a plane.

$$slope = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$$

It is also called **gradient**. It is a real number. Its value can be anything, i.e. positive, zero or negative.



The slope is always calculated with respect to the positive direction of x-axis.

If the line is inclined with the positive side of x-axis in the angle θ , the value of the slope of the line is given by $tan\theta$. In general, it is denoted by m.

The inclination and the slope are different. The inclination is the angle made by the line and the slope is the value of tangent of that angle made by the line with the positive side of the x-axis in the anticlockwise direction.

(a) Angle with axis



When the angle made by the line with the positive direction of x-axis in anticlockwise direction is an acute angle like α , the slope **tan** α is **positive**. When the angle made is obtuse as β , then the slope **tan** β is **negative**. Examples:

- 1. If a line makes an angle of 60° with the positive side of x-axis in the anticlockwise direction, then the slope of this line will be tan 60° .
- 2. If a line makes an angle of 60° with the negative side of x-axis in clockwise direction, then the slope of the line will be tan (180°-60°) because the line is making 120° with the positive side of x-axis.
- 3. If a line makes an angle of 60° with the negative side of x-axis in anticlockwise direction, then the slope of the line will be tan ($180^{\circ}+60^{\circ}$).
- 4. If a line is making angle of 60° with the positive side of y-axis in anticlockwise direction, then the slope of the line will be tan ($90^{\circ}+60^{\circ}$).
- 5. If a line is making an angle of 60° with the positive side of y-axis in the clockwise direction, then the slope will be tan (90° - 60°).
- 6. If a line makes an angle of 60° with the negative side of y-axis in the anticlockwise direction, then the slope of the line will be tan $(180^{\circ}+90^{\circ}+60^{\circ})$.
- 7. If a line is making an angle of 60° with the negative side of y-axis in clockwise direction, then the slope of the line will be tan (180°+90°-60°).

(b) Two points given

When the value of the angle made by the line with axes is not known, and the coordinates of the two points on the line are known, then the slope is calculated as

$$m = \tan \theta = \frac{y_2 - y_1}{x_2 - x_1}$$



Slope of line L is given by :

$$m_{AB} = \tan \theta = \frac{y_2 - y_1}{x_2 - x_1} = \frac{9 - 6}{6 - 3} = 1$$

It means the line makes an angle of 45° with the positive side of x-axis in the anticlockwise direction, or the slope is 1.

(c) Equation of a line given

When the equation of a line is given, the slope is calculated by the following way:

Let the equation of the line be *ax+by+c=o*.

The slope is given by the value of
$$-\frac{coefficient of x with proper sign}{coefficient of y with proper sign} = -\frac{a}{b}$$

Note:

- (a) When the lines are parallel to each other, their slopes are equal.
- (b) When the lines are perpendicular to each other, the product of their slopes is always equal to -1.
- (c) When a line is parallel to x-axis, the slope is o.
- (d) When a line is perpendicular to x-axis, the slope is said to be undefined, but for calculation purposes, it is taken to be ¹/₀ and not ∞.
- (e) The three points are called to be collinear when the slopes of each of the twos are equal, i.e. A, B, C are collinear iff $m_{AB} = m_{BC} = m_{AC}$.
- (f) The three points are called to be **collinear** when the area of $\triangle ABC=0$.
- (g) The three points are called to be

Collinear when either of the points divide the line segments made by the other twos externally or internally. For example, A, B, C are collinear if B divides the line segment AC, or A divided line segment BC, of C divides line segment AB.

EQUATION OF A LINE

Equation of a line is unique. The two conditions are required to determine the equation of a line. These two conditions may be

- (a) Line is parallel to either of the axes.
- (b) Line is passing through a point and its inclination or slope is known.
- (c) Line is passing through two points.
- (d) Line makes intercepts with axes.
- (e) The length of perpendicular to the line from the origin and its inclination with positive side of x-axis in the anticlockwise direction is known.

(a) Equation of a line Parallel to x-axis



When the line parallel to x-axis is at a distance **b** from xaxis, the equation of such line is given by y = b. If **b** is in the positive direction, it is y = +b and if it is in the negative direction, it is given by y = -b.

(f) Equation of a line Parallel to y-axis



When the line is parallel to y-axis and it is at a distance a from it, the equation of this line is given by x = a. If this line is on the right side of y-axis, its equation is given by x = +a and if it is on the Left side of y-axis, then it is given by x = -a.

(g) Equation of a line when a point on the line is given and the slope of the line is known Point-Slope Form



Let a point on the line be (x, y). The slope of the line segment joining (x_1, y_1) and (x, y) will be $m = \frac{y-y_1}{x-x_1}$ Or, $(y - y_1) = m (x - x_1)$

Two-Point Form



If the line passes through the two points (x_1, y_1) and (x_2, y_2) .

Then its slope is
$$m = \tan \theta = \frac{y_2 - y_1}{x_2 - x_1}$$

If a general point on the line be (x, y), then the slope of line segment joining (x, y) and (x_1, y_1) will also be

$$m = \tan \theta = \frac{y - y_1}{x - x_1}$$

Hence $\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$
Or, $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1} (x - x_1)$

(h) Slope-Intercept Form

Case I: When the intercept with y-axis is positive



If the slope of the line is **m** and the intercept with y-axis is **c**, then $m = \tan \theta = \frac{y-c}{x}$ Or, *y***-c=mx** or *y***=mx+c**

Note:

The intercept with x-axis in this case can be calculated by putting $\boldsymbol{y} = \boldsymbol{o}$ in the equation, i.e., $x_0 = -\frac{c}{m}$. Here c and m will be with their proper signs.

Case II: When the intercept with y-axis is negative



$$m = \tan \theta = \frac{y+c}{r}$$

Or, y=mx-c, where c is with proper sign i.e. below origin.

(i) Intercept Form



The line AB is passing through the two points A (a, o) and B (o, b). Using two points form of the equation of the line, it is $\frac{x}{a} + \frac{y}{b} = 1$. Here, intercepts **a** and **b** are with their proper signs.

(j) Normal Form



The equation of the line AB is in the form of p (the perpendicular distance from the origin to the line) and angle α made by the perpendicular with the positive side of x-axis in the anticlockwise direction is given by :

$x\cos\alpha + y\sin\alpha = p$.

Note: p is always taken to be positive as the distance is conventionally considered positive.

This equation is derived using two-point form or intercepts form.

OA is hypotenuse of the right angled \triangle ODA.

From $\triangle ODA$, $\angle ODA=90^{\circ}$.

$$\cos \alpha = \frac{p}{OA} \Longrightarrow OA = \frac{p}{\cos \alpha}$$

OB is the hypotenuse of the Right angled $\triangle ODB$.

From $\triangle ODB$, $\angle ODB=90^{\circ}$ and $\angle OBD=\alpha$,

$$\sin \alpha = \frac{p}{OB} \Longrightarrow OB = \frac{p}{\sin \alpha}$$

Using intercepts form, the equation of AB is given by

$$\frac{x}{OA} + \frac{y}{OB} = 1 \Longrightarrow \frac{x}{p/\cos\alpha} + \frac{y}{p/\sin\alpha} = 1$$

Or, $x\cos\alpha + y\sin\alpha = p$

GENERAL EQUATION OF A LINE

All the forms of the equation of a line are in One degree in x and y. We may say that One degree equation in x and y will represent always a line. This is the reason, one degree equation is also called linear equation.

The general equation of One degree is written as Ax+By+C=o, where A, B, C are real numbers.

Conversion of Ax+By+C=o in

(a)
$$y=mx+c$$
 form: $y=-\frac{A}{B}x-\frac{C}{B}$.

(b) Intercepts form:
$$\frac{x}{(-C/A)} + \frac{y}{(-C/B)} = 1$$

(c) Normal form:

$$\frac{-Ax}{\sqrt{A^2 + B^2}} + \frac{-By}{\sqrt{A^2 + B^2}} = \frac{C}{\sqrt{A^2 + B^2}}$$

Or, $x \cos \alpha + y \sin \alpha = p$ where $\cos \alpha = \frac{-A}{\sqrt{A^2 + A^2}}$

$$\sin \alpha = \frac{-B}{\sqrt{A^2 + B^2}}$$
, and $p = \frac{C}{\sqrt{A^2 + B^2}}$.

Note: Keep p always positive and then evaluate value of angle α , otherwise the equation conversion will not be correct.

DISTANCE OF A POINT FROM A LINE

Distance of a point (x_1, y_1) from a line Ax+By+C=o means perpendicular distance of a point from the line. It is given by

$$d = \left| \frac{Ax_1 + By_1 + C}{\sqrt{A^2 + B^2}} \right|$$

Note: distance should always be taken positive.

Distance between two parallel lines

Let the equation of the lines be $y=mx+c_1$ and $y=mx+c_2$.

$$d = \left| \frac{c_1 - c_2}{\sqrt{1 + m^2}} \right|$$

LOCUS AND EQUATION OF LOCUS

Locus is defined as the path traversed by the point.

The following rules are followed to find the equation of the locus of the point.

(a) Assume the point to be (h, k) whose locus is to be determined.

- (b) Fulfill the conditions given for the movement of the point.
- (c) Simplify the equation generated in step b.
- (d) Replace *h* by *x* and *k* by *y*.
- (e) The equation in x and y is the required equation of the locus of the point.

Example 7:

Find equation of the locus of the centroid of the triangle whose vertices are (*a cost, a sint*), (*b sint, -b cost*) and (1, 0); *t* being a parameter.

Solution:

Let the centroid be (h, k), then

$$h = \frac{a\cos t + b\sin t + 1}{3}$$
, and $k = \frac{a\sin t - b\cos t + 0}{3}$

Or, $a\cos t + b\sin t = 3h - 1$, and $a\sin t - b\cos t = 3k$

On solving these equations, we get

$$\sin t = \frac{3bh + 3ak - b}{\sqrt{a^2 + b^2}}$$
, and $\cos t = \frac{3ah - 3bk - a}{\sqrt{a^2 + b^2}}$

Using the identity,

 $\sin^2 t + \cos^2 t = 1$, we get

$$(1-3h)^2 + 9k^2 = (a^2 + b^2)$$

The required locus is found by replacing h by x and k by y as $(1-3x)^2 + 9y^2 = (a^2 + b^2)$

INTERSECTION OF TWO GIVEN LINES

Point of Intersection of two lines is calculated by solving the equation of the lines for x and y.

The coordinates of point is given by (x, y).

Let the lines be $a_1x+b_1y+c_1=o$ and $a_2x+b_2y+c_2=o$.

These lines will be

(a) Parallel and distinct iff
$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

(b) Coincident iff $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$
(c) Intersecting iff $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

Example:8

Find the point of intersection of the lines $y = \frac{1}{2}x + 2$ and

y = -x + 5.



Obviously, x=2 and y=3. So the point of intersection is (2, 3).

Example:9

If the lines x+3y-9=0, 4x+by-2=0, and 2x-y-4=0 are concurrent, then find the equation of the line that passes through the point (b,o) and concurrent with the given lines.

Solution:

Given that the three lines

x+3y=9	(i)
2x-y=4	(ii)
4x+by=2	.(iii)

are meeting at one point. To find out this meeting point, let us solve equations (i) and (ii).

x=3, y=2. So, the point is (3, 2).

Line (iii) also passes through (3, 2) hence b=-5.

Now equation of the line that passes through (b, 0) or (-5, 0) and point of concurrency (3, 2) is

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1} (x - x_1)$$

Or, $y - 0 = \frac{2 - 0}{3 - (-5)} (x - (-5)) = \frac{2}{8} (x + 5)$

Or,
$$4y - x = 5$$

IMAGE OF A POINT

Image of a point means the plane mirror image.

For example, we know that the plane mirror image is always at the same distance from the object at which it is at a distance from the mirror.

We shall study here the three cases of the images:

(a) Image of a point about x-axis

Let a point be (2, 3). Obviously, this point is at a distance 2 from y-axis and at a distance 3 units from x-axis. If we want its image about x-axis, it means x-axis should work as a plane mirror, i.e., the point in First Quadrant will image in IV Quadrant. It means only the ordinate part of the coordinates will change to negative. Hence the image of (2, 3) in x-axis will be (2, -3).

Similarly, the image of (2, -3) will be (2, 3); image of (-2, 3) will be (-2, -3); image of (-2, -3) will be (-2, 3).

(b) Image of a point about y-axis

Image about y-axis means, y-axis will work as plane mirror. Hence the x coordinate of the point will change to negative.

For example:

Image of (2, 3) about y-axis will be (-2, 3); image of (-2, -3) will be (2, -3).

(c) Image of a point about a line

Consider a point (x_1, y_1) and the line be ax+by+c=o. Here the line will work as a plane mirror. Let the mirror image of the point be (x', y'). The line segment joining (x_1, y_1) and (x', y') be perpendicular to the given line ax+by+c=o.

The image coordinates can be calculated by the following formula:

$$\frac{x'-x_1}{a} = \frac{y'-y_1}{b} = -\frac{2(ax_1+by_1+c)}{a^2+b^2}$$

Note: *a*, *b*, *c*, *x*₁, *y*₁ will be taken with proper sign.

IMAGE OF A LINE ABOUT X-AXIS

Let the line be ax+by+c=0. Its image about x-axis will be ax-by+c=0. Only y will change from positive to negative or vice-versa.

Image of a line about y-axis

Let the line be ax+by+c=0. Its image about y-axis will be -ax+by+c=0. Only x will change from positive to negative or vice-versa.

IMAGE OF A LINE ABOUT A LINE

Let the line be ax+by+c=0 and the line about which the image is to be found is Ax+By+C=0. If the reflected line is a'x+b'y+c'=0, then the line Ax+By+C=0 will be the internal bisector of the angle made by the lines ax+by+c=0 and a'x+b'y+c'=0.

This can be theoretically, very easily be calculated if we could find the two distinct points on the given line. By this we shall find out their images in two points and then a line passing through those two points.

Example:10

Find the distance from the origin to the image of (1, 1) with respect to the line x+y+5=0.

Solution:

First find the image of the point (1, 1) w.r.t the line x+y+5=0 using the formula

$$\frac{x - x_1}{a} = \frac{y - y_1}{b} = -\frac{2(ax_1 + by_1 + c)}{a^2 + b^2}$$

Here (x, y) is the image of (x_1, y_1) , or

x₁=1, y₁=1, a=1,b=1,c=5

Hence
$$\frac{x-1}{1} = \frac{y-1}{1} = -\frac{2(1+1+5)}{1+1} = -7$$

Or, x=-6, y=-6

Now the distance between (0, 0) and (-6, -6) is given by $6\sqrt{2}$ using distance formula $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

ANGLE BETWEEN TWO LINES



Consider the two lines L_1 and L_2 .

 L_1 makes α_1 angle with x-axis and L_2 makes α_2 with the positive side of x-axis.

Let slopes be m_1 =tan α_1 and m_2 = tan α_2 .

The angle between L_1 and L_2 is either ϕ or θ as shown in the figure.

Obviously,

$$\alpha_1 + \theta = \alpha_2 \Longrightarrow \theta = \alpha_2 - \alpha_1; \ \theta = 180^\circ - \phi$$

Or,
$$\tan \theta = \tan(\alpha_2 - \alpha_1) = \frac{\tan \alpha_2 - \tan \alpha_1}{1 + \tan \alpha_2 \tan \alpha_1}$$

$$=\frac{m_2 - m_1}{1 + m_2 m_1} \qquad ...(i)$$

And,
$$\tan \phi = \tan(180^\circ - \theta) = -\tan \theta = \frac{m_2 - m_1}{1 + m_2 m_1}$$

$$\Rightarrow \tan \theta = -\frac{m_2 - m_1}{1 + m_2 m_1} \qquad \dots (ii)$$

On combining results (i) and (ii),

$$\tan\theta = \pm \frac{m_2 - m_1}{1 + m_2 m_1}$$

SHIFTING OF ORIGIN OR CHANGE OF ORIGIN

Shifting of origin means the whole coordinate system is moved to some other point keeping the axes intact.



Some problems need shifting of origin to be solved comfortably. For this we follow the following rules:

- (a) Let the new origin be (h, k)
- (b) Let the new coordinates of the point be (x', y')
- (c) Let the original coordinates of the point be (x, y)
- (d) The inter-related formula is x'=x-h and y'=y-k.
- (e) The new coordinates w.r.t the new origin (h, k) of the old point (x, y) will be (x-h, y-k)

Example:11

Find the new coordinates of the point (3, 5) when the origin is shifted to (1, -3).

Here, x=3, y=5, h=1, k=-3

Let the new coordinates of the point be (x', y')

x'=x-h, y'=y-k

Hence, x'=3-1=2 and y'=5-(-3)=8 i.e., (2, 8)

Example:12

Write the new equation of the straight line 4x+5y-7=0 when the origin is shifted to (4, 6).

Here, we have to write the equation in the form of x' and y'.

So, x=x'+h and y=y'+k

Or, x=x'+4 and y=y'+6

Hence 4x+5y-7=0 becomes $4(x'+4)+5(y'+6)-7=0 \Rightarrow 4x'+5y'+39=0$

ROTATION OF AXES

Rotation of axes means the origin is at its point and the axes are rotated through some angle clockwise or anticlockwise.

Position of a point when the axes are rotated



Let the axes be rotated through an angle θ in anticlockwise direction. Let the original axes be blue lined and the new be red lined.

Let the old coordinates be (x, y) and the new coordinates be (x', y').

$$x' = x\cos\theta + y\sin\theta$$

 $y' = -x\sin\theta + y\cos\theta$

And

 $x = x' \cos \theta - y' \sin \theta$

 $y = x'\sin\theta + y'\cos\theta$

Example:13

If the coordinate axes are rotated through 45° in anticlockwise direction then write the new coordinates of (2, 6).

Solution13:

Given: x=2, y=6, θ=45°

$$x' = x\cos\theta + y\sin\theta = 2\cos 45^\circ + 6\sin 45^\circ$$

$$=2\left(\frac{1}{\sqrt{2}}\right)+6\left(\frac{1}{\sqrt{2}}\right)=\sqrt{2}+3\sqrt{2}$$
, and

$$y' = -x\sin\theta + y\cos\theta = -2\sin 45^\circ + 6\cos 45^\circ$$

$$= -2\left(\frac{1}{\sqrt{2}}\right) + 6\left(\frac{1}{\sqrt{2}}\right) = -\sqrt{2} + 3\sqrt{2}$$

i.e., the new coordinates will be $(\sqrt{2} + 3\sqrt{2}, -\sqrt{2} + 3\sqrt{2})$.

Example:14

If the coordinate axes are rotated through an angle 30° about the origin, then transform the equation: $\sqrt{3}x^2 - 4xy + \sqrt{3}y^2 = 0$.

Solution14:

 $x = x'\cos\theta - y'\sin\theta$ and $y = x'\sin\theta + y'\cos\theta$ where $\theta = 30^{\circ}$

$$x = x'\cos\theta - y'\sin\theta = x'\cos 30^{\circ} - y'\sin 30^{\circ} \qquad \text{or}$$
$$x = x'\left(\frac{\sqrt{3}}{2}\right) - y'\left(\frac{1}{2}\right) = \frac{\sqrt{3}x' - y'}{2}$$

$$y = x'\sin\theta + y'\cos\theta = x'\sin 30^{\circ} + y'\cos 30^{\circ}$$
 or

$$y = x'\left(\frac{1}{2}\right) + y'\left(\frac{\sqrt{3}}{2}\right) = \frac{x' + \sqrt{3}y'}{2}$$

Replacing x and y in the given equation $\sqrt{3}x^2 - 4xy + \sqrt{3}y^2 = 0$

We get,
$$\sqrt{3}\left(\frac{\sqrt{3}x'-y'}{2}\right)^2 - 4\left(\frac{\sqrt{3}x'-y'}{2}\right)\left(\frac{x'+\sqrt{3}y'}{2}\right) + \sqrt{3}\left(\frac{x'+\sqrt{3}y'}{2}\right)^2 = 0$$
 Or, $\sqrt{3}y'^2 - x'y' = 0$

The shortest distance between two points is a straight line.

Archimedes



Dr S.B. Dhar, is **Editor of this Quartrerly e-Bulletin**. He is an eminent mentor, analyst and connoisseur of Mathematics from IIT for preparing aspirants of Competitive Examinations for Services & Admissions to different streams of study at Undergraduate and Graduate levels using formal methods of teaching shared with technological aids to keep learning at par with escalating standards of scholars and learners. He has authored numerous books – Handbook of Mathematics for IIT JEE, A Textbook on Engineering Mathematics, Reasoning Ability, Lateral Wisdom, Progress in Mathematics (series for Beginner to Class VIII), Target PSA (series for class VI to class XII) and many more.

e-Mail ID: maths.iitk@gmail.com

--00---

											_			
L	А	Х	F	К	Р	D	V	В	R	U	V	D	Х	Q
В	А	R	Е	L	I	R	А	Т	Н	W		U	С	R
R	D	L	А	٧	В	I	Q	L	S		S	Н	G	В
0	Μ	Х	D	А	Ι	Е	Q	R	А	Т	L	А	М	L
L	0	Q	М	Ν	К	F	E	А	I	Н	Е	А	G	G
Х	R	В	Ι	А	А	G	Υ	F	С	-	L	Р	L	W
R	0	А	L	R	Ν	Н	J	Т	Ν	-	H	Z	Υ	А
0	А	К	0	А	-	G	Т	Y	R	Μ	G	L	К	W
V	٧	Ν	Н	Ν	Р	Н	0	А	Е	0	-	К	R	W
К	J	А	А	G	В	٧	J	E	Т	Р	F	U	С	В
D	J	Υ	L	Р	Ν	Р	К	0	S	J	V	Х	Z	Q
_	Q	F	Z	U	U	К	Ι	S	E	W	S	R	С	W
R	-	V	Т	R	W	R	Н	0	W	D	В	Z	J	L
L	V	Ι	S	А	٧	Ι	D	А	W	Y	Х	R	٧	U
R	Х	Z	В	R	R	Р	Т	F	D	Y	Ν	W	V	Ν

JHABUA: WORDS PUZZLE

Search the following words in the Puzzle:

ALIRAJPUR	BAMBOO	ADIVASI	WESTERN
BHILALA	DEOJHIRI	BARELIRATHWI	FORTYFIVE
JAHANGER	FIVE	MANGOES	RANAPUR
KVKLAKE	RATLAM	THANDLA	RANGPURA



CROSS-WORD PUZZLE ON STRAIGHT LINE: Jan'17

ACROSS

- 3: Coplanar and non-intersecting lines
- 6: A line that intersects a curve
- 8: Degree of slope
- 9: Lines in different planes, neither Parallel nor intersecting
- 12: Lines at equal distance
- 13: Father of Coordinate Geometry
- 14: Equal in all respects

DOWN

- 1: Distance from origin to the point where curve or line Intersects the axis
- 2: Line touching a curve at single point
- 4: Slope of line
- 5: Curve having no curvature
- 7: Part of a line
- 10: Mathematician defining line as "breadth less length"
- 11: A hlf-line

(Answer to this Crossword Puzzle shall be provided in 1st Suoolement to Qarterly e-Bulletin No 2, Dt. 1st Feb'17)

--00---

INVITATION FOR CONTRIBUTION OF ARTICLES

Your contribution in the form of an article, story poem or a narration of real life experience is of immense value to our students, the target audience, and elite readers of this Quarterly monthly e-Bulletin **Gyan-Vigyan Sarita**: शिक्षा, and thus create a visibility of the concerns of this initiative. It gives them a feel that you care for them, and they are anxiously awaiting to read your contributions. We request you to please feel free to send your creation, by <u>20th of this</u> <u>month</u> to enable us to incorporate your contribution in next bulletin, <u>subhashjoshi2107@qmail.com</u>.

We will be pleased have your association in taking forward path our plans as under-

- Next monthly Supplement to Quarterly e-Bulletin Gyan-Vigyan Sarita: 創細 shall be brought out 1st Feb'16
- > And this cycle monthly supplement to Quarterly e-Bulletin <u>Gyan-Vigyan Sarita: शिक्षा</u> shall continue endlessly

We believe that this quarterly periodicity of e-Bulletins shall make it possible for our esteemed contributors to make contribution rich in content, diversity and based on their ground level work.

__00__

ABOUT US

This is an initiative, not an abrupt eruption, but driven by spirit of returning back to society with a spirit of Personal Social Responsibility (PSR) by a team of co-passionate persons who have survived many decades of rough weather conditions. It is not an organization, and it aims at Democratization of Education, in spiritual sense.

It works on non-remunerative, non-commercial and non-political manner. Its financial model is based on Zero-Fund-&-Zero-Asset, wherein participation is welcome from those who wish to contribute, with तन और मन. As and when the feel need of धन to supplement the initiative ownership of Funds and Assets is theirs, we are just user if it.

OUR MENTORING PHILOSOPHY: Mentoring is not teaching, neither tuition nor coaching. It is an activity driven by passion and commerce has no place in it. In this effort is to caution students that -

- This place is not where they will be taught how to score marks and get higher ranks, but to conceptualize and visualize subject matter in their real life so that it becomes intuitive.
- This place is not to aim at solutions but inculcate competence to analyze a problem and evolve solution.
- This place does not extend selective and personalized attention, rather an opportunity to become a part of which is focused on learning and problem solving ability collectively.
- This place provides an opportunity to find students above and below one's own level of learning. Thus students develop not in isolation but learn from better ones and associate in problem solving to those who need help. This group dynamics while create a team spirit, an essential attribute of personality, while one learns more by teaching others.
- This place has strategically chosen Online Mentoring, so that those who are unprivileged can gather at one point and those who can facilitate learning of such students by creating, necessary IT setup. Aseperate <u>Mentor's Manual</u> is being developed to support the cause.
- We are implementing this philosophy through **<u>Online Mentoring</u>**

--00---

GROWING WITH CONCEPTS- Physics

Mechanics-IV: FLUID MECHANICS

Dr Subhash Kumar Joshi

Understanding of nature of fluids dates to prehistoric period and is evident from evolution of boat, syringe (गिचकारी), use of water for irrigation etc. It got formalized by Archimedes, Pascal and many more scientists. In

study of mechanics till now we consides matter as a rigid body, which has negligible relative displacement between various parts of the rigid body. Here negligible displacement refers to deformation in solid under application of an external force, otherwise within the volume of solid even at atomic level relative position remains unchanged with negligible molecular space. This is referred to as molecular bonding, which assigns it a property of retaining shape. But, fluids have large inter-molecular space where molecular bounding is feeble. As a result firstly molecules perform random chaotic motion and velocity of molecules performing such motion is a dependent upon internal energy. This internal energy, in the form of kinetic energy, is gained from heat energy of the mass and temperature of fluid is an indicator of the heat content. This can be experienced in a situation where a class is required to attend extra class, after school hour, and students are hungry. In another situation the same class, when schools starts, has first period free. It will be seen that activity level of the class in second situation is much higher and energetic as compared to the earlier situation. The students of the latter class can reach to the limits of premises. This is only a representative analogy. Secondly, feeble molecular bonding in fluids, provides them a property to flow from higher pressure to lower pressure.

Fluids are of Two types -a) Liquids and b) Gases. In gases inter-molecular spacing is sufficiently large as compared to the size of the molecule, on account of this kinetic energy of the molecules lets them fill available space and exert a force on the walls of the container. The physics of such a behaviour of gases shall be analysed later while dwelling Kinetic Theory of Gases in Chapter V on Heat. Nevertheless, liquids, which have intermolecular space lesser than gases, when attain a velocity greater than escape velocity evaporation, occurs, otherwise it is a case of surface tension, which is included here, in illustrations as an integral part of chapter on Mechanics.

Fluid mechanics can also be classified in two distinct studies -a*) Fluid Statics and* b*) Fluid Dynamics, and illustrations of both of these are covered here.*

Fluid Statics: Archimedes law of buoyancy was a great revelation 250 B.C. was a great revelation in understanding behaviour of a solid when immersed in liquid. Before, understanding buoyancy review of concept of density is essential. Visualize a school having Two sections A and B of a class which are accommodated in rooms of same size. For some reason there are 50 students in section A and 30 students. Obviously, section B is less packed as compared to Section A, and accordingly students of class B are more sparsely spaced.

In physics, property of a matter pertaining to mass of a material in the space occupied by it, i.e. volume is called density and is mathematically represented as $=\frac{M}{V}$; here, *M* is mass of the material, *V* is its volume and ρ is the density. Volume depends upon shape and is determined geometrically, brought out in Chapter – IV. Unit of density in MKS system is kg/m³ while dimension is [*ML*⁻³].

In above example of Two sections of a class, Section A more students than in Section B, and occupancy i.e. space occupied by students in section A is lesser than that in Section B, because sizes of rooms of both the class are stated to be same. Similarly, comparison of the density of different material is provided with **Relative Density(RD)** which is equal to ration of density of two materials being compared. Accordingly, $RD = \frac{\rho}{\rho_w}$, where, ρ – is the density of material and ρ_w is the density of two materials being compared. Accordingly, $RD = \frac{\rho}{\rho_w}$, where, ρ – is the density of material and ρ_w is

the density of water at 4° C which is 1 gm/cc in CHS system and in MKS system is 1000 kg/m³. Choice of water was made initially for its value in CGS system and continues to be used to define RD.

Page 29 of 47 2nd Quarterly e-Bulletin: Gyan- Vigyan Sarita: शिक्षा http://www.gyanvigyansarita.in/

Taking forward learning of mechanics in previous section force exerted by a stack of Five boxes of books of Physics, each



weighing 7 kg, as shown in the figure is $=7 \times 5 = 7.5$ kg. The stack remains in place unless it is displaced. Force exerted by each box, progressively, on the lower box and reaction offered by the lower surface is shown in the figure.

This analogy is extended to liquid. Taking a simple case of a U-tube in which liquid, in Green colour, of density ρ_1 is poured slowly to fill a small part of its height. It will be seen that liquid in both arms of the U-tube rise to same heights equally. Once the liquid level has settled, the height of liquid in both arms is same A and B,

above the level O. Now another liquid, mixable in earlier liquid, in Blue colour, having density $\rho_2 < \rho_1$ is poured slowly. It will be seen that

level of liquid of density ρ_1 , in the arm, in which liquid of density ρ_2 is being poured, lowers down (level B descends) while in another arm its level rises (level A ascends) . Keep pouring liquid of density ρ_2 , until separating layer is at the midpoint of the Utube. In such a state, it will be observed that height h_1 of liquid column of density ρ_1 and height h_2 of liquid column of density ρ_2 is such that $\frac{\rho_1}{\rho_2} = \frac{h_2}{h_1}$. This observation



lays foundation in understanding of fluid mechanics in general and fluid statistics in particular.

Static Fluid Pressure: Let there be a vessel filled with liquid. A small ball of volumetric density equal to that of water is



immersed in liquid below the surface of liquid in the vessel. It will be observed that the ball remains in place. It implies that the fall is in equilibrium which is possible resultant force acting on the ball along any line drawn through it the ball is Zero. Now, let a thin cylindrical volume, of cross-sectional area A and thickness Δh , placed horizontally at a depth h from the surface in a liquid tank be considered. Let upper surface is under a downward pressure p and lower surface under a upward pressure $p + \Delta p$. The volume is since in equilibrium resultant vertical force on the volume must be ZERO. Accordingly, $pA + \rho g(A\Delta h) =$ $(p + \Delta p)A$. Here, $\rho h(A\Delta h)$ is the weight of the volume. It leads

to, $p + \rho h \Delta h = p + \Delta p$, or $\rho g \Delta h = \Delta p$, or $\frac{dp}{dh} = \rho g$. Therefore, net

vertical pressure at a depth is $p = \int (\rho g) dh + C = \rho gh + C$. Here, *C* is integration constant such that at h = 0, i.e. on the surface of the liquid pressure is p_0 , and, thus using these values in the instant integration $C = p_0$. It implies that at any depth *h* below the surface of the liquid pressure is $p = p_0 + \rho gh$, i.e. as depth increases pressure increases. This is based on the assumption that density of the liquid is uniform, and is valid for liquids considered to be incompressible. This is, however, not valid for gases which are compressible.



This principle of Fluid Pressure, helps to explain why despite different shapes of fluid column open to an environment having uniform pressure, height of fluid column is same. *It needs to be noted that this equality implies to Height of Fluid Column and length of Fluid Column.*

Next question that remains unanswered is "what is the pressure on vertical-circular surface of the volume?". It is



experienced that liquids have a tendency to flow, and, therefore, under vertical pressure liquid in the volume should start flowing sideways, which does not happen. This is possible only if the volume remains in equilibrium, and that is the case. This leads to conclusion that horizontal pressure on the side walls is also same as vertical pressure. It concludes that any volume of liquid, infinitesimal size, experiences equal



pressure from all directions.

Page 30 of 47 2nd Quarterly e-Bulletin: Gyan- Vigyan Sarita: शिक्षा http://www.gyanvigyansarita.in/

PASCAL'S PRINCIPLE: The mechanics of fluid pressure was studied by Blaise Pascal and based on his

experimental observation he formulated a principle in his treatise Equilibrium of Liquids, which was found only after his death and published in 1663. The principle states that – "A change in pressure at any point in an enclosed *fluid at rest is transmitted undiminished to all points in the fluid*". It has found a wide application in *Hydraulic Press or Levers* as illustrated in the diagram. This principle has bearing on the principle of Fluid Static Pressure and demonstrates as to how with little effort large loads can be managed. A refinement to the Pascal's illustration, pressure at same height is constant and therefore Since pressure is constant throughout the fluid force on load is amplified in proportion of the enclosed surface area supporting load and surface area at application of efforts i.e. $P_L = P_E$; $F_L = P_LA_L$ and $F_E = P_EA_E$; $F_L = \frac{A_L}{A_E}F_E$.

area at application of efforts i.e. $P_L = P_E$; $F_L = P_L A_L$ and $F_E = P_E A_E$; $F_L = \frac{A_L}{A_E} F_E$. At a first glance, it will be seen that though rationale of force violates Principle of Lever, discussed earlier in Mechanics. But, a further analysis reveals that it is in conformance with the principle of Conservation of Energy, common to both. The volume of liquid displaced in effort column (V_E) is moved into load column (V_L), without change in volume. Accordingly, $V_L = A_L X_L$ and $V_E = A_E X_E$; or $\frac{A_L}{A_E} = \frac{X_E}{X_L}$. Accordingly, using this relationship together with hydraulic force ratio, it leads to $F_L = \frac{X_E}{X_L} F_E$. Alternately, $F_L X_L = F_E F_E$. Both of these relationships are in conformance with principle of level and conservation of energy and hence it is called Fluid Lever.

Application of Pascal's Principle has been made in pressure gauge where one surface of the liquid is open to environment of which pressure is to be measured, while the other surface pf the liquid is exposed to reference. In case of barometer, which measures absolute pressure, reference is vacuum, while pressure gauge, ambient pressure is reference and measurand is pressure inside an enclosed surface. Diagrammatic representation of barometer and pressure gauge is shown in figure.

ARCHIMEDES PRINCIPLE: In Fluid Statics. Principle of Buoyancy was promulgated by Archimedes about 17 centuries ago and was also an experimental observation, but in different situations, but with a scientific way to solve problem posed upon him by the king to determine purity of Gold. This principle states that – "**upward buoyant force** that is exerted on a body immersed in a fluid, whether fully or partially submerged, is equal to the weight of the fluid that the body displaces and it acts in the upward direction at the centre of mass of the displaced fluid"

This problem is analysed in two situations: **a)** Floating Objects, and **b)** Fully immersed Object. Each of the situation is being discussed separately.

Buoyancy of Floating Objects: In this case reference plane is considered tangential to the bottom most point of the



floating object (along line AB), and parallel to the surface of the liquid along line (CD) separated by height *h*. Every point on the bottom surface of the floating object is assigned an height h_{i1} , the height of the floating object is above the bottom most point and upper surface of the floating object is h_{i2} limiting to the height of surface of the liquid, height of liquid surface above the upper surface of the floating object is h_{i3} , and height of upper surface of the floating object above the surface of the liquid is h_{i4} . Accordingly, force on the projection (shadow) of floating object on the surface AB shall be $F = \sum (h_{i1}\rho_l + h_{i2}\rho_s + h_{i3}\rho_l + h_{i3}\rho_s)$

 $+h_{i4}\rho_s)A_i$, Here, surface $A = \sum A_i$ is the surface area of the projection, here A_i is the area of an infinitesimal *i*th element. Therefore, pressure on the projection shall be –

$$P = \frac{F}{A} = \frac{\sum g(h_{i1}\rho_l + h_{i2}\rho_s + h_{i3}\rho_l + h_{i4}\rho_s)A_i}{A} = \frac{\sum g((h_{i1}\rho_l + h_{i3}\rho_l) + (h_{i2}\rho_s + h_{i4}\rho_s))A_i}{A} = \frac{\sum g((h_{i1}\rho_l + h_{i3}\rho_l) + (h_{i2}h_{i4}\rho_s)A_i)}{A} = \rho gh.$$



Page 31 of 47 2nd Quarterly e-Bulletin: Gyan- Vigyan Sarita: शिक्षा <u>http://www.gyanvigyansarita.in/</u>

Taking, last of the two equalities can be written as: $\sum g((h_{i1}\rho_l + h_{i3}\rho_l) + (h_{i2} + h_{i4})\rho_s)A_i = \rho ghA$. Here, $\sum (h_{i2} + h_{i4})A_i$ is volume of solid and $\sum h_{i2}A_i$ is the volume of solid immersed in liquid, which is same as volume of liquid displaced by immersion of solid in liquid. This would maintain equality of pressure only iff, $\sum (h_{i2} + h_{i4})A_i\rho_s g = \sum h_{i2}A_i\rho_l g$. It leads to necessary condition of float $\rho_s < \rho_l$.

Since, the partially immersed object is floating in equilibrium part I of the Archimedes Principle (*upward buoyant force that is exerted on a body immersed in a fluid, whether fully or partially submerged, is equal to the weight of the fluid that the body displaces)* is proved. Further, taking moment of mass distribution of displaced liquid at the surface of



the liquid, along CD, 'it leads to $\sum h_{i2}A_i \rho_l = Ah'$, here' is the average height h' is on the line passing through COM of displaced liquid. Further, the floating object is just not in linear equilibrium, it is in rotational equilibrium too, which, according to **D'** *Alembert's Principle*, can happen iff upward thrust is passing thorough COM only which proves part II of the Archimedes Principle (*buoyant force acts in the upward direction at the centre of mass of the displaced fluid*).

The principle of buoyancy knowingly, or unknowingly with mere experience, has found application in increasing load bearing capacity of boats which are made of wood lighter than water; so also in design of ships which are made of steel much denser metal than water, yet carry very heavy loads.

Buoyancy of Immersed Objects: In case of fully immersed object, the above analysis shall apply with $h_{i4} = 0$, and h_{i3} will depend upon shape and depth of submergence of object in liquid. Another deviation in the analysis is that weight of the object is greater than weight of liquid displaced i.e. $\sum h_{i2}A_i \rho_s g > \sum h_{i2}A_i \rho_l g$. This leads to reduction of weight of a denser object immersed in lighter liquid. This principle causes reduction in effort to take away an immersed objects.

Stability during Float: Extending Part II of the Archimedes principle, together with principle of *Centre of Gravity (CG)* and moments. Mass distribution of floating object is different and may be non-homogenous, while mass distribution of displaced liquid is based on volume immersed, but homogenous. This could lead to three situations.

: a) CG of object coincides with the Centre of Buoyancy CB of displaced liquid, b) CG of Object is above CB of displaced liquid, and c) CG of object is below CB of the displaced liquid.

In situation (a) CG of object coincides with the *Centre of Buoyancy (CB)* of displaced liquid . If the object *is slightly tilted* and left to negotiate with liquid, it would continue to be in that position. As per D' Alembert's Principles since centre of gravity acts as fulcrum, since CG and CB are coinciding there would be no torque caused by buoyancy and state of *stable*



CG





equilibrium would continue to be there.

In situation (b), a clockwise tilt of the object, which is initially stable, shifts its CB such that a torque caused by buoyant force tends to tilt the object farther in clockwise direction. This

torque is being called as *Toppling Torque*. This cascaded tilting leads to toppling of the floating object. Such a situation is called *dynamic in-equilibrium*.

In situation (c), also the object is initially in equilibrium. When object is slightly tilted, shift of CB and the torque caused by buoyant force

about CG counters the tilt. Such a torque is being called as *Balancing Torque*. Accordingly, the floating object starts oscillating about its mean position, until it settles down to rest at its mean position. This is called *dynamic equilibrium*.

Shift in CB depends more upon shape of the floating objects, which are generally symmetrical

about vertical axis in its static equilibrium. But, shift in CB requires to be observed closely, which generally conform to the above analysis.

Balancing Torque: r=xf.

The Archimedes Principle seems to produce nearly correct results for objects having high mass to surface area ration. But, when this ration is small causing floating conditions, like that of a metal sheet, it fails. The reason of this boundary condition is Surface Tension, illustration of which shall follows in next paragraph.

SURFACE TENSION: It must have been observed that a thin metal sheet placed horizontally on the surface of water keeps floating, and the same when tilted slightly it submerges in water. This floatation cannot be explained with principle of buoyancy. It

6 8 - 10 - 10	 -	 	
	 -	 	
	 	 	-
		_	5.2

requires understanding and analysis of interaction of molecules inside liquid. A molecule inside liquid is surrounded by large number of molecules each exerting force of gravitational interaction causing a state of static equilibrium as shown for molecule A. This molecule under consideration when moved near the surface, it creates a state of in-equilibrium resulting into a

downward pull as shown for molecule B. Existence of this force can be realized with creation of a liquid film in a rectangular frame which is adjustable in one direction. It requires a U-shaped frame with a sliding arm to make a closed surface. The frame is dipped in soap solution and when taken out in horizontal position the sliding arm is closed to opposite fixed side of the frame. But, when the frame is held vertical with a small force the sliding arm can be pulled off. Magnitude of the force (F) on the adjustable arm is F = 2Sl, here S is the surface tension per unit length and l is the width of the film. Here, multiplier 2 is due to two





surfaces of the film formed by the frame, and each surface exerts a force on the adjustable arm.



In another experiment a film is formed in a closed frame. On this film a light loop of thread, wetted in the same solution, is placed. It retains a shape as it is left on the film. Now the film inside the loop is punctured with a fine needle, it is observed that the loop rearranges itself in shape of a circle. From knowledge of geometry circle is a shape whose area is largest for a perimeter. Further, assuming that the film has a surface energy, largest area being taken out by the circular loop, created by the puncture, remnant film shall have least surface energy, and is in accordance with the *principle of least potential* which states that every body tries to occupy position of least potential energy. The concept of surface energy is another evolution in the journey.

Surface Energy: Molecules inside liquid and those at surface experience molecular interaction in a state of equilibrium. Equilibrium of molecules inside liquid is due to balanced radial forces within the sphere of influence, as shown above. Radius of the sphere of influence is about 10-15 molecular diameter. While, molecules near the surface due to hemispherical distribution of molecules creates an downward pull. Though, liquids have a tendency to remain in shape of the vessel, its molecules experience random chaotic motion (this shall be a subject matter during illustrations on Heat, as Brownian Motion) and elastic collisions due energy acquired by it in the form of heat. These molecules as they approach surface of liquid loose velocity due to downwards pull in the surface layer due to the imbalance of molecular forces. Thus like a particle projected upwards on the earth's surface, these molecules gain potential energy following laws of conservation of energy. Few molecules, having remnant kinetic energy may leave the surface of liquid, but would return back to the liquid surface due to molecular pull unless such molecules are swept away by either wind or have sufficient velocity, similar to escape velocity illustrated in gravitational field, so as to be able to come out of zone of influence caused by surface layer of liquid.

Surface energy of a film is illustrated the example of the film created by a moving of a U-shaped frame. Total force tends to shrink the film. If the moving arm is slowly moved through a distance x, to increase the size of the film, the amount of work done on the film (Potential energy of the film: U = W = S2lx = SA, here, A is the total surface area of both the faces of the film

Pressure Inside a Bubble & Drop: The concept of *Surface Energy* is useful in analysing pressure inside bubble and drop of liquid.

Pressure inside Drop

An horizontal hemisphere of a small drop be considered. Let a small area be taken from a circular strip, parallel to



the cross-section of the hemisphere, on the surface of the drop. The area of the element shall be $= (2\pi r \sin \theta)(rd\theta)$. Ambient pressure on it would be radially uniform.

The force along the cross-section shall be cancelled out to elements

of the strip which are diametrically opposite. The component of pressure perpendicular to the crosssection shall be $= p(2\pi r^2 \sin \theta \, d\theta) \cos \theta = \pi r^2 p \sin 2\theta d\theta$. Here, *p* is the pressure inside the drop.

Thus overall force on the cross-section shall be = $\int_0^{\pi/2} \pi r^2 p \sin 2\theta d\theta = \pi r^2 p \left[-\frac{\cos 2\theta}{2} \right]_0^{\pi/2} = \pi r^2 (p - p_o)$, here, p_o is the ambient pressure outside the drop.

While, edge of the hemisphere would exert a force on account of Surface Tension caused by surface of the bubble $= 2\pi rS$. Equating the forces in a state of equilibrium leads to $p = \frac{2S}{r} + p_0$

Pressure inside Bubble

Bubble is like a drop but it has a small difference such that inside and outside bubble there is gas at different pressures



and these are separated by a thin film of liquid. Accordingly, it requires analysis of two surfaces. For outer surface is

two surfaces. For outer surface is balanced by difference $(p - p_o)$ of ambient pressure (p_o) and outwards pressure exerted by liquid film (p). While, the inner surface is balanced by difference $(p_i - p)$ of inwards pressure exerted by liquid film (p)

and outward pressure (p_i) exerted by the gas trapped within the bubble.

On the cross-sectional edge will experience force of Two surfaces (inner and outer) = $2 \times (2\pi r)s = 4\pi rS$, here, *r* is the radius of bubble having a liquid film of negligible thickness.

Thus, net upward force would be :

$$[(p_i - p) - (p - p_o)]\pi r^2 = 4\pi rS; p_i - p_o = \frac{4S}{r}.$$

Therefore pressure inside bubble: $p_i = \frac{4S}{r} + p_i$

Capillary Action: This is an effect of surface tension which causes extraction of water and nutrients from soil by plants, a beginning of life. Understanding capillary actions requires deeper understanding of inter molecular forces. Force of attraction between homogenous molecules (belonging to same substance) is called *force of cohesion* (f_c) and similar force between heterogeneous molecules (belonging to different substances) is called *force of adhesion* (f_a). The capillary actions is a result of : **a**) difference between forces of cohesion and adhesion, and **b**) extension of capillary above the surface of the liquid.

Concave of meniscus exists, like that in water, when shape of concave surface of the liquid $f_a > f_c$ while, convex shape of meniscus, like that in mercury, occurs when $f_a < f_c$, accordingly both the cases are discussed separately. Another, important property of the liquid is its fluidity, i.e. it would start flowing in the direction of force, unless equilibrium exits. According to this property, *net force on a liquid, in equilibrium must be perpendicular to the surface*. This property need not be confused to be in contradiction to the surface tension illustrated so far rather, it is an extension of surface tension and is illustrated below.

Fa

Shape of Liquid Surface

 $(f_a < f_c)$



The resultant force on molecules in contact with the container is downwards towards the solid container. Accordingly, shapes of the surfaces dipped in:

Case a- A sheet or the plane of container: A curved surface on the **walls of solid surface**

Case b- *A rod or a cylinder in:* A circular curved surface

rising on the walls of solid surface

Case c- *A Capillary (tube of small diameter:* A concave curved surface tending to be hemisphere rising above the surface of liquid outside capillary

Shape of Liquid Surface $(f_a > f_c)$

The resultant force on molecules in contact with the container is downwards inside the liquid in the container. Accordingly, shapes of the

surfaces dipped in:

Case a- A sheet or the plane of container: A curved surface tending to dip in the walls of solid surface

Case b- *A rod or a cylinder in:* A circular curved tending

to dip in walls of solid surface

Force

F

g

Case c- A Capillary (tube of small diameter: A convex curved surface tending to be inverted hemisphere, and dipping below the surface of the liquid outside capillary The above analysis requires consideration of forces acting on the molecules of liquid in contact with the container, separator or a capillary. This determines direction of the resultant force, which has to be perpendicular to the surface of liquid in a state of equilibrium. This direction of force shall accordingly decide surface of liquid.

It is seen that surface of liquid makes an angle with the solid wall of container, separator or capillary. The angle between a perpendicular line from the point of contact and a line drawn from the point of contact with the solid surface, which is tangential to the liquid surface and perpendicular to the surficial line along the solid surface is called *Angle of Contact*.

Height of Liquid Inside Capillary : In addition to capillary action height of liquid column depends upon: **a)** density of liquid in capillary, **b)** pressure above surface of liquid, and **c)** radius of capillary.

Let, p_0 - atmospheric pressure above base liquid level, p_i – pressure above liquid in capillary then, h – height of the liquid in capillary above base liquid, ρ is the density of liquid, and r – radius of capillary. The force created by rise or fall of liquid in capillary= $\pi r^2 h \rho g$. This force is in the direction opposite to rise/fall of liquid. Surface Tension = $2\pi rS \cos \theta$ balances the force created by liquid column and this keeps liquid column in capillary in equilibrium with the surface of liquid outside capillary.



Situation that arises when length or depth of the tube is less than h, wherein, both the cases, liquid neither spills over the capillary nor liquid loosing contact with the capillary. In such cases $\theta \rightarrow \frac{\pi}{2}$, i.e. liquid surface inside tends to lose its curvature. This can be verified by the mentor.

A simple experiment which *combines principles of gravity, buoyancy and surface tension* illustrated earlier and is brought out here under-

Page 35 of 47 2nd Quarterly e-Bulletin: Gyan- Vigyan Sarita: शिक्षा http://www.gyanvigyansarita.in/



Fluid Dynamics: Flow of liquid is characterized in two forms: **a)** *Streamline Flow* and **b)** *Turbulent Flow*. In *Streamline flow* of liquid is linear i.e. flowing along a line viz. lines of field which do not cross each other. A flow of liquid through a pipe of different cross-section and changing shapes these lines of flow bend, compress or rarefied depending on

cross-section of the pipe, without intersecting each other, as shown in the figure. It leads to various observations in respect of : a) Volume of liquid flow remains constant because of it incompressibility, b) Velocity of flow of liquid shall increase/decrease with decrease/increase in cross-sectional are of pipe, and c) this continuity in stream of liquid flow should conform with the law of conservation of energy. These observations shall now be analysed mathematically to obtain a general equation for stream line flow.



Let *V* is the volume of liquid entering the pipe shown in the figure. Therefore velocity of water at the entrance of the pipe shall be $v_1 = \frac{V}{\pi d_{1/4}^2}$, and velocity of liquid leaving the pipe shall be $v_2 = \frac{V}{\pi d_{2/4}^2}$. Accordingly as per observation at (a and b)

above, ratio of velocities of liquid at the entrance of the pipe and its exit shall be, $v_1: v_2:: d_2^2: d_1^2$.

At this point applying Law of Conservation led to a new revelation. Initially, the pipe is considered to be laid horizontally both along the length and bend, such that axis if the pipe is a uniform height 'h' leading to constant potential during the flow. Nevertheless, there is an imbalance in total energy of the liquid at entrance $(E_1 = V\rho gh + \frac{1}{2}(V\rho)v_1^2)$ and energy at exit $(E_1 = V\rho gh + \frac{1}{2}(V\rho)v_2^2)$. Since, $d_1 > d_1$; $E_2 - E_1 = \frac{1}{2}(V\rho)v_2^2 - \frac{1}{2}(V\rho)v_1^2 = \frac{1}{2}(V\rho)(v_2^2 - v_1^2) > 0$, there must be some other form of energy that must be existing in the flowing water. This inequality led Daniel Bernoulli to investigate the flow of incompressible liquids and he propounded in 1738 relation between velocity and potential energy in the form of pressure and is known after his name as **Bernoulli's Equation** such that: $E_2 - E_1 = \frac{1}{2}(V\rho)(v_2^2 - v_1^2) = V\Delta p$. In a generalized form removing assumption of uniform height along the flow of liquid, as per energy conservation the energy equation shall be: $((V\rho gh_2 + \frac{1}{2}(V\rho)v_2^2 + Vp_2) - (V\rho gh_1 + \frac{1}{2}(V\rho)v_1^2 + Vp_1)) = 0$. It leads to: $gh_1 + \frac{1}{2}v_1^2 + \frac{p_1}{\rho} = gh_2 + \frac{1}{2}v_2^2 + \frac{p_2}{\rho}$. Thus, for isothermal conditions energy in a streamline flow

of liquid at any point in flow has three forms: **a**) **Potential Energy** arising due to height of liquid under gravitational field, **b**) *Kinetic Energy*, due to velocity of flow, and **c**) **Pressure Energy**, caused by the pressure with which liquid is flowing. This principle, also called as *Bernoulli's Principle* is excellently demonstrated through a Ventury Tube, a small reduction in diameter of pipe through which liquid is flowing as



shown in the figure. It is also called Ventury Meter to determine velocity of flow of liquid through a cross-section of a pipe. Accordingly, equation of pressure difference, as per principle of Barometer, is $p_1 - p_2 = \rho gh$. Using this equation together with Bernoulli's Equation it leads to $\frac{\rho gh}{\rho} = \frac{1}{2}(v_2^2 - v_1^2)$, Accordingly, $(v_2^2 - v_1^2) = 2gh$, is used for determining velocity in a pipe at any cross-section. An excellent application of this Bernoulli's Principle spray machine used for spraying insecticide



on farms, spray painting etc, which is schematically creating a high velocity jet of air, at which liquid rises due reduction of pressure, and this liquid utilizing high kinetic energy of air flow, splinter into small droplets in the form of surface energy, as analysed in Surface Tension;

higher the velocity of air finer is the spray. This Bernoulli's Equation is an important tool in design of wings of air craft, and a natural inheritance of birds in the form of wings.

Viscosity: Property of liquid to flow is influenced by inter-molecular forces within the volumes of liquid and gets manifested as force of friction. It involves both the forces viz. Force of Adhesion on the particles

of liquid in contact with the static boundary and force cohesion within the volume of liquid. In static state, when water is stationary and it is different from state of equilibrium, they keep attracted each other. But, when a molecule is set in motion the force of attraction continues depleting as per laws of gravitation as they move away from sphere of influence of each other.

Thus, moving molecule tries to pull along with it the adjoining molecules with relatively lower velocity while the latter tries to retard the molecule moving at relatively higher velocity. This is called *Viscosity* and is different from *Surface Tension*. An understanding Viscosity requires first to understand behaviour of liquid during flow. Effect of viscosity is a gradient in velocity of flow. The solid surface over which liquid is flowing viz. river bed or canal is since static layer of liquid layer touching experiences : a) maximum intra-molecular force i.e. force of cohesion, b) pressure due to head of



liquid above it, and c) atmospheric pressure. But, for the molecules above it force on it decreases – i) in inverse proportion of square of the distance from the layer, and ii) direct proportion of liquid head. As a result of these reducing forces on the molecules of liquid velocity of liquid increases as they approach surface

of liquid. This gradient exists in layers, and conceptual representation of the laminar is shown in the figure. This gradient is also true for adjoining walls of the liquid and is well depicted for circular tube in the figure. It is pertinent to observe three exceptions in case of laminar flow of liquid:

a) Bernoulli considered uniform velocity of liquid across the direction of flow, an



Static

Condition

Molecule

ý

ideal situation, which does not happen due to viscosity, **b**) In wide stream velocity gradient is uniform along the width of stream, It is subject to following conditions - *i*) the flow under consideration is sufficiently away from the banks, and *ii*) bed of flowing liquid is parallel to the horizontal surface of the flowing liquid, and **c**) flow of liquid in pipe is radially uniform along the cross-section of the pipe.

Taking this conceptual representation of viscosity, next is analytical aspect and it is seen that Viscous Force in an open stream is proportional to – a) is proportional to the surface area being of nature similar to shear force, it is attributed by the fact that number interacting molecules are proportional to surface area, and b) gradient of velocity from the surface of flowing liquid. Accordingly, Viscous Force $F_v \propto A$ and $F_v \propto \frac{dv}{dx}$; consolidating these two relationships, $F_v = \eta A \frac{dv}{dx}$; here, η is proportionality constant and dimensionally it is, $\left[\eta\right] = \frac{[F_v]}{[A] \left[\frac{dv}{dx}\right]} = \frac{[ML^{-1}T^{-1}]}{[L^2] \left[\frac{LT^{-1}}{L}\right]} = [ML^{-1}T^{-1}]$. Likewise, unit of η is N-s/m², which in CCS is Poise = 0.1 N s/m². Viscous Force is like Friedral force and its comes into play only when there is relative.

in CGS is Poise = 0.1 N-s/m². Viscous Force is like Frictional force and its comes into play only when there is relative motion between adjoin molecules, be it of the same liquid or a container or different object moving inside the liquid.

Qualitatively, effect of viscosity in tubular flow is identical to that of a stream, but quantitatively is different. Experimentally it is observed that rate of flow of liquid $\binom{v}{t}$ in a tube is a function of $-\mathbf{a}$) Pressure gradient along the tube i.e. $\frac{p}{l}$; here, l – is the length of the tube and p - is pressure difference in liquid flowing in the tube along the length, **b**) Viscosity of the liquid (η) , and **c**) radius of the tube (r). *Dimensional analysis* has been excellently used to determine effect of these parameters on rate of flow of liquid. Accordingly, $\left[\frac{v}{t}\right] = k \left[\frac{p}{l}\right] [\eta][r]$, here, k is taken to be dimensionless constant. Accordingly, $\left[\frac{L^3}{l}\right] = \left[\frac{ML^{-1}T^{-1}}{L}\right]^a [ML^{-1}T^{-1}]^b [L]^c$. It leads to, $[L^3T^{-1}] = [ML^{-2}T^{-2}]^a [ML^{-1}T^{-1}]^b [L]^c = [M^{a+b}L^{-2a-b+c}T^{-2a-b}]$,

it leads to three equations for three dimensional exponents, **i**) for exponents of M, 0 = a + b; **ii**) for exponents of L, 3 = -2a - b + c, and iii) for exponents of T, -1 = -2a - b. Solution of these three simultaneous equations is, a = 1, b = -1, and c = 4. Experimentally, value of dimension less constant (*k*)was determined to be $\frac{\pi}{2}$, independently by *Jean Léonard Marie Poiseuille in 1838 and Heinrich*

Ludwig Hagen and published later. It is also known as *Hagen–Poiseuille equation*, also known as *Poiseuille Formula*: $\frac{V}{t} = \frac{\pi p r^4}{8\eta l}$. In the analysis brought above, it was assumed that the flow isothermal and temperatures are conducive to laminar flow.

Stoke's Law: In 1851, George Gabriel Stokes determined viscous force exerted on motion of a spherical object, having smooth surface, in a homogeneous liquid at a velocity having laminar flow. He propounded that viscous force is given by: $F = kv^a \eta^b r^c$; here, k is dimensionless constant, while, F - is the frictional force caused by liquid medium in which object is moving, v - is the flow velocity relative to the object, η - is the coefficient of viscosity, and r is the radius of the spherical object.

Again, using dimensional analysis the relationship of viscous force is arrived. $[MLT^{-2}] = [LT^{-1}]^a [ML^{-1}T^{-1}]^b [L]^c = [M^b L^{a-b+c}T^{-a-b}]$. The equating dimensional exponents, three simultaneous equations are: i) 1 = b, ii) 1 = a - b + c, and iii) -2 = -a - b. Accordingly, a = 1, b = 1, and c = 1. Accordingly, the relationship comes out to be $F = kv\eta r$. Experimentally, Stoke

determined $k = 6\pi$, thus the quation got formalized as $F = 6\pi v\eta r$, and is known as **Stoke's Law**. In SI units, *F* is in Newtons, η in Poise, *r* in meters, and *v* in m/s. It is interesting to observe that apart from other parameters, for a spherical object, the only variable is velocity *v*. Further, if the object is moving under gravity experiences a constant acceleration and buoyant force. Thus, taking a free body diagram of the object it will initially accelerate and finally attain a constant velocity called *Terminal Velocity* (v_T) such that there is equilibrium of forces, represented by equation: $(\frac{4}{7}\pi r^3)\rho_{r}q = (\frac{4}{7}\pi r^3)\rho_{r}q + 6\pi v_{T}nr$.



such that there is equilibrium of forces, represented by equation: $\left(\frac{4}{3}\pi r^3\right)\rho_o g = \left(\frac{4}{3}\pi r^3\right)\rho_l g + 6\pi v_T \eta r$. Accordingly, $\left(\frac{4}{3}\pi r^3\right)(\rho_o - \rho_l)g = 6\pi v_T \eta r$, and thus, $v_T = \frac{2r^2(\rho_o - \rho_l)g}{9\eta}$. This concept explains velocity of rain drops, never exceeds its limiting value. This is used to determine viscosity of a liquid.

In the event of either of $-\mathbf{a}$) temperature increasing. molecules of liquid acquire sufficient velocity to trespass sphere of influence of molecules immediate vicinity, **b**) there is obstruction in way of laminar flow, **c**) velocity of flow is large and sudden change of pressure, flow of liquid loses laminar flow. Such a flow is called **Turbulent Flow** where path of liquid cannot be predicted. This is like students leaving extra class after the school hours, unlike students assembly ground to enter into their class rooms, rows of respective classes; the latter is streamline like. While, all other parameters, for a particular situation, are constant velocity is something which can affect laminar flow and it is defined as Reynolds number (Re). Basically, it is representative of ratio of inertial force responsible for flow of liquid and viscous force. This concept was introduced by Stoke, but Osborne Reynolds who popularized use of the concept in 1883, was named by Arnold Sommerfeld in 1908 as Reynolds number $Re = \frac{\rho v D}{\eta}$. It is seen that $-\mathbf{a}$) for Re < 2000, liquid flow is steady, **b**) for 2000 < Re < 3000 flow is unstable i.e. it may suddenly change from steady to turbulent or vice-versa, and **c**) for Re > 2000 it is turbulent.

Summary: This part concludes concepts of Mechanics. Analysis of varieties of problems, representing different situation involve concepts of Fluid Statistics and Dynamics. Examples drawn from real life experiences help to build visualization and an insight into the phenomenon occurring around. A deeper journey into the problem solving would make integration and application of concepts intuitive. This is absolutely true for any real life situations, which requires multi-disciplinary knowledge, in skill for evolving solution. Thus, problem solving process is more a conditioning of the thought process, rather than just learning the subject. Practice with wide range of problems is the only pre-requisite to develop proficiency and speed of problem solving, and making formulations more intuitive rather than a burden on memory, as much as overall personality of a person. References cited below provide an excellent repository of problems. Readers are welcome to pose their difficulties to solve any-problem from anywhere, but only after two attempts to solve. It is our endeavour to stand by upcoming student in their journey to become a scientist, engineer and professional, whatever they choose to be.

References:

- 1. NCERT; PHYSICS, Text Book for Class XI (Part I and II), and Exemplar Problems.
- 2. S.L.Loney; The Elements of Statistics and Dynamics: Part 1 Statics and Part 2 Dynamics.
- 3. H.C. Verma; Concepts of Physics, (Vil 1 & 2).
- 3. Resnick, Halliday, Resnick and Krane; Physics (Vol I and II).
- 4. Sears & Zemansky; University Physics with Modern Physics.
- 5. I.E. Irodov; Problems in General Physics



Author is Coordinator of this initiative Gyan-Vigyan Sarita, a non-organizational entity of co-passionate persons who are dedicated to the mission. He had his career as a power engineer, and after superannuation he did his Ph.D, from IIT Roorkee. Soonafter the Ph.D. in 2012, he took a plunge into mentoring unprivileged children with Sarthak Prayash an NGO. Thereafter for about for about One Year till Sept'16 he was Founder-cum-Chairman of Subodh Foundation.

e-Mail ID: subhashjoshi2107@gmail.com

GROWING WITH CONCEPTS - Chemistry

(....Contd.) ORGANIC CHEMISTRY : BASIC PRINCIPLES AND TECNIQUES

Kumud Bala

Rules for IUPAC nomenclature of compounds containing one functional group, multiple bonds and substituent :- While naming organic compounds containing one functional group, double and triple bonds, and substituents, the following additional rules are observed.

1. Parent chain:- Select the longest possible chain of carbon atoms containing the functional group and the maximum number of multiple bonds as the parent chain without caring whether it also denotes the longest possible carbon chain or not . For example, in below shown compound, the parent chain containing the functional group has six carbon atoms while the longest possible carbon chain has seven carbon atoms.



Parent chain contains six rather than seven carbon atoms



2. Lowest locant rule for the functional group: - Number the parent chain in such a way that the functional group gets the lowest possible number followed by the double and triple bonds even if it violates the lowest set of locants rule. For example

ambiguity . For example

has set of locant= 4,4 not 2,2 name of the compound is 4,4-dimethy-2-butanol

3. Numbering the chain terminating functional groups:- when a chain terminating functional groups such as –CHO, -COOH, -COOR, -CONH₂, -COCl, -C≡N, etc. is present, it is always given number 1 and number 1 is usually omitted from

the final name of the compound when there is no



2-ethyl-4,4-dimethylpentanoic acid











However, in the following examples, the numerical locant 1 is always included when another numerical locant appears in the same name.

$CH_3CH_2CH(Br)COOC_2H_5$	Ethyl 2-bromobutan-1-oate
CH ₃ -CH=CH-CH ₂ OH	But-2-en-1-ol
$CH_3C \equiv C - CH_2 - CH = O$	Pent-3-yn-1-al

If a compound contains two or more like groups the numerical prefixes di, tri, tetra , etc. are used and terminal 'e' from the primary suffix is retained (not dropped) while writing the IUPAC name. For example :-

NC-CH=CH- CN	But-2-ene-1,4-dinitrile
OHC-CH=CH- CHO	But-2-ene-1,4-dial

НООС-СООН	Ethane-1,2-dioic acid
HOOC-	But-2-ene-1,4-dioic acid
CH=CH-	
СООН	
H ₅ C ₂ OOC-	Diethylbutane-1,4 –dioate
CH ₂ -CH ₂ -	
COOC ₂ H ₅	
HOCH ₂ CH ₂ OH	Ethane-1,2-diol
CH2OH	Propane-1,2,3-triol
снон	
 CH₂OH	

Rules for IUPAC Nomenclature of polyfunctional compound:- Organic compounds which contain two or more functional groups are called polyfunctional compounds. Their IUPAC names are obtain as follow:

Principal functional group:- When an organic compound contains two or more different functional groups, one of the functional group is selected as the principal functional group while all other groups (also called the secondary functional group) are treated as substituents. The choice of the principal functional group is made on the basis of the following order of preference.

Amine salts > Carboxylic acids > Sulphonic acid > Anhydrides > esters >acid chlorides > acid amides >nitrile > aldehydes > ketones > alcohols > phenols >thiols > amines > ethers > alkenes > alkynes. All the remaining functional groups such as halo(fluoro, chloro, bromo , iodo) , nitroso (-NO) , nitro (-NO₂) , and alkoxy (-OR) , -R (alkyl), $C_6H_{5^-}$ etc. are always treated as substituent groups. It may be noted that while writing the names of the polyfunctional compounds, the principal functional group is indicated by adding the secondary suffix to the word root while the secondary functional groups are indicated by adding suitable prefixes to the word root . The prefixes for secondary functional groups are listed below:

SECONDAR Y FUNCTION AL GROUP	PREFIX	SECONDAR Y FUNCTION AL GROUP	PREFIX
-X (F, Cl , Br, I)	Halo	-CHO	Forml
-OH	Hydroxy	>C=0	Keto
-SH	Sulphanyl or marcapto	-СООН	Carboxy
-OR	Alkoxy	-COOR	Alkoxycarb onyl
-NH ₂	Amino	-COCl	Halocarbon yl
-NHR	Alkylamin o	-CN	Cyano
-NR ₂	Dialkylam	-CONH ₂	Carbamoyl

|--|

Selecting the principal chain:- While selecting the principal chain present in a polyfunctional compound care should be taken that it must contain the principal functional group and the maximum number of secondary functional groups and multiple bonds if any.

Numbering the principal chain:- The principal chain present in a polyfunctional compound must be numbered in such a way that the principal functional group gets the lowest possible number followed by double bond, triple bond and the substituents i.e. Principal functional group > double bond > triple bond > substituent

Alphabetical order:- The prefixes for the secondary functional groups and other substituents should be placed in alphabetical order before the word root. If, however, two groups of the same preference occupy identical position from either end of the parent chain, the lower number must be given to the group whose prefix comes first in the alphabetical order. For example:-



-COOH is principal functional group , wWhile >C=O is the substituent group



-CHO is the principal functional group and >C=O is the substituent group



4-chloro-3-methylbut-2-en-1-ol

-OH is the principal functional group and $-\mathrm{Cl}$,-CH_3 are substituents.



-COOCH₃ is the principal functional group and –OCH₃ and –CN are the substituent groups



-OH is the principal functional group and –O-CH₂-CH₃ is substituent group



3-hydroxy-4-methylhex-5-yn-1-oylchloride

-COCl is the principal functional group. –OH and –CH $_{3}$ are substituents

Rules for naming alicyclic compound:- the following rules are generally used

1. The names alicyclic compound are obtained by adding prefix 'cyclo' to the name of the corresponding straight chain hydrocarbon (alkane, alkene or alkyne).



2. If two or more alkyl groups or other substituent groups are present in the ring, their positions are indicated by Arabic numerals, i.e., 1,2,3,4,..... etc. While numbering the carbon atoms of the ring, the substituent which comes first in the alphabetical order is given the lowest number provided it does not violate the lowest sum rule. For example:-



3. (a) If the ring contains more or equal number of carbon atoms than the alkyl group attached to it, it is named as a derivative of cycloalkane and alkyl group is treated as a substituent group, otherwise it is named as a derivative of alkane and the cycloalkyl group is considered as a substituent group. For example:-



(b) If the side chain contains a multiple bond or a functional group, the alicyclic ring is treated as the substituent irrespective of the size of the ring. For example,



(c) If more than one alicyclic ring is attached to a single chain, the compound is named as a derivatives of alkane irrespective of the number of carbon atoms in the ring or the chain. For example



4. If a multiple (double or triple) bond and some other substituent are present in the ring, the number is done in such a way that the multiple bond gets the lowest number. For example:-





2,3-dimethylcyclopent-1-ene

3-chlorocyclohex-1-ene

- 5. If the ring contains a multiple bond and the side chain contains a functional group, then the ring is treated as the substituent and the compound is named as a derivative of the side chain. For example
- 6. If the ring as well as the side chain contain functional group, the compound is named as a derivative of the side chain or the alicyclic ring according as the side chain or the ring contains the principal functional group. For example



4-(4-nitrocyclohex-1-enyl)but-2-en-1-oic acid

If , the alicyclic ring and the side chain contain the same functional group, the compound is named as a derivative of the side chain of the ring according as the side chain or the ring contains higher number of carbon atoms. for example :-



2-(2-hydroxybut-1-yl)cyclopentan-1-ol

 If a compound contains an alicyclic ring directly linked to the benzene ring, it is named as a derivatives of benzene, i.e., the compound having lowest state of hydrogenation. For example:-



8. If some functional group along with other substituent groups are present in the ring, it is indicated by some appropriate prefix or suffix and its position is indicated by numbering the carbon atoms of the ring in such a way that the functional group gets the lowest number. For example







nylcyclohexan-1-ol 3-hydroxy

5,6-dimethylcyclohex-2-en-1-one

9. If an alicyclic ring is directly attached to a carbon containing functional group, the carbon atoms of the functional group is not included in the parent name of the alicylic system. Therefore ,for such systems, the following prefixes and suffixes for the functional groups are commonly used.

FUNCTIONAL	PREFIX	SUFFIX
GROUP		
-CHO	Formyl	Carbaldehyde
-COOH	Carboxy	Carboxylic acid
-COX (Halocarbonyl	Carbonyl halide
X=F,Cl,Br, I)		
-COOR	Alkoxy carbonyl	Alkyl Carboxylate
	or Carbalkoxy	
-CONH ₂	Carbamoyl	Carboxamide
-CN	Cyano	Carbonitrile

For example:-





Nomenclature of Simple Aromatic Compounds:- Aromatic compounds contain one or more isolated or fused benzene rings. An aromatic compound consists of two parts: (i) Nucleus and (ii) Side chain

(i) Nucleus : The most ideal aromatic compound is benzene. It is represented by a hexagon of six carbon atoms with three alternate single and double bonds. This is called the nucleus.



A circle inside the cyclohexane ring represents six completely delocalized π - electrons or three conjugated double bonds.

(ii) Side chain: The alkyl group or any other aliphatic group containing at least one carbon atom which is attached to the benzene ring is called side chain.

Page 42 of 47 2nd Quarterly e-Bulletin: Gyan- Vigyan Sarita: शिक्षा http://www.gyanvigyansarita.in/



Each family of aromatic compounds consists of the following two type of compounds with quite different chemical properties. (1) Nuclear substituted (2) Side chain substituted

- 1. Nuclear substituted- In these compounds the functional group is directly attached to the benzene ring. Most of these compounds are better known by their common names. In the IUPAC system they are named as derivative of benzene. However, many of their common names have also been adopted by the IUPAC system. The positions of the substituents in disubstituted benzene are indicated either by prefixes or by Arabic numerals such as o (ortho), for 1,2; m(meta) for 1,3 and p (para) for 1,4.
- 2. Side chain substituted- those in which the functional group is present in the side chain of the benzene ring. Both in the common and IUPAC systems, these are usually named as phenyl derivatives of the corresponding aliphatic compounds(except arenes which are named as derivatives of the benzene in the IUPAC system). The position of the substituents on the side chain including the benzene ring are indicated by Greek letters i.e., α, β, γ In the common system, and by Arabic numerals, i.e. 1,2,3....etc. in the IUPAC system. However , many of these compounds are better known by their common names. The IUPAC and common names(given in brackets) of a few important members of each family are given below.

Aromatic hydrocarbons : Hydrocarbons which contain both aliphatic and aromatic units are called arenes.



Aryl groups



Halogen derivatives



Hydroxy derivatives. The nuclear hydroxy derivatives are called phenols while the side chain substituted hydroxyl derivatives are called aromatic alcohols.



Aromatic alcohols



Aromatic ethers.



Aldehydes



Ketones.

Page 43 of 47 2nd Quarterly e-Bulletin: Gyan- Vigyan Sarita: शिक्षा <u>http://www.gyanvigyansarita.in/</u>







Aralkyl amines.

Carboxylic acids.



Amines. Aryl amines



-00-

ASSIGNMENT

- IUPAC name of CH₃CH=CHCOOC₂H₅ is

 (a) Ethylbut-1-enoate
 (b) Ethylbut-2-enoate
 - (c) Ethylprop-2-enoate (d) none of these
- 2. What is the name of this compound



- (a) 2,3-dibromoaniline (b) 1,2-dibromoaniline
- (c) 1,2-dibromophenylamine (d) none of these
- 3. What is the name of the given compound





(b) 3-amino-5-hydroxybenzoic acid

- (c) 1-hydroxybenzoic acid(d) none of these
- 4. The IUPAC name of C₆H₅COCl is
 - (a) Chlorobenzyl ketone (b) benzene chloro ketone
 - (c) benzenecarbonyl chloride (d) chlorophenyl ketone
- 5. Give the name of the compound given below



- (a) 3-methoxybenzenamine (b) 3-aminoanisole
- (c) 3-methoxyaniline (d) 4-aminoanisole

(d) .2 (a) 3. (c) 4. (a) 5. (b) 5. (d) 5. (d) 4. (d) 5. (b)



Author is M.Sc. (Chem.), M.Ed. and Advanced Diploma in German Language (Gold Medallist). She retired as a Principal, Govt. School Haryana, has 3-1/2 years' experience in teaching Chemistry and distance teaching through lectures on Radio and Videos. She has volunteered to complement mentoring of students for Chemistry through Online Web-enabled Classes of this initiative. e-Mail ID: kumud.bala@yahoo.com

--00---

SOLUTION TO THE CROSSWORD PUZZLE Dec'16: EDUCATION

Prof. SB. Dhar



Answers to Science Quiz in Supplementaty e-Bulletin dt 1st Dec'16

Kumud Bala

1. [A] 2. [C] 3. [D] 4. [C] 5. [D] 6. [B] 7. [C] 8. [B] 9. [B] 10. [B] 11. [C] 12. [C] 13. [A] 14. [C] 15. [A] 16. [B] 17. [C] 18. [B] 19. [C]

-00-

Answers to QUIZDOM : Dec'16

1. POONA PACT; 2. "MANGO OF SALEM"; 3. MAHATMA GANDHI; 4. DEVDAS GANDHI; 5. HE BROKE THE SALT LAW THERE IN THE WAKE OF GANDHIJI'S DANDI MARCH IN THE 1930s; 6. HINDUSTAN SOCIALIST REPUBLIC ASSOCIATION (HSRA); 7. KAKORI TRAIN ROBBERY OR KAKORI CONSPIRACY; 8. MOTILAL NEHRU; 9. ALFRED PARK, ALLAHABAD; 10. CHANDRASEKHAR TIWARI; 11. RASH BEHARI BOSE (1886-1945)

-00-

(Contd. Freedom Struggle)

QUIZDOM – Jan'17

PHANINDRA IVATURY, QUIZ HOST

(<u>Note</u>: In view of the dedication of this issue on 'Education to Unprivileged Children' and our country celebrating 67th Republic Day on 26th of this month, **our Quiz Host has specially designed Quiz on Jewels of our country** who worked for education, reform and freedom struggle, as a tribute to them in the form a series of Quiz started in Aug'16, before moving on to new series of Quiz from next e-Bulletin**)**

- 1. Which pioneer of the initial Indian Freedom Movement was also referred to as "Rashtra Guru" which means "Teacher of the Nation"?
- 2. Who used to be referred to by Mahatma Gandhi as "Gurudev" or the "Great Sentinel"?
- 3. Which Indian independence activist, politician, writer is referred to as "Kualapati" and also is the founder of the Bharatiya Vidya Bhawan in 1938?
- 4. The mantra "SatyamevaJayate" (Which means Truth Alone Triumphs) was adopted as the national motto of India upon Independence. From which Upanishad was this motto adopted from?
- 5. In 1929, who founded the "VanarSena" or the "Monkey Brigade" the Children's Wing of the Congress with around 1000 children members who hoisted Congress flags everywhere, wrote letters to freedom fighter s who were jailed and provided food and water to agitators who used to be beaten up by the British Police?
- 6. The birthday of which leading figure of Indian Freedom Struggle is celebrated as the National Education Day in India on 11 November every year?
- 7. Which revolutionary of the Indian Independence era is credited as the writer of the popular patriotic poem "Sarfaroshi ki tamanna ab hamare dil mein hai"?, (dekhna hai dum hai kitna bazuen kaatil mein hai)
- 8. The Hindu Widows Remarriage Act of 1856 also referred to as Act XV of 1856 legalising remarriage of hindu widows in all jurisdictions of India under East India Company rule was primarily enacted in response to intense campaigning by which Indian reformer?
- 9. A collection of 196 letters written by Pandit Jawaharlal Nehru to his daughter Indira Gandhi during his imprisonment in various jails between 1930-33 was later converted into a Book in 1934. What is the name of this book?
- 10. Which Indian Freedom Fighter was popularly referred to as "Deshbandhu" which means Friend of the Nation?
- 11. 5TH September every year is celebrated as the "Teacher's Day" in memory of a former President of India. Who is he?
- 12. He was known for his efforts in abolishing the evil practice of Sati. He is instrumental in introducing the word "Hinduism" into English Language. He is known as the Father of Indian Renaissance" Who are we talking about?
- 13. He was an Indian politician, barrister and academician. He started the Bharatiya Jan Sangh which later evolved into the Bharatiya Janata Party. The Headquarters of the Municipal Corporation of Delhi is named after him. Who are we talking about?
- 14. "The Golden Threshold" is a collection of poems authored by which popular Indian freedom fighter?



Quiz Host is a Post-Graduate in Public Personnel Management and Winner of Kulapati K.M.Munshi Medal in Public Relations, has quizzing as a hobby. He has so far hosted over 200 Quizzing events on various platforms all over the globe. He currently works with the Comptroller & Auditor General of India, New Delhi having worked on intra/inter-national assignments. E-mail ID: phanindraivaturi@vahoo.com

__00___

Kumud Bala

SCIENCE QUIZ - Jan'2017

1. Which original particle of atom contains negative charge

(a) on nucleus (b) on proton

- (c) on neutron (d) electron
- 2. The formula of potassium chlorate is : (a) KClO (b) KCl (c) KClO₂ (d) KClO₃
- 3. Which of the following is not a decomposition reaction ?
 (a) CaCO₃ → CaO + CO₂ (b) H₂ + Cl₂ → 2HCl

(c) $H_2CO_3 \rightarrow H_2O + CO_2$ (d) $2KClO_3 \rightarrow 2KCl + 3O_2$

- 4. In the reaction, 2FeCl₂ + Cl₂ → 2FeCl₃, chlorine may be regarded as
 (a) an oxidizing agent (b) a reducing agent
 (c) a catalyst (d) providing an inert medium
- 5. HCl reacts with NaOH to form salt and water, this reaction is called
 - (a) precipitation reaction (b) neutralization
 - (b) redox reaction (d) combination reaction
- 6. An element reacts with oxygen to give a compound with a high melting point. This compound is also soluble in water. The element is likely to be :
 (a) calcium (b) carbon (c) silicon (d) iron
- 7. Butanone is a four carbon compound with the functional group

(a) carboxylic acid(b) aldehyde(c) ketone(d) alcohol

- 8. Which element still has dicey position in Modern periodic table?(a) earbon (b) nitrogen (c) eargen (d) hydrogen
 - (a) carbon (b) nitrogen (c) oxygen (d) hydrogen
- 9. Which of the following is not true about colloids
- (a) Particles in a colloids can pass through filter paper
- (b) A colloid is a homogeneous solution
- (c) Colloidal particles exhibit Brownian motion
- (d) Colloidal particles exhibit electrophoresis

- 10. The percentage of hydrogen in H₂O molecule is:
 (a) 5.55 (b) 11.11 (c) 44.45 (d) 88.89
- 11. Which one of the following will have the maximum charge/mass ratio?(a) electron (b) proton (c) neutron (d) α -particle
- 12. The plastics in which monomers are arranged in a straight chain are known as
 (a) thermoplastics (b) thermosetting plastics
 (c) PET (d) polythene
- 13. Whose reactivity is highest among the following metals?(a) copper (b) potassium (c) iron (d) zinc
- 14. What is used for surfacing of roads :(a) paraffin wax (b) coke (c) lubricants (d) bitumen
- 15. What is the full form of PCRA?
- (a) Petroleum conservation research association
- (b) Petroleum consumption research association
- (c) Petroleum conservation resource association
- (d) Petrochemical consumption research association
- 16. Chemical name of oil of vitriol is:(a) nitric acid(b) acetic acid(c) sulphuric acid(d) sodium hydroxide
- 17. The most commonly used natural indicator 'Litmus' is extracted from (a) lichens (b) turmeric (c) beetroot (d) china rose
- 18. A characteristic that gives a matter the ability / inability to undergo a change that alters its composition is called :
 - (a) physical change (b) chemical change
 - (c) physical property (d) chemical property
- 19. Who introduced the term 'mole' in chemistry (a) John Dalton (b) Amedeo Avagadro
 - (c) A. Lavosier (d) Wilhelm Ostwald
- 20. Which gas is filled in packet-packed snacks like potato chips
 - (a) nitrogen (b) oxygen (c) neon (d) carbon dioxide

(Answers to this Science Quiz shall be provided in First Supplementray Bulletin dt 1st Feb'17 following the 2nd Quarterly e-Bulletin)

Theme Song :

<u>PREMISE:</u> We are pleased to adopt a song " इतनी शक्ति हमें देना दाता....." from a old Hindi Movie Do Aankhen Barah Haath दो आँखें बारह हाथ of year 1957, directed by The Late V. Shantaram. The lyrics are by Shri Bharat Vyas, singer Melody Queen Sushri Lata Mangeshkar, and Music Direction by Vasant Desai. It has become a widely accepted inspirational song and/or prayer in many educational institutions and socially inspired initiatives engaged in mentoring of unprivileged children. This newly formed non-organizational initiative, being selflessly operated by a small set of compassionate persons, finds its philosophy in tune with the song and conveys its gratitude to all he eminent persons who brought out the song in a manner that it has attained an epitome of popularity. While working its mission and passion, the group invites one and all to collectively complement in grooming competence to compete among unprivileged children. The song/prayer goes as under -

इतनी शक्ति हमें देना दाता, मन का विश्वास कमजोर हो ना

हम चले नेक रस्ते पे हमसे, भूलकर भी कोई भूल हो ना ||

दूर अज्ञान के हो अंधेरे, तू हमें ज्ञान की रोशनी दे हर बुराई से बचते रहें हम, जितनी भी दे भली ज़िन्दगी दे बैर हो ना किसी का किसी से, भावना मन में बदले की हो ना ॥

इतनी शक्ति हमें देना दाता, मन का विश्वास कमजोर हो ना हम चले नेक रस्ते पे हमसे, भूलकर भी कोई भूल हो ना ॥

हम ना सोचें हमें क्या मिला है, हम ये सोचे किया क्या है अर्पण फूल खुशियों के बाँटे सभी को, सब का जीवन ही बन जाए मधुबन अपनी करुणा का जल तू बहा के, कर दे पावन हर एक मन का कोना ||

इतनी शक्ति हमें देना दाता, मन का विश्वास कमजोर हो ना हम चले नेक रस्ते पे हमसे, भूलकर भी कोई भूल हो ना ॥



Together Each Achieves More (TEAM)

Every end, so also end of this e-Bulletin, is a pause for a review, before re-continuing of a journey far beyond ...



