# GYAN-VIGYAN SARITA: शिक्षा

A non-remunerative, non-commercial and non-political initiative to Democratize Education as a Personal Social Responsibility (PSR) <sup>2nd</sup> Supplemetary e-Bulletin dt 1<sup>st</sup> Dec'17 of 5<sup>th</sup> Quarterly Issue, Second Year of Publication

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## ... start, without loosing time, with whatever is available.

#### <u>संपादकीय</u>

## अलौकिक प्रतिभा के धनी रामानुजन



उनकी प्रतिभा का लोहा इसी बात से माना जा सकता है कि कैंब्रिज विश्वविद्यालय को उनके ग्रेजुयेशन की डिग्री को ही पीएचडी माननी पड़ी। आजतक कोई यह नहीं जान पाया कि रामानुजन की डायरी में लिखे प्रश्नों को करने की उनकी क्या तरकीब हुआ करती थी। कुछ का मानना है कि वह रात को उठ बैठते और अपनी नींद में आये सपनों के आधार पर ही स्लेट पर लिख डालते। कुछ का मानना है कि उनको सूत्र उनकी कुलदेवी से प्राप्त होते थे।

भारतवर्ष में 22 दिसम्बर का दिन हर वर्ष राष्ट्रीय गणित दिवस के रूप में मनाया जाता है। 22 दिसम्बर रामानुजन का जन्मदिन है। उनका जन्म 22 दिसम्बर 1887 को कोयंबटूर के इरोड नामक गांव में हुआ था। यह स्थान आजकल तमिलनाडु में है। वर्ष 2012 में रामानुजन के जन्म की 125वीं जयंती थी। तब से भारत सरकार ने उनके जन्म दिन को गणित में उनके योगदान के लिये राष्ट्रीय गणित दिवस के रूप में मनाने का निर्णय लिया। श्रीरामानुजन की माता का नाम कोमल तम्मल और उनके पिता का नाम श्रीनिवास अयंगर था।

यथा शिखा मयूराणां नागानां मणयो यथा तद् वेदांगशास्त्राणां गणितं मूध्नि वर्तते अर्थात् जैसे मोरों में शिखा और नागों में मणि का स्थान सबसे ऊपर

है, वैसे ही सभी वेदांग और शास्त्रों में गणित का स्थान सबसे ऊपर है।

गणित वह उपकरण है जिसकी शक्ति अतुल्य है। इसका उपयोग सर्वत्र संभव है। यह एक ऐसी भाषा है जो प्राकृतिक है। प्रकृति बस गणित की भाषा ही समझती और जानती है। यह असंभव है कि बिना गणित को समझे हम वृहस्पति अथवा अन्य ग्रहों पर राकेट अथवा उपग्रह भेज पाये होते। इस चराचर जगत में जो कोई भी वस्तु है, वह गणित के बिना नहीं समझी जा सकती है अर्थात् यदि किसी वस्तु को समझना है तो बिना गणित के उसे नहीं समझा जा सकता है। गैलीलियो इटली का वैज्ञानिक था। उसका मानना था कि ज्यामिति की रेखाओं और चित्रों से हम वे अक्षर सीखते हैं जिनसे यह संसार रूपी महान पुस्तक लिखी गयी है।

महान वह होता है जो रास्ते में आने वाली कठिनाइयों की परवाह नहीं करता है और लगातार आगे बढ़ता जाता है। यह तब होता है जब वह अपना लक्ष्य कभी नहीं छोडता है, सोते-जागते सदा उसी के बारे में सोचता रहता है और उसके अनुसंधान में लगा रहता है। रामानुजन एक ऐसी ही अद्भुत प्रतिभा का नाम है जिसने गरीबी में जीवन जिया पर अपने गणितीय काम को जारी रखा और 3000 से अधिक समीकरणों को अपने 32 वर्ष की छोटी सी जिंदगी में लिख डाला जिसे आज भी दुनिया हल करने में लगी हुयी है।

रामानुजन का पूरा नाम था - श्रीनिवास रामानुजन अयंगर। रामानुजन विलक्षण प्रतिभा के धनी थे। बिना किसी मार्गदर्शक के सहारे गणित में उनके काम ने विदेशों में रह रहे गणितज्ञों का



रामानुजन एक धार्मिक व्यक्ति थे। रामानुजन बचपन से ही प्रतिभाशाली थे। उनके द्वारा पूछे गये प्रश्न लोगों के लिये अटपटे होते थे - जैसे इस पृथ्वी का पहला इंसान कौन था? आकाश और पृथ्वी के बीच की दूरी कितने फुट है? समुद्र की गहराई कितनी है? अब लगता है कि अटपटे प्रश्नों में ही भविष्य की खोजें छिपी होती हैं। एक बार की बात है, एक शिक्षक ने कक्षा में सिखाया कि अगर किसी संख्या को उसी संख्या से भाग दिया जाये तो उसका उत्तर एक होता है। रामानुजन का सकुचाते हुये प्रश्न था कि अगर शून्य को शून्य से भाग दिया जाये तो भी क्या एक ही आयेगा?

रामानुजन के जीवन पर आधारित एक पुस्तक राबर्ट कैनिगल ने वर्ष 1991 में लिखी। पुस्तक का नाम था- The Man Who Knew Infinity. राबर्ट कैनिगल एक मशहूर अमेरिकी बायोग्राफर हैं। उनके अनुसार रामानुजन का मानना था कि गणित में कोई खोज करना ईश्वर की खोज करने जैसा है। उन्हें विश्वास था कि अगर ईश्वर के स्वरूप का पता करना है तो यह सिर्फ गणित से ही संभव है। उनका कहना था कि मेरे लिये गणित के उस सूत्र का कोई मतलब नहीं है जिससे मुझे आध्यात्मिक विचार न मिलते हों।

रामानुजन अंकों के जादूगर थे। वह हर समस्या का हल अंकों के माध्यम से ढूढते थे। प्राचीन काल के गणितज्ञ अपनी - अपनी सूझबूझ और अपने - अपने तरीके अपनाकर जीवन के रहस्यों को ढूंढ़ते थे। जैसे यूनानी गणितज्ञ थेल्स ने पिरैमिड की ऊंचाई पता करने के लिये ज्यामिती का प्रयोग किया और इसी विधि का प्रयोग उसने पानी के जहाजों के समुद्र के किनारे से दूरी का पता लगाने में भी किया। मिस्र के इरेटोस्थेनीज ने भी बिना मिस्र से बाहर गये करीब 2200 साल पहले धरती की परिधि की गणना गणित की मदद से किया। वह भी इतना सटीक कि आज के कम्प्यूटर युग में भी उसे करीब करीब सही ही माना जाता है। प्रोफेसर हार्डी ने रामानुजन की छिपी प्रतिभा को निखारने में एक जौहरी का काम किया। प्रोफेसर हार्डी बहुत ही सख्त मिजाज व्यक्ति थे लेकिन वह अपनी पूरी जिंदगी रामानुजन के प्रशंसक रहे। प्रोफेसर हार्डी अपने काल के प्रतिभाशाली व्यक्तियों को 100 के पैमाने पर आंकते थे। उन्होंने विशिष्ट व्यक्तियों को अधिकतम 60 अंक तक दिये थे परंतु रामानुजन को 100 में से 100 अंक दिये। उनका कहना था कि रामानुजन को सिखाते - सिखाते रामानुजन से स्वयं सीखे ज्यादा और उसे सिखाया कम। आज के शोध और तत्कालीन गणितज्ञों की दृष्टि में रामानुजन एक दुर्लभ व्यक्तित्व थे।

अंकगणित के इतिहास में रामानुजन की दी हुयी एक संख्या है जिसे रामानुजन - डॉ हार्डी संख्या अथवा टैक्सी कैब नंबर भी कहा जाता है और वह है 1729, जिसे दो अलग अलग जोड़े में संख्याओं का घन निकालकर जोड़कर बनाया जा सकता है।

 $1729 = 1^3 + 12^3$  अथवा  $1729 = 9^3 + 10^3$ 

हम ज्ञानविज्ञानसरिता परिवार की तरफ से शत शत नमन करते हैं, उस महान गणितज्ञ रामानुजन को जो विश्व पटल पर गणित के क्षेत्र में एक नक्षत्र के रूप में चमक रहा है और आने वाली पीढ़ियों तक चमकता रहेगा।

आइये, रामानुजन के जीवन से हम सब सीखने की कोशिश करें कि अगर हम मुख्यधारा से अलग हैं तब भी हम महान काम कर सकते हैं, चाहे कोई भी क्षेत्र क्यों न हो, यहां तक कि हम नयी खोजें भी कर सकते हैं। शर्त यह है कि हममें लगन और अनवरत प्रयास करने की लालसा होनी चाहिये।

-00-

## An Appeal: Gyan Vigyan Sarita

## A non-organizational initiative of a small set of Co-passionate Persons

### Philosophy: Personal Social Responsibility (PSR)

**Objective:** Groom competence to Compete among unprivileged children from 9<sup>th</sup>-12<sup>th</sup> in Maths and Physics, leading to IIT-JEE.

**Financial Model:** *Zero-&-Fund-Zero-Asset* (*ZFZA*). It calls for promoters and facilitators to provide infrastructure for use to the extent they feel it is neither abused nor there is a breach of trust. And, reimbursement of operational expenses to the participators

## **Operation:**

- a. **Mode:** Online since July'16, using Google Hangouts, a free we-conferencing S/w, with connectivity upto 15 nodes.
- b. **Participation:** Voluntary and Nonremunerative, Non-Commercial and Non-Political

## **Involvement:**

- a. As Promoter
  - i. Initiate a Learning Center,
  - ii. Sponsor a Mentor who is willing to join on certain terms,
- iii. sponsor cost of operation and up-gradation of infrastructure to voluntary mentors,
- iv. Sponsor Website.

### b. As Facilitator –

- i. Provide space and infrastructure for **Online Mentoring Sessions (OMS)**, which is generally available, with a marginal add-on,
- ii. Garner support of elite persons to act as coordinators at a Learning Centre.

## c. As Participator -

- i. As a Mentor,
- ii. As Coordinator,
- iii. As Editor and or contributor of thought provoking articles for e-Bulletin, which are relevant to the initiative, and make it more purposeful and reachable to the target audience.
- iv. As author of Chapters for Mentors' Manual, being uploaded as a Free Web Resource,

- v. Anything else that you feel can add value to the mission and make it more purposeful.
- vi. Anything else that you consider to make this initiative to become more effective.

**Background:** The initiative had its offing in May'12, when its coordinator, a power engineer by profession, soonafter submission of Ph.D. Thesis in April'12, at IIT Roorkee, at the age of 61 years, decided to mentor unprivileged students.

SARTHAK PRAYASH, a Ghaziabad based NGO, warmly accepted the proposition and created a facility to mentor students from 8+ to prepare in mathematics and physics and prepare them for engineering entrance tests. They warmly reciprocated and created a class room.

Experience in this selfless social work were used to navigate across without losing focus. He was associated with SUBODH FOUNDATION from Sept'15 to Sept'16 during which he published a monthly e-Bulletin **SUBODH**-पत्रिका to create visibility across persons who could make a difference.

In Sept'16, post transition, the mission has been continued as a non-organizational entity Gyan Vigyan Sarita, with a set of Four persons, including retired Prof. SB Dhar, Alumnus-IIT Kanpur, a middle aged Shri Shailendra Parolkar, Alumnus-IIT Kharagpur, settled at Texas, US and Smt. Kumud Bala, Retired Principal, Govt. School Haryana. Earlier, they were complementing the OMS. While, the initiative survived transition. website: а http://quanviguansarita.in has been launched. It contains under its Menu: Publication>e-Bulletins, and >Mentors' Manual. You may like to read them.

Actions Requested: May please like to ponder upon this initiative. Queries, *if any, are heartily welcome*. We would welcome your collective complementing in any of the areas listed at **Involvement**, above, to make the mission more purposeful and reachable to target children. Page 6 of 35 2nd Supplement dt 1st Dec'17 to 5th Quarterly e-Bulletin - Ggyan Vigyan Sarita: शिक्षा http://www.gyanvigyansarita.in/



### **Coordinator's Views**

## **Secularism And Education**

Mother is regarded as the most natural teacher, and this makes education an inseparable ingredient in grooming of a child into a person of potential. Likewise, perceptions of power of nature incarnated into God of various forms grew into faiths, practices, and many explained and unexplained rituals of a group of families. As number of these families grew, it became sects. The bitter truth about the sects is that each claims its supremacy over other, despite their genesis in the nature, the Mother Nature, common to all. In this article an effort is made to explore : **should education be made secular**?

Human civilization has grown from standalone predators. Instinct of survival and procreation, natural to every life underwent refinement as human being got organized. Learning of these skills was need based and was acquired from the surrounding people and elders. Learning curve grew further with the growth of agriculture, and mass production of necessities. This growth was to take advantage of economics of scale, without really understanding economics at that stage.

Hinduism is regarded as an oldest religion which has given Four Vedas developed during 15<sup>th</sup> to 5<sup>th</sup> centuries BCE. In that **era** education had flourished in गुरुकुल, **a** place of learning. Transfer of knowledge was formalized through oral recitations and imparting of wisdom by ग्र

to शिष्य was more a matter of transfer of spirit. The transfer of spirit was at the pleasure and judgement of  $\overline{g}$  on the competence of शिष्य to use it. The scripture of Hinduism cite competence in diverse fields. Though the Hinduism has survived, many of the acclaimed competence have disappeared. The basic reason behind this is the oral transmission of knowledge without documentation.

In perpetuation of Hinduism, **Takshshila University**, now in ruins in North-West Pakistan, was established around 2700 years ago. It attracted scholars from all over the world to study in 64 different fields viz. Vedas, grammar, philosophy, Ayurveda, agriculture, surgery and many more.

Inception of Buddhism and Jainism, as religion, in 5<sup>th</sup> century BCE has continued to thrive. The scholarly traditions of Buddhism led to creation of learning centre Nalanda in 5<sup>th</sup> century which flourished upto 12<sup>th</sup> century.

**Confucius,** (551–479 BCE), in China is considered to have perpetuated Zhou values concerning ethics and politics, emphasizing personal and governmental morality, correctness of social relationships, justice, traditionalism, and sincerity. He travelled across the world and had many disciples. Little later, **Socrates** (470 – 399 BCE) a Greek philosopher is considered to

beyond fragments of religious beliefs. He had to pay his life for his conviction. His school of thoughts were perpetuated, in Fourth century BC, by his scholarly disciples Plato and Aristotle. This grew beyond changing understanding of nature culminated into Mathematical Principles of Natural Philosophy by Isaac Newton in 1687. This made learning a scientific activity with famous phrase "there is no need to reinvent the wheel". Albert Einstein an exponent of Though Experiment has said that – "Every day I remind myself that my inner and outer life are based on the labors of other men, living and dead, and that I must exert myself in order to give in the same measure as I have received and am still receiving." He did propound need of exploration by saying that -"Imagination is more important than knowledge. For knowledge is limited to all we now know and understand, while imagination embraces the entire world, and all there ever will be to know and understand". The essence of growth of knowledge lies in thinking beyond, reasoning out every observations and beliefs, to explore how? and why? In this pursuit thought experiments play important roles. First it determines boundaries of the known observations, and then what lies beyond those boundaries.

While there are many ancient higher learning institutions ordained sponsored and overseen by religious institutions and the rulers. Each of them supported scholarly pursuit as per their school of thoughts, with different model of learning and imparting knowledge. In modern times University of Balona founded on 1088, has continued its operations. There after, came in many universities spanning over a wide range of structured and powered learning to open learning. The basic question remains to be answered can elite persons bias the learning of descendants and right to reason proclaimed theories and believes?. If not, can the innocent children be left to learn on their own and reinvent wheel to satisfy their urge and survival instinct. Limited environment of deprived children constricts their learning opportunities. Thus most are benefitted are those who are privileged to be born and grow in an environment filled with the discoveries and inventions. Both, the premises are diagrammatically opposite and involve their own cost. With advent of science and technology, need of learning has grown exponentially. Nevertheless, continuance of discoveries validates that there is much to blow imagination and explore nature to make development. This development must support growth of human civilization, make the Mother Nature stable and sustainable.

Many universities are there thriving in competition against each other with dynamic ranking based on various parameters laid down by accreditation agencies. A spurt of new universities are joining the fray, some independently while others collaborating with established universities.

Still the basic questions that remains unanswered are, should bias of elite regulate and create a learning frame? And should unprivileged children be allowed to live in their own peril for the sake of naturalized learning?

In this context, views of **Swami Vivekananda** expressed in an answer to a question : How would you define "True Education" ?. He answered that- "*I never define anything, Still, it may be described as a development of faculty, not an accumulation of words, or a training of individuals to will rightly or efficiently.....". [Prabuddha Bharat, December 1898, Complete Work, 5.231]. Swami Vivekananda despite being a monk was a science student and contemporary to late 19<sup>th</sup> and early 20<sup>th</sup> century scientists, who did not advocate confining of learning to a rigid frame as also advocated by Einstein. This is where true spiritual freedom in pursuit of learning is granted naturally.* 

An initiative driven by sense of **Personal Social Responsibility (PSR)** was started about 5-1/2 years ago in chalk-n-talk mode by a set of compassionate persons to **democratize education**. In this pursuit, aim is to mentor, and neither to teach, nor to tut, nor to coach students. This mentoring is invoke out-of-box thinking. It aims at motivating students to question their observation, surrounding and learning on How? And Why? Analyse every observation or problem that they encounter, evolve alternatives way of resolving the problem, select an alternative which is feasible, and sustainable, in coexistence. Another, important feature of mentoring is invoking **group dynamics** among students where they interact mutually in problem solving. This entails in students, firstly better learning,

secondly boosts their confidence, and thirdly a team spirit and collaborative growth a necessity of their times ahead. Off late, about Two years ago the mentoring initiative was upgraded to Online Mentoring inviting schools to avail benefit of the initiative in improving quality of learning to their students. In an upgrade about Six months ago, it becomes **Interactive Online Mentoring Session (IOMS)**, where students at remote end can collaborate in problem solving with their mentors. It is seen to be phenomenally enhancing confidence of students. This initiative uses technology in India growing digital to connect passionate persons to mentor unprivileged students, who are otherwise disconnected and unable to reach each the other on account of many barriers.

This initiative is non-remunerative, non-commercial and non-political. It requires schools, institutions, organizations, social groups, individuals, administration and government to choose a place for collating target students, create IT setup for IOMS, arrange a local coordinator, preferably from subject and ensure its operation and maintenance with continuity and consistency. They are required to support mentors with up-gradation of their IT setup or operational need wherever necessary. The overall cost is insignificant as compared to what is being selflessly imparted to the target students. This financial model is Zero-Fund-&-Zero-Asset (ZFZA), where promoter of the equipment is the owner until mutual trust between mentor and the promoter exits, Any breach of trust is reciprocated with return of equipment to the owner, for a use deemed fit.

**Ramkrishna Mission High School, Sitanagram**, Distt. Guntur is the biggest learning centre with about 40 students. Extensive efforts are being made to add more learning centres. It is seen that within Three months of the initiative at the school, spiritual environment at learning centre, together with participation of students with their teachers and school administration, without hegemony, has become strength to effectively promote IOMS.

This idea started in a very small way about 5-1/2 years ago to get to the present shape. Without any malice, all the retardants experienced during this journey are seen as an integral part of a तपस्या for a larger good. Perhaps GOD also wants to satisfy about sincerity of passion and commitment and ensure that His blessings do not go either in selfish or incompetent hands, liable for abuse. तपस्या is being realized as a pursuit of a cause with sincerity, dedication, and pursuance and perseverance. During this process a person performing Tapsya undergoes gradual realization in a natural course. In this process there is assimilation of truth. This in turn creates power of self-conviction, and an irresistible force to reckon with in words, expression and actions. People regard this power as सिद्धि of Tapasya, while other see as a miracle or चमत्कार. There is nothing supernatural about it. In fact it is just a process of self-purification, self-carving through pursuit of selfless and dedicated renunciation. The moment a person with the kind of सिद्धि abuses this power automatically he belittles himself and its intensive of effects starts vanishing out.

In this pursuit, inspiration is derived from a quote of Swami **Vivekananda** – "Take up one idea. Make that one idea your life; dream of it; think of it; live on that idea. Let the brain, the body, muscles, nerves, every part of your body be full of that idea, and just leave every other idea alone. This is the way to success, and this is the way great spiritual giants are produced."

Getting back to the issue of democratizing education first necessity is to make quality education accessible to unprivileged children. Unless it is done in a manner to groom competence to compete among them, all efforts and investments would be just worth of building numbers without really creating social capital. This quality education encompasses knowledge of science whereby thought process of target students opens up to explore new horizons. Here emphasis is being given to unprivileged children since they deserve support in building competence. This support derives justification by virtue of deprivation of awareness, guidance and opportunities they suffer in prevalent environment of severely commercialized education.

This initiative is indiscriminative in nature. If children from affluent families avail this opportunity, strength of their understanding and competence on one hand would reinforce efforts of capitalizing upon group dynamics, and secondly they would emerge as better team player with human sensitivity for deprivation, a high valued social capital. All that is expected from this class of students is to live within the

constraints of the system of IOMS, without demanding special favours. Unfortunately, experiences are contrary to these expectations. Children from affluent families, and their parents are overwhelmed with their affordability to play highest stakes in choice of a branded institute. This unhealthy competition of affordability is driving the para-academic institutes to commercialize their services. Moreover sycophancy for crowd-pullers is strong enough to attract even lower middleclass parents to play stakes, beyond their capacity. Eventually, forward journey of this initiative becomes tougher and target children remain marginalized in availing the opportunities. Despite, all these factors and best efforts are being made to motivate them and institutes catering their educational needs.

Next issue that comes up - is there any sect based discrimination among target students?. The whole philosophy of education from Socrates, to Newton to Einstein and Vivekananda is exploring the **mother nature**. This is essential not only to make living but make it sustainable for our descendants to peacefully co-exist. **Thus education is and must be totally indiscriminative**. In view of this, any effort either alienate target students from truth of Maths and Science, mother of all disciplines of knowledge, deserve to be denounced.

Summary: This initiative of IOMS is totally indiscriminative. *non-monopolistic* and noncommercial. It aims to use digital technology to connect passionate mentors to students deprived of educational motivation and guidance. The basic philosophy behind the initiative is to facilitate right to grow with quality education, a fundamental right to everyone, irrespective of gender, economic condition, sect and beyond any man-made barriers. Such an initiative cannot be philanthropic if it is pursued to suit one's convenience. It is essential to remember that such philanthropy is a fashionable luxury for those who can afford it. But, it is a spiritual mission for those who are passionately committed to it with continuity and perseverance. Above all indiscrimination in pursuit of truth is nature of education. Therefore, any attempt call education a secular question about secular endeavour is over emphahsizing its basic nature, and hence superfluous. So also putting preachings of religion or of a in frame of education is communializing it and is absolutely incorrect.

यह प्रयास अपने सामाजिक कर्त्तव्य के प्रति सहज विनीत आग्रह है; कृपया इस पर विचार करें.

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## **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, b*</u>) <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.

Looking forward, these articles are being integrated into Mentors' Manual. After completion of series of such articles on Physics it is contemplated to come up representative problems from contemporary text books and Question papers from various competitive examinations and a guide to their solutions in a structured manner, as a dynamic exercise to catalyse the conceptual thought process.

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**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 **Online Mentoring** 



Students of Academy Home, Morning Star Society, Lucknow A Learning Centre on IOMS; Target Students: 8<sup>th</sup> and above

## **Educational Challenges in the Underprivileged Children**

## Dr Tayyaba Qidwai Muscat, Oman

When I first started thinking about spending the rest of my life living the passion, which I always had for social work, the plight of the underprivileged children was the first which caught my eye and then took hold of my heart. The sight of distressed expressions and eager street children at my heels begging for money always haunted me. There was no avoiding a child's eye looking up at you, an amputee holding out an empty cup or a mother and an infant sitting in the blazing heat hoping to look pathetic enough to warrant the charity of a few coins. It was an anxietyridden dilemma for me. Knowing that these kids have not only been damaged by constant physical and emotional abuse but also frequently by sexual abuse, saying No to them offered a tortuous spiritual task for me, because handing out a few coins was increasing their helplessness, as this donation invariably went to their beggar masters or their parents who often spent it on alcohol.

So what was the remedy? And the words of a Chinese proverb rang loud and clear in my mind- Give a Man a Fish, and you feed him for a day. Teach a Man to Fish, and you feed him for a lifetime.

Poverty is no doubt the number one cause of this plight, but lack of education is the second most important culprit. We can either fight poverty by donating just food or also try to fight poverty by giving Education so that they themselves would become selfsufficient for life. I, like many before me chose the latter option. But how do I go about it? Being a medical doctor and being in general practice for a long time, I had an idea that a child born to poor parents meant total exposure to malnutrition, diseases, poor living conditions, inadequate sanitation and many other hardships. So if I had to take an Educational initiative for these underprivileged children, it had to be something different- a practical and scientific approach which would develop their intellectual abilities to the fullest.

When I started working with Underprivileged Children Education, the fact which struck me at the outset was the high drop-out rate of these children from school, even when facilities were given to them to attend a school in the neighborhood. Also even what little education they were given, they could not benefit from it as much as some child from a privileged background would have done. Which lead to a new question - what is it in the daily life of a disadvantaged child that most acutely hampers the development of skills he needs to succeed? Of course, part of the answer was the basic issues of health- No nutritious food, worst medical care but, also no stimulants are provided to them to develop their cognitive abilities like educational toys and books, no libraries or museums in their neighborhood. Further the vocabulary they are exposed to is very limited and often containing words which will be frowned upon or earn a slap on the wrist in an educated household. All these matter a great deal. Recently, many of the researches by neuro-scientists and psychologists have started to focus on the different set of causes for the problems of children who have grown up in adversity. They have found that the primary mechanism through which children's environment affects their development is Stress. Certain environmental factors, a sustained period, produce unhealthy over developments, both physiological and psychological, in a child, so that the development of a child's prefrontal cortex, the part of the brain that controls our most complex intellectual functions, as well as our ability to regulate ourselves both emotionally and cognitively is compromised. Toxic stress can make it difficult for children to moderate their responses to disappointments and provocations-so that small setbacks feel like crushing defeats and tiny slights turn into serious confrontations. So one sees patterns which are so familiar- fighting, talking back, acting up in class and also going through each day perpetually wary of connection to outreach from teachers and adults. Also on a cognitive level, growing up in a chaotic, unstable environment causes disruption of a set of skills, controlled by the frontal cortex known as executive functions of the brain-like working memory, self-regulation and cognitive flexibility. This also underpins many of the noncognitive abilities, like resilience and perseverance. And when the child's executive functions aren't fully developed, then those school days with so many complicated directions become an exercise in frustration.

Childhood poverty is a multi-faceted phenomenon which cannot be measured or resolved only through monetary means. It requires comprehensive strategies to address its many features.

Thinking of all these, we thought that the best way to achieve good results would be to change the environment they live in, so that their health concerns are also met with and the relationships they experience – the way their teachers and mentors and adults interact with them would help take away the stresses of life which they experienced in their homes. Thus our NGO has taken up the challenge of trying out a pilot project of providing residential facilities for these underprivileged children and helping them in fitting into the mainstream education. Our motto is Education for All, by the Efforts of All.

So it was a great privilege to be introduced to GyanVigyanSarita, an initiative by a small group of co-passionate persons engaged in mentoring unprivileged children selflessly and bring them to a level of competence to compete, by my school mate and childhood friend Shalini Mathur. Talking to Dr Joshi, I could catch the cherished goals as well. Online Mentoring was the best option being offered to me, as there was a great paucity of educated adults which I was trying to find for my children in the 10 years since we started working, who would give their time and tender, loving care to a group of compromised children, who were plagued by emotional burden of losing a parent or both parents, of being themselves the victims of diseases like tuberculosis and malnutrition, for whom there was no light at the end of the tunnel. Though we had brought them into the mainstream of education, but still that personal

contact with a role model, a Guru, a guide and a friend was badly needed for day to day management of stress and confusions of life. We were lucky enough to get the guidance and help of just one concerned individual, who was a retired General Manager of one of the prestigious Birla groups of companies whose idea of charity was a similar sense of sharing of talent and knowledge with a less privileged section of society and he was available locally to interact with the children. And then of course now, team of GyanVigyanSarita mentors them online. They have strengthened our vision and a resolve to create a harmonious integration of the scientific and sociocultural knowledge, which will provide a grounding base for a balanced individual. Such persons would cater to needs of their everyday life and ambition, the needs of their society and the needs of the nation as a whole. I think the concept of Online Mentoring is the best way by which the services of the educated and professional class of the community may be utilized, on a voluntary basis to participate in the education, upbringing and training of orphans and children from compromised backgrounds, and most important is to bridge large gap. Specially, as this class comes not only with the academic qualifications to make a difference, but a vast experience of the complexities of life and the wisdom they have derived over the years.

We look forward to long years of working together to what Rabindranath Tagore had envisioned-

Where the mind is without fear and the head is held high,

Where knowledge is free.....



Author is a retired Medical Practitioner. She is running an NGO, Morning Start Society at Lucknow, which has created Academy Home, a residential facility for children from underprivileged background.

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Education is just not training; It is about ability to think; It is about ability to reason; It is about ability to choose; It is to develop a faith in self, And, a passion to apply. Page 13 of 35 2nd Supplement dt 1st Sept17 to 4th Quarterly e-Bulletin-Ggyan Vigyan Sarita: शिक्षा http://www.gyanvigyansarita.in/

## FACE YOUR FEAR....

## Haritha

One day, Swami Vivekananda was returning from temple of Maa Durga. Path was very narrow as on one side it was covered by large water tank and on other side there was a high wall.

On the path Swami Vivekananda saw a number of monkeys and those were not allowing him to pass by the path and whenever Swami Vivekananda would take a step forward, those monkeys would make a lot of noise and make angry faces, showing their annoyance by shrieking near his feet.

As Swami Vivekananda took a step forward, monkeys got close to him. Faster Swami Ji ran, bolder the monkeys got and tried to catch him and bite him.

A time came when Swami Ji felt that it would be impossible to escape, just then an old Sanyasi called out and said "face them...!!!"

Those words brought Swamiji to senses and he stopped running. Swami Ji turned back, face the monkeys boldly.

As soon as Swami Ji did that, those monkey fell back and left.

## Moral of the story is -

## "WE SHOULD NOT RUN AWAY FROM DIFFICULTIES,

## **INSTEAD FACE THEM BOLDLY.**"



Haritha, Student Class 9<sup>th</sup>, Ramkrishna Mission High School, Sitanagram, Guntur Distt. A.P. She is a regular student of IOMS at the school. She is a member of Ramanujan Group of students created for the purpose of IOMS in an endeavor to encourage group dynamics, through intra- and inter-group interaction.

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## <u>हमारा पंचवर्षीय प्रवास</u>



Start: June-2012





April-2015

June-2016......

पारम्परिक शैक्षणिक मार्दर्शन से प्रारम्भ कर आज हम तकनीकी-विकास के सहारे मूलभूत प्रासंगिकता को आगे बढ़ने में संलग्न हैं...

## **TINY HANDS: BIG JOBS**

A large number of children are quite stranger to the joy and innocence of the formative years of their lives. Not all children in India are lucky to enjoy their childhood. Many of them are forced to work under inhuman conditions where their miseries know no end. Though there are laws banning child labour still children continue to be exploited as cheap labour. Instead of enjoying their early steps of their life's journey, they are forced to work under conditions of slavery. It is because the authorities are unable to implement laws meant to protect children from being engaged as labours. Children are employed illegally in various industries. But, agriculture is the largest sector where children work at early ages to contribute to their family income. Children are illegally working in factories. Unfortunately the actual number of child labourers in India goes undetected, since it is not recorded to escape from encroachment of law. Children are forced to work without adequate food, proper wages is completely unregulated, and conditions they are subjected are physical and emotional abuse.



A Widespread Problem: Due to high poverty and poor schooling opportunities of child labour is quite prevalent in India. Child labour is found in rural as well as urban areas. Children comprise 40% of the labour in the precious stone cutting sector. They are also employed in industries like mining, zari, embroidery and in homes as domestic labour. G. Meghna



**Conclusion:** Government authorities and civic society organizations need to work in tandem to free children engaged engaged in labour under abysmal conditions. They need to be rescued from exploitative working conditions and supported with adequate education. Above all, there is a need to mobilize public opinion with an aim to bring about an effective policy initiative to abolish child labour in all forms.



"Child is Meant to Learn, not to labour"



Author is a student of Class 9<sup>th</sup> at Ramkrishna Mission High School, Sitanagram, Distt. Guntur, AP. She is a regular student of IOMS being held at the school. She is a Leader of Ramanujan Group of students created for the purpose of IOMS in an endeavor to encourage group dynamics, through intra- and inter-group interaction.

## Virtual Classroom (or Learning Centre): A Case Study (Ramakrishna Mission High School, Sitanagaram - 522501, Tadepalli Mandal, Guntur District, Andhra Pradesh)

#### **R.K. Mohan Rao**

The Case Study is considered to be of value in dissemination of experience at the school. It is believed that it would help to catalyse more schools to explore the model and evaluate its relevance. Moreover, more persons specially senior citizens would find in it an opportunity to add positivity to their living a long life, a precious gift of GOD. While doing so one joins hand in building of social capital, of immense value, through education. Likewise, more organizations vouching social welfare may like to use this experience in furtherance of their maintaining their own sovereignty and may consult whenever and wherever need is felt.

In 1965, Ramakrishna Samiti, a Service organization dedicated to implementing Ramakrishna-Vivekananda teachings, started a Telugu Medium High School, Ramakrishna Vidyalaya to impart quality education to the children of settlers, poor, SC & ST and backward communities in Sitanagaram village near the outskirts of Vijayawada in Andhra Pradesh.

In 2001, Ramakrishna Mission, Vijayawada took over its

management and the school was renamed as Ramakrishna Mission High School. Along with improving the basic infrastructure comprehensively,

Ramakrishna Mission started English Medium classes

English Medium classes during 2004. The school started registering 100% pass and distinctions in Board examinations consistently from 2008 onwards.

During early 2017, the school came in contact with 'Ek Kadam Aur', an NGO with its base at Chicago, USA dedicated to spreading e-learning with e-volunteers as part of their philanthropic services in the field of education. With the financial support from 'Ek Kadam Aur', the school started a Virtual Classroom tailoring the Conferencing Technology Video for classroom environment with the objective of enhancing the confidence of its students by exposing them to different domains of knowledge and by seamlessly crossing its school boundaries with sky as the limit. Virtual Classroom became operational in June 2017 and it came into regular operation from August 2017. 'Ek Kadam Aur' started arranging e-volunteer teachers from Chicago and Delhi in the fields of Biology, Medicine, IT, Genetic Engineering etc.



Our students are very comfortable in hearing, understanding and appreciating lectures in English from 8<sup>th</sup> class onwards whereas they are comfortable for interactions in English from 9<sup>th</sup> class onwards. Hence we have chosen students from 9<sup>th</sup> class for Virtual classroom and trained them in the techniques of Virtual Classroom interactions.

During August 2017, 'Ek Kadam Aur' arranged a talk of

an e-volunteer from 'Gvan Sarita' Vigyan а nonorganizational group of compassionate mentors based at Noida, Utter Pradesh offering its services through On-line Mentoring free of any charge. What thought of as one time routine talk, has turned out to be a steep rise in the utility and effectiveness of our Virtual Classroom operations. The

binding between the mentor and our students became so strong that it is giving a feeling for us that 'Gyan Vigyan Sarita' and 'Ramakrishna Mission High School' are made for each other. It is a unique phenomenon where energy levels are growing consistently at high pace in all stakeholders and it is a wonderful demonstration of eagerness, sincerity, ownership and emotional involvement.

The mentor is taking classes regularly from Tuesday to Friday during 8.00 am to 9.30 am in Physics and Mathematics. The mentor is treating Mathematics and Physics as one subject and giving our students strong foundation and conceptual understanding.

The techniques that evolved and practiced in the process are Accelerated Learning by Group Dynamics and On-line Interactive processes for testing, evaluation, reviewing, collaborative working, periodic consolidation and last but not the least is the mentor-teachers periodic interactions.

## Photo Galary of IOMS at Ramkrishna Mission High School, Sitanagram



Divya K, Sri Manasa Vaishnavi D, Bindu Sri K, Vennela P Left to Right

#### Aryabhatt Group



tto Right Bhanu manojna D, Veena Sri N, Jahnavi M, Vyshnavi G

#### CV Raman Group



Let to Fight : Jayavardhan Reddy P, Venkatesh kumar T, Kamalesh N, Sai Venkata Ganesh J, Baok alde Sai Rahul T, Twinkle Mokshaona A

#### Varahmihira Group



All Groups at IOMS



Left to Right : Priyanka Y, Lavanya S, Vijaya T, Vijaya Lakshmi R

Bhaskara Group



Left to right
Ramanujan Group





в Right Divya Ch, Naga Harshitha K, Bhanu Sri Sai Durga K, Muntaz Sk

**Btahmagupta Group** 



<sup>lata</sup> Radha Y, Haritha G, Kavya P, Naga Vidya Harini T, Poojitha Reddy N

Susruta Group



#### After Refurbishment





Teachers Collaborating in Carving Road Map of IOMS

Present Screen & ICT Setup



#### Interactive Participation of Students at Online Learning

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Left to Right : Smt. Ch. Anjani Kumari, Smt. S. Rajani Chandra, Smt. U.V.Vldya Rani, Sri D.V.S. Durga Prasad, Sri P.V.R. Durga Prasad

Team of Passionate Teachers Taking up Helm of Change Upon Themselves



Author is a former Scientist of Central Scientific Instruments Organisation (CSIO), a constituent laboratory under Council of Scientific and Industrial Research (CSIR). He is associated with Ramakrishna Mission for more than forty years. After his retirement, he is associating with the Swamijis of Ramakrishna Mission and assisting them to execute projects like Value Education, Smart Classrooms, Communicative English, Virtual Classroom etc.

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**GROWING WITH CONCEPTS - Mathematics** 

## **DIFFERENTIAL EQUATIONS**

#### **Prof. SB DHAR**

#### **Differential Equations**

There are six types of questions that are generally asked on this chapter.

1. Formation of differential equation on the basis of (a) Curve's Equation

(b) The word problem related to two dimensional co-ordinate geometry in

which firstly the student will have to write the equation of the curve required and then find the differential equation of that curve.

- 2. Checking the truthfulness of the (given) solution for the given curves, i.e. whether the given curve is a solution of the differential equation (given) or not.
- 3. Order and degree of the given differential equation.
- 4. Finding out the solution for the given differential equation.

This solution is of the following types:

- (a) *general solution*: the solution that contains as many arbitrary constants as the order of the differential equation.
- (b) *particular solution* : the solution free from the arbitrary constants.
- (c) *singular solutions* other than general and particular solutions
- (d) complete solution
- 5. Orthogonal trajectory, and

6. Solutions of First order and higher degree differential equations

### Definition

Differential equation may be defined as an equation consisting of derivatives.

Differential equations are of following types:

#### (a) Ordinary differential equations

Differential equations which involve only *one independent variable* are called ordinary differential equations.

Examples:

1

(i) 
$$(x+y)\frac{dy}{dx} = xy$$
.  
(ii)  $y = x\frac{dy}{dx} + y^2\left(\frac{dy}{dx}\right)^3$ .  
(iii)  $x^3\frac{d^3y}{dx^3} + 3x^2\frac{d^2y}{dx^2} + 4x\frac{dy}{dx} - 5y = x^2 - 5$   
(iv)  $\frac{dy}{dx} = k$   
(v)  $\left(\frac{dy}{dx}\right)^2 + \left(\frac{dy}{dx}\right) - 3 = 0$   
(vi)  $\rho = \frac{\left(1 + \left(\frac{dy}{dx}\right)^2\right)^{\frac{3}{2}}}{\frac{d^2y}{dx^2}}$ 

#### (b) Partial differential equations

Differential equations that involve *two or more independent variables* and *contain partial differential coefficients* are called partial differential equations.

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Examples:

(i) 
$$x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z} = xyz$$
  
(ii)  $\frac{\partial^2 u}{\partial x^2} = \lambda \frac{\partial^2 u}{\partial y^2}$   
(iii)  $\frac{\partial u}{\partial y} = 5 \left(\frac{\partial u}{\partial x}\right)^2$   
(iv)  $\frac{\partial u}{\partial y} = 3$   
 $\partial^2 u$ 

(v) 
$$\frac{\partial^2 u}{\partial x \partial y} = k$$

#### **Order Of Differential Equation**

The order of a differential equation is defined as the *highest differential coefficient* of the dependent variable *w.r.t.* the independent variable.

Example:

$$\left(\frac{d^3 y}{dx^3}\right)^{\frac{1}{2}} = \sqrt[4]{\frac{dy}{dx} - 2}$$

To find the order of the differential equation, we rationalize the given equation until all the radical signs are removed from all the derivatives and then note the highest derivative.

The above equation after rationalization looks as below:

$$\left(\frac{d^3y}{dx^3}\right)^2 = \left(\frac{dy}{dx}\right) - 2$$

Obviously, the highest order is the Three due to the

radical sign free  $\frac{d^3 y}{dx^3}$ .

#### **Degree Of Differential Equation**

(a) The degree of the differential equation is defined as the index or power of the highest order derivative after the derivatives have been represented as polynomials *i.e.* the equation has been made rational and integral.

(b) If any how the derivatives cannot be represented as their polynomial then the degree becomes undefined.

For example:

In the Differential Equation 
$$\left(\frac{d^2 y}{dx^2}\right) = x \cdot \sin\left(\frac{dy}{dx}\right)$$
,

Degree is **undefined** as the differential equation cannot be written as the polynomial of all the derivatives. Hence the **order is 2** but the **degree is undefined**.

# Checking the truthfulness of the differential equations by the given curves.

Let us consider an Example:

Which one of the following is a solution of  $d^2 x = dx$ 

$$\frac{d^{2}y}{dx^{2}} - 6\frac{dy}{dx} + 9y = 0$$
(a)  $c_{1} + c_{2}x$ 
(b)  $(c_{1} + c_{2}x)e^{3x}$ 
(c)  $c_{1}\cos 3x + c_{2}\sin 3x$ 
(d) none

In such type of questions one should put the required values using the options and check the truthfulness.

Here in this question, obviously by differentiating twice and putting the values of second and first derivatives of option (b) satisfies the given differential equation. Hence the correct solution is option (b).

Consider 
$$y = (c_1 + c_2 x)e^{3x}$$
  
 $\frac{dy}{dx} = (3c_1 + c_2 + 3c_2 x)e^{3x}$   
 $\frac{d^2 y}{dx^2} = (9c_1 + 6c_2 + 9c_2 x)e^{3x}$ 

On putting these values in the given differential equation, we get the result satisfied.

#### **Formation of differential equations**

Let us consider an example:

Form differential equation from  $y = ae^{3x} + be^{-2x}$ 

To form a differential equation from the given curve, we shall eliminate the arbitrary constants a and b. For this, we first find the first and the second derivatives and using these three equations we eliminate the constants a and b.

$$y = ae^{3x} + be^{-2x}$$
 (i)  
$$\frac{dy}{dx} = 3ae^{3x} - 2be^{-2x}$$
 (ii)

$$\frac{d^2 y}{dx^2} = 9ae^{3x} + 4be^{-2x}$$
(iii)

Multiplying equn (i) by 2 and adding it to equn (ii), we get

$$2y + \frac{dy}{dx} = 5ae^{3x} \dots (iv)$$

Now multiply equn (ii) by 2 and add to equn (iii), to get

$$2\frac{dy}{dx} + \frac{d^2y}{dx^2} = 15ae^{3x}\dots(v)$$

Now divide equn (iv) by (v) to get

$$\frac{2y + \frac{dy}{dx}}{2\frac{dy}{dx} + \frac{d^2y}{dx^2}} = \frac{1}{3}$$
  
Or,  $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 6y = 0$ 

It is obvious that the equation consisting of 2 arbitrary constants a and b has been transformed into a differential equation which is of second order i.e. the order of the differential equation = # arbitrary constants.

Where # denotes hence afterward "number of".

## Solution Of A Differential Equation

## (i) General solution :

 $\frac{dy}{dx} = f(x) \Rightarrow y = \int f(x)dx + c$  where c is an arbitrary constant.

If by any condition c is eliminated by any numeric value then that solution becomes **a particular solution**.

General solution may have more than one form but the number of arbitrary constants remains the same.

## (ii) **Particular solution**:

It is obtained by the elimination of the arbitrary constants under the given conditions i.e. arbitrary constants are removed under some conditions.

(iii)Complete Solution = Complementary Function + Particular Integral

**Complementary Function**: It is the part where the number of arbitrary constants is equal to the order of differential equation.

**Particular Integral**: In this part there exists no arbitrary constant.

In case of Linear Differential Equations, the working rule to find the complementary function is as below:

(a) Replace RHS of the given equation by Zero.

For example in case of 
$$\frac{d^2 y}{dx^2} - 8\frac{dy}{dx} + 15y = 0$$

 $(D^2-8D+15)y=0$  is called the Auxilliary Equation (A.E.) where D=(d/dx).

- (b) Solve for the roots of this A.E and let the roots be  $m_1$ ,  $m_2$  in general and particularly here in above case  $m_1=3$ ,  $m_2=5$ .
- (c) Remember that if the roots are real and distinct, then  $CF = c_1 e^{m_1 x} + c_2 e^{m_2 x} = c_1 e^{3x} + c_2 e^{5x}$
- (d) If the roots are equal i.e. both equal to m, then  $CF = (c_1 + c_2 x)e^{mx}$
- (e) If the roots are imaginary, certainly they will be in pair i.e.  $(\alpha+i\beta),(\alpha-i\beta)$  then CF=  $e^{\alpha x}$  (C<sub>1</sub> cos  $\beta x$ + C<sub>2</sub> sin  $\beta x$ ).

# For evaluation of Particular Integral, the following working rule is followed:

(a) in case of 
$$\frac{dy}{dx} + Py = Q$$
.

P.I.=  $\frac{1}{(D+P)}Q = e^{-\int Pdx} \int \left(Q \cdot e^{\int Pdx}\right) dx$ (b) in case of  $\frac{1}{f(D)}e^{\alpha x}$ , the  $P.I.=\frac{1}{f(\alpha)}e^{\alpha x},$ if  $f(\alpha) = 0$  then P.I.=  $x \cdot \frac{1}{f'(\alpha)} e^{\alpha x}$ if f'( $\alpha$ )=0 then P.I.=  $x^2 \cdot \frac{1}{f'(\alpha)} e^{\alpha x}$ (c) in case of  $\frac{1}{f(D)}x^n$ , the  $P.I.={f(D)}^{-1}.x^{n}$ 

apply the integration/differentiation operator after expanding the above expression.

(d) In case of 
$$\frac{1}{f(D^2)} \sin ax$$
, the  
P.I.=  $\frac{1}{f(-a^2)} \sin ax$ ,

If  $f(-a^2)=0$  then the

$$P.I.= x.\frac{1}{f(-a^2)}\sin ax$$

(e) In case of 
$$\frac{1}{f(D)}e^{ax}.\phi(x)$$
, the  
P.I.=  $\frac{1}{f(D+a)}e^{ax}.\phi(x)$   
(f) In case of  $\frac{1}{D+a}\phi(x)$ , the  
P.I.=  $e^{-ax}\int e^{ax}\phi(x)dx$ .

#### (iv) Complete solutions and singular solution

Example: 
$$y = x \frac{dy}{dx} + \frac{dy}{dx} - \left(\frac{dy}{dx}\right)^2$$
  
Let  $p = \frac{dy}{dx}$  then  $y = x \frac{dy}{dx} + \frac{dy}{dx} - \left(\frac{dy}{dx}\right)^2$  becomes  
 $y = xp + p - p^2$  this is called the *Clairaut's form.*  
To solve such type of equations;  
differentiate w.r.t. x and get  
 $p = p + \frac{dp}{dx}$  (x + 1 - 2p)  
 $\Rightarrow \frac{dp}{dx} = 0$  and  $2p = x + 1$ .

$$p=p+\frac{dp}{dx} (x + 1 - 2p)$$

$$\Rightarrow \frac{dp}{dx} = 0 \text{ and } 2p = x + 1.$$

$$\Rightarrow \qquad p=c \text{ and } y=\frac{(x+1)^2}{4}$$

 $y = xc + c - c^2$  is called *complete solution*, and  $\Rightarrow$  $y = \frac{(x+1)^2}{4}$ 

is called the singular solution.

#### Equations of the Type where variables are **(v)** Separable

Such type of equations' format is of the type where one can easily separate the y variable with dy and x variable with dx and then easily by integrating them separately the answer can be reached.

Example:

$$x\frac{dy}{dx} + y = 2\left(\frac{dy}{dx} - y^3\right)$$

This can be written as

$$(2-x)\frac{dy}{dx} = y(1+2y^2)$$
$$dy \qquad dx$$

$$\frac{dy}{y(1+2y^2)} = \frac{dx}{2-x}$$

Use Method of Partial Fractions to write LHS into two fractions

С

$$\frac{A}{y} + \frac{By}{1+2y^2} = \frac{dx}{2-x}$$

$$2A + B = 0, A = 1$$
Giving A=1, B=-2
$$\int \frac{1}{y} dy - \int \frac{2y}{1+2y^2} dy = \int \frac{dx}{2-x}$$

$$\log_e y - \frac{1}{2} \log_e (1+2y^2) = -\log_e (2-x) + \log_e$$

$$\log_e \frac{y(2-x)}{\sqrt{1+2y^2}} = \log_e c$$

$$y(2-x) = c\sqrt{1+2y^2}$$

#### **Important Facts To Remember**

- 1. If  $\frac{dy}{dx} = f(ax+by+c)$ ; then substitute ax+by+c = t and start solving problem.
- 2. If  $\frac{dy}{dx} = e^{x-y} + x^2 e^{-2y}$  is of *separable type* then function of *y* will go with *dy* and function of *x* will set with *dx*.
- 3. If  $(x-y)^2 \frac{dy}{dx} = k$  is of *separable type*, then put *x-y* = *t*, and proceed.
- 4. If  $2\frac{dy}{dx} = \frac{y}{x} + \frac{y^2}{x^2}$  is of *Homogeneous form* then y = yx.
- 5. If (2x-y+6)dy+(x-2y+3)dx=0 is of *Reducible* to homogeneous form then substitute x'=x+h and y'=y+k.
- 6. If the differential equation is of type M dx + N dy=0 where M and N are functions of x and y, and  $\partial M = \partial N$  then this differential equation is called

 $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ , then this differential equation is called

### of *Exact form*.

Expressions  $\frac{\partial M}{\partial y}, \frac{\partial N}{\partial x}$  represent the partial

derivatives of M w.r.t y and the partial derivative of N w.r.t x respectively.

Solution of such type of differential equations is written asbelow:

Direct solution is

$$\int (Mdx_{(treat)y-constant} + \int_{(take.terms.not.containing.x)} Ndy = c.$$
  
Example: Solve:  $(x^2 - ay)dx + (y^2 - ax)dy = 0$   
This is of type Mdx+Ndy=0  
 $M = (x^2 - ay)$  and  $N = (y^2 - ax)$   
 $\frac{\partial M}{\partial y} = -a$  and  $\frac{\partial N}{\partial x} = -a$  because when we differentiate M with respect to y, x becomes constant and when we differentiate N with respect to x, y becomes constant.

Since  $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ , hence the given differential

equation is of EXACT FORM.

The solution of this equation is

$$\int (Mdx_{(treat)y-constant} + \int_{(take.terms.not.containing.x)} Ndy = c$$
$$\int (x^2 - ay) dx + \int y^2 dy = c ; \left(\frac{x^3}{3} - ayx\right) + \frac{y^3}{3} = c$$

 $Or x^3 + y^3 - 3axy = C$ 

## 7. Linear Differential Equations

If the **degree of the dependent variable** and **all its derivatives is one (1)**, then such differential equation is called Linear differential equation(*LDE*).

Example:

(a) 
$$\frac{d^2 y}{dx^2} + 4\frac{dy}{dx} + 6y = x^2 + x - 1$$
  
(b)  $2\frac{d^2 y}{dx^2} - 6y = f(x)$ 

### 8. Non- linear Differential Equations:

If the **degree of the dependent variable** and/or **its derivatives are of degree greater than 1**, then

such differential equation is called **non-linear** differential equation.

Example:

(a) 
$$\frac{d^2 y}{dx^2} + 4\frac{dy}{dx} + 6y^2 = \sin x$$
  
(b)  $\frac{d^2 y}{dx^2} + 4\left(\frac{dy}{dx}\right)^2 + 6y = e^x$ 

9.  $\frac{dy}{dx} + Py = Q$  is called Linear Differential Equation. If P and Q are solely functions of x

If P and Q are solely functions of x.

The Integrating factor (I.F) = 
$$e^{\int Pdx}$$
, and

The Solution : y 
$$e^{\int Pdx} = \int Q.e^{\int Pdx} dx + c$$

10.  $\frac{dy}{dx} + Py = Qy^n$  is called the **Bernoullian form** and is solved by first dividing the equation by  $y^n$  and then assuming  $\frac{1}{y^{n-1}} = y$ .

$$\frac{dy}{dx} + Py = Qy^n \Longrightarrow \frac{1}{y^n} \frac{dy}{dx} + \frac{1}{y^{n-1}}P = Q$$
. It becomes LDE.

11. If  $\frac{dy}{dx} = \frac{ax+by+c}{a'x+b'y+c'}$  and  $\frac{a}{a'} = \frac{b}{b'} = k$ ; then

substitute **a'x+b'y= t** and proceed.

12. If  $\frac{a}{a'} \neq \frac{b}{b'}$  then put **x'=x+h** and **y'=y+k**, i.e. make homogeneous and proceed.

#### 13. Orthogonal trajectory:

Any curve which cuts every member of the family of curves at right angle i.e. at 90 degrees is called the orthogonal trajectory.

#### Example

y = mx, a line passing through the centre of the circle  $x^2 + y^2 = a^2$  will be always perpendicular to the circle.

# The working rule to find out the orthogonal trajectory is as below:

(a) Differentiate the given curve w.r.t. x and eliminate the arbitrary constant or constants i.e. form differential equation and

(b) Replace 
$$\frac{dy}{dx}$$
 by  $-\frac{dx}{dy}$ .

- (c) Now solve this differential equation.
- (d) The general solution of this equation is the required orthogonal trajectory.

#### **Some Solved Questions**

1. Form the differential equation of the family of all parabolas with focus at the origin and the x-axis as the axis.

Hint:



Obviously,

$$F = (0,0), Vertex = (-a,0)$$

Directrix is x=-2a

The parabola will be

$$y^2 = 4a(x+a)$$

$$2y\frac{dy}{dx} = 4a \Longrightarrow 2a = y\frac{dy}{dx}$$

Put the value of a in the equation of the parabola to eliminate a.

$$y\left(\frac{dy}{dx}\right)^2 + 2x\frac{dy}{dx} - y = 0$$

2. Verify that the function  $y=e^{-3x}$  is a solution of the differential equation

$$\frac{d^2 y}{dx^2} + \frac{dy}{dx} - 6y = 0$$

Solution:

$$y = e^{-3x} \Longrightarrow \frac{dy}{dx} = -3e^{-3x} \Longrightarrow \frac{d^2 y}{dx^2} = 9e^{-3x}$$
$$\frac{d^2 y}{dx^2} + \frac{dy}{dx} - 6y = 9e^{-3x} - 3e^{-3x} - 6e^{-3x} = 0$$

3. Form the differential equation representing the family of ellipses having foci on x-axis and centre at the origin.

Solution:



We know that the equation of such ellipse is  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  where  $b^2 = a^2(1-e^2)$ , e < 1

From the equation of the ellipse we get

$$\frac{dy}{dx} = -\frac{b^2 x}{a^2 y} \qquad \dots (i) \text{ and}$$

$$\frac{d^2 y}{dx^2} = -\frac{b^2}{a^2} \left( \frac{y - x \frac{dy}{dx}}{y^2} \right) \quad \dots \text{(ii)}$$

On dividing (ii) by (i)

$$\frac{\frac{d^2 y}{dx^2}}{\frac{dy}{dx}} = \frac{\left(\frac{y - x\frac{dy}{dx}}{y^2}\right)}{\frac{x}{y}}$$
$$\Rightarrow xy\frac{d^2 y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$$

4. Find the general solution of the differential equation  $\frac{dy}{dx} = \frac{x+1}{2-y}, y \neq 2$ 

#### Solution:

The differential equation relates to the type variables separable.

It can be written as

$$(2 - y)dy = (x + 1)dx$$
$$\Rightarrow 2y - \frac{y^2}{2} = \frac{x^2}{2} + x + C_1$$
$$\Rightarrow x^2 + y^2 + 2x - 2y = C$$

5. Show that the differential equation  $(x-y)\frac{dy}{dx} = x+2y$  is homogeneous and solve it.

#### Solution:

The given equation can be written as  $\frac{dy}{dx} = \frac{x+2y}{x-y} = f(x, y) \text{ (say)}$ 

Replace x by tx and y by ty

$$f(tx,ty) = \frac{tx + 2ty}{tx - ty} = t^{0} \frac{x + 2y}{x - y} = t^{0} f(x,y)$$

It means the given differential equation is homogeneous of degree 0.

To solve homogeneous type of differential equation, we put

y=vx

so, the equation becomes

$$v + x\frac{dv}{dx} = \frac{x + 2vx}{x - vx} = \frac{1 + 2v}{1 - v}$$
$$\Rightarrow x\frac{dv}{dx} = \frac{1 + 2v}{1 - v} - v = \frac{1 + v + v^2}{1 - v}$$
$$\Rightarrow \frac{1 - v}{1 + v + v^2} dv = \frac{dx}{x}$$

Integrate both sides to get

$$-\frac{1}{2}\log(1+\nu+\nu^{2}) + \sqrt{3}\tan^{-1}\left(\frac{2\nu+1}{\sqrt{3}}\right) = \log_{e} x + C$$

Replace v by y/x to get the required solution.

6. Solve the differential equation  $x^2 dy + (xy + y^2) dx = 0$ , at y=1 when x=1

### Solution:

The given differential equation is of Homogeneous type.

Let us assume y=vx

And rewrite the DE as

$$\frac{dy}{dx} = -\frac{xy + y^2}{x^2}$$
$$\Rightarrow v + x\frac{dv}{dx} = -\frac{xvx + v^2x^2}{x^2} = -(v + v^2)$$
$$\Rightarrow v + x\frac{dv}{dx} = -v - v^2$$
$$\Rightarrow x\frac{dv}{dx} = -2v - v^2 = -v(2 + v)$$

$$\Rightarrow \frac{dv}{v(2+v)} = -\frac{dx}{x}$$
$$\Rightarrow \frac{v}{2+v} = \frac{1}{x^2} + C$$

On replacing v by y/x we get

$$\frac{y}{2x+y} = \frac{1}{x^2} + C$$
  
At x=1,y=1, C= $-\frac{2}{3}$ 

So the required solution in x and y is  $4x^3 + 5x^2y = 6x + 3y$ .

7. Find the general solution of the differential equation  $\frac{dy}{dx} - y = \cos x$ 

## Solution:

This is of type LDE

$$\frac{dy}{dx} + Py = Q \text{ with solution : } y e^{\int Pdx} = \int Q e^{\int Pdx} dx$$
+c

Here P=- 1, Q=cosx

Hence the solution is

y 
$$e^{\int -dx} = \int \cos x \cdot e^{\int -dx} dx + c$$
  
 $\Rightarrow y e^{-x} = \int \cos x \cdot e^{-x} dx + c$   
 $\Rightarrow y e^{-x} = \frac{1}{2} (\sin x - \cos x) e^{-x} + c$ 



dx

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 of excellence.

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## **CROSS WORD PUZZLE Dec'17: RAMANUJAN**

## S.B. Dhar



## ACROSS

- 5 Type of Equation solved by Ramanujan
- 6 Family deity of Ramanujan
- 9 Wife of Ramanujan
- 10 Author of The Man who knew Infinity
- 12 Month in which Ramanujan was born

### **DOWN**

- 1 Name of Number 1729
- 2 Number independently developed by Ramanujan
- 3 Place where Ramanujan was born
- 4 Village where Ramanujan parents lived
- 7 Man who founded Indian Mathematical Society
- 8 University from where Ramanujan graduated
- 11 Mathematician who sharpened Ramanujan's life



## **ANSWER: CROSSWORD PUZZLE Nov'17: INTEGERATION**

### Prof. S.B. Dhar

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## **External Support to Gyan Vigyan Sarita**

S.No. 27/17/11<sup>th</sup> November 2017

RC No. 037569



Senior Citizens Welfare Society H-1070, Gaur Grandeur, Sector 119, Noida-201301

Τo,

The Coordinator,

Gyan Vigyan Sarita,

Dear Sir,

The Senior Citizens Welfare Society, Gaur Grandeur, Noida has come to know that you are heading a team of mentors, that is selflessly working hard to democratize the education through the online mentoring in the name of *Gyan Vigyan Sarita* on *zero-fund-zero asset* basis.

The society appreciates your efforts of making costly education free and reachable to the underprivileged as well as to the well-off at the same time, and at the same platform by the same energetic, passionate, and highly qualified mentoring team. The society stands with you and your team in hours of need.

Good wishes for welfare activities. May God bless you all success.

Regards,

IDMIN VIMON OIL

hdhar

(Dr SB Dhar) Secretary

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email: scwsgg.noida@gmail.com; mobile: 8076934850, 8860237655,7428543999,9958575264, 8750425687

**GROWING WITH CONCEPTS - Chemistry** 

## **COVALENT BONDS : Lewis-Langmuir Concept**

#### Kumud Bala

Langmuir, in 1919 improved the Lewis concept by suggesting that when both the atoms taking part in a chemical combination are short of electrons than the nearest noble gas configuration, they can share their electrons in order to complete their octets. Each atom contributes the same number of electrons to form common pairs which are then shared by both atoms.

"The bond formed by mutual sharing of electrons between the combining atoms of the same or different elements is called a covalent bond".

The compounds so formed are called covalent compounds. Let us consider the formation of a hydrogen molecule from two hydrogen atoms. When two hydrogen atoms approach each other, the single electron of both the atoms forms a shared pair. Each hydrogen atom can now be thought of as having noble gas configuration of helium (1s<sup>2</sup>). H· + ·H  $\rightarrow$  H:H or H–H



Similarly, two chlorine atoms combine with each other to form a molecule of chlorine. In this case, both the atoms have seven electrons in the outermost shell ([Ne] 3s<sup>2</sup>3p<sup>5</sup>) and have one electron less than argon configuration. Therefore, they contribute one electron each to form a shared pair between two atoms. By doing so, both the chlorine atoms attain the stable electronic configuration of noble gas (octet).



This results in the formation of a covalent bond in  $Cl_2$  molecule. However, a covalent is not only formed between similar atoms but it may also be formed between dissimilar atoms.

For example: In the formation of HCl , H and Cl contribute one electron each which is then shared by both so as to complete duplet of hydrogen and octet of chlorine.



## Lewis structures for molecules having multiple covalent bonds

- (i) If two atoms share one electron pair, bond is known as single covalent bond and is represented by one dash (-)
- (ii)If two atoms share two electron pairs, bond is known as double covalent bond and is represented by two dashes (=)
- (iii) If two atoms share three electron pairs, bond is known as triple covalent bond and is represented by three dashes(=)Some examples of molecules having double and triple bonds
  - (i) Formation of oxygen molecule:



(ii) Formation of nitrogen molecule:

# Condition for writing the Lewis dot structures of molecules:-

The important conditions being that:

1. Each bond is formed as a result of sharing of an electron pair between the atoms.

2. Each combining atom contributes at least one electron to the shared pair.

3. The combining atoms attain the outer shell a noble gas configuration as a result of the sharing of electrons. In other words, octets of both the atoms get completed.

# Lewis representation of simple molecules and ions (the Lewis structures)

The following steps are adopted for writing the Lewis dot structures or Lewis structures:

- Calculate the total number of electrons required for writing the structure by adding the valence electrons of the combining atoms. For example

   In the CH<sub>4</sub> (methane) molecule, there are 8 valence electrons( 4 from carbon and 4 from four H atoms)
- 2. For anions, each negative charge means addition of one electron. For cations, each positive charge means subtraction of one electron from the valence electrons.
- 3. Knowing the chemical symbols of the combining atoms and guessing the skeletal structure of the compound, distribute the total number of electrons as bonding shared pairs between the atoms in proportion to the total bonds.
- 4. In general, the least electronegative atom occupies the central position in the molecule or ion. For example, in the  $NF_3$  and  $CO_3^{-2}$ , nitrogen and carbon are the central atoms

whereas fluorine and oxygen occupy the terminal positions.

5. After distributing the shared pairs of electrons for single bond, the remaining electron pairs are used either for multiple bonds or they constitute lone pairs. The basic requirement is that each bonded atom gets an octet of electrons.

Example 1 – Lewis dot structure of CO molecule:

Step1. Total number of valence electrons in CO = 4+6 = 10 [ $_{6}C = 2,4(1s^{2} 2s^{2} 2p^{2}), {}_{8}O = 2,6(1s^{2} 2s^{2} 2p^{4})$ ]

Step2. The skeletal structure of carbon monoxide (CO)

Step3. Putting a single bond between C and O, i.e., one shared pair of electrons between C and O, the remaining 8 electrons as 3 lone pairs on O to complete its octet and 1 lone pair on C, we have

$$\cdot \dot{c} \cdot \dot{o} \vdots \xrightarrow{redraw} C \longrightarrow O$$

Step4- As in this structure, octet of C is not complete, multi bonding is required between C and O. To complete the octets of C triple bond is required between C and O. We should, therefore, shift two lone pairs on O as shared pairs between C and O so that octet of both C and O remains complete. Thus, the structure should be

**Example 2** - Lewis structure of nitrite ion (NO<sub>2</sub>-):

**Step1.** Counting the total number of valence electrons of one nitrogen atom, two oxygen atoms and the additional one negative charge (equal to one electron).

Total number of valence electrons: N  $(2s^2 2p^3) + 2O(2s^2 2p^4) + 1$  (-ive charge)

5 + 12 + 1 = 18 electrons

**Step2**. The skeletal structure of  $NO_2^-$  ion is O N O **Step3**. Draw single bonds between oxygen and nitrogen, nitrogen and oxygen, O: N : O

**Step4-**Putting the remaining 7 pairs of electrons as lone pairs, 3 on each O and 1 on N(so that octet of O are completed), we have

**Step5** – As octet of N is not complete, multiple bonding is required. As N is short of only one pair of electron, one pair from O should be shifted as shared pair between O and N or N and O, i.e., a double bond should exist. Thus , the structure should be



**Example 3** - Lewis dot structure of  $CO_3^{-2}$  ion.

**Step1** – Total number of valence electrons of  $CO_3^{-2}$ = 4 + (3x6) + 2 = 24

 $(_{6}C = 2,4 _{8}O = 2,6 \text{ and two units of negative charge})$ 

**Step2-** the skeletal structure of  $CO_3$  is



**Step3**- Putting one shared pair of electrons between each C and O and completing the octets of oxygen, we have



In this structure, octet of C is not complete. Hence, multiple bonding is required between C and one of

the O- atoms. Drawing a double bond between C and O-atoms serves the purpose.



**Formal charge:-** Lewis dot structures do not represent the actual shapes of molecules. In case of polyatomic ions, the net charge is possessed by the ion as a whole and not by a particular atom. It is possible, however, to assign a formal charge on each atom. The formal charge of an atom in a polyatomic ion or molecule is defined as " the difference between the number of valence electrons of that atom in the free state and the number of electrons assigned to that atom in the Lewis structure, assuming that in each shared pair of electrons, the atom has one electron of its own and the lone pair on it belongs to it completely."

It is expressed as: [formal charge (F.C) on an atom in a Lewis structure] = [total number of valence electrons in the free atom] – [total number of electrons of lone pairs (non-bonding electrons)] –  $\frac{1}{2}$ [total number of shared electrons (bonding electrons)] i.e., F.C = V – L -  $\frac{1}{2}$  S

For example- Formal charge on each O-atom of  $O_3$  molecule.

Lewis structure of  $O_3$  is as follow:



The central O- atom has 6 valence electrons, one lone pair (2 electrons) and three bonds (6 bonding electrons). Therefore, its formal charge is : F. C on O =  $6 - 2 - \frac{1}{2} \times 6 = 6 - 2 - 3 = +1$ 

The end O-atom has 6 valence electrons, two lone pair (4 electrons) and two bonds (4 bonding electrons). Therefore, its formal charge is : F.C on O =  $6 - 4 - \frac{1}{2} (4) = 6 - 4 - 2 = 0$ 

The second end O-atom has 6 valence electrons, three lone pairs and one bond (2 bonding electrons). Therefore, its formal charge is : F.C on O-atom = 6 -6  $-\frac{1}{2}$  x2 = 6 - 6 -1 = -1

Therefore, the formal charges on the oxygen atoms in the Lewis structure of ozone molecule are written as:



It may be noted that formal charges do not indicate real charge separation within the molecules. These only help in keeping track of the valence electrons in the molecule.

**Significance of formal charge:-** The main advantage of the calculation of formal charges is that it helps to select the most stable structure, i.e., the one with least energy out of the different possible Lewis structure. The most stable is the one which has the smallest formal charges on the atoms.

**Limitation of the octet rule:** Although octet rule is useful in a large number of compounds, it is quite useful for understanding the structures of most of the organic compounds and it applies mainly to the second period elements of the periodic table. There are three types of exceptions to the octet rule.

(1) The incomplete octet of the central atom:- In some compounds, the number of electrons surrounding the central atom is less than eight i.e., these are electron deficient compounds, especially the case with elements having less than four valence electrons. For example- LiCl, BeH<sub>2</sub> and BCl<sub>3</sub>



Li, Be and B have 1, 2 and 3 valence electrons only.  $AlCl_3$  and  $BF_3$ , in these cases B and Al have 6 electrons around them. Thus, octet rule is violated.

## CI : AI : CI CI F:B:F

(2) Odd- electron molecules:- There are some molecules and ions in which the bonded atoms contain odd number of electrons (usually 3) between them. The bonds thus present are called odd electron bonds and the molecules are called odd electron molecules, like nitric oxide (NO) and nitrogen dioxide (NO<sub>2</sub>). In these cases octet rule is not satisfied for all the atoms.



(3) The expanded octet:- There are many stable molecules which have more than eight electrons in their valence shells. For example,  $PF_5$  has ten,  $SF_6$  has twelve and  $IF_7$  has fourteen electrons around the central atoms, P, S, and I respectively. This is termed as the expanded octet.



10e<sup>-</sup> around P

12e<sup>-</sup> around S



14e- around I

These compounds in which the atoms have more than 8 electrons around it are called hypervalent compound. Again the octet rule is violated in these molecules. Interestingly, sulphur also forms many compounds in which the octet rule is obeyed. For example, in  $SCl_2$ , the S atom has an octet of electrons around it.



Other drawbacks of the octet theory are:-

1. Hydrogen has one electron in its first energy shell (n=1). It needs only one more electron to

fill this shell, because the first shell cannot have more than two electrons. This configuration (1s<sup>2</sup>) is similar to that of noble gas helium and is stable. In this case, therefore, octet is not needed to achieve a stable configuration.

- 2. Noble gases which have already complete octets or duplets, as in case of helium, should not form compounds. However, it has been found that some noble gases (especially xenon and krypton) also combine with oxygen and fluorine to form a large number of compounds such as XeF<sub>2</sub>, KrF<sub>2</sub>, XeOF<sub>2</sub>, XeOF<sub>4</sub>, XeF<sub>6</sub> etc.
- 3. This theory does not account for the shape of molecules.
- 4. It cannot explain the relative stability of the molecules in terms of the energy.

## Assignment

- 1. Define octet rule. Write its significance and limitations.
- 2. Draw the Lewis structures for the following molecules or ions.  $H_2S$ , SiCl<sub>4</sub>, BeF<sub>2</sub>, CO<sub>3</sub><sup>-2</sup>, HCOOH.



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-00-

Growing with Concepts : Physics

Dr Subhash Joshi

This month inability to contribute an article is deeply regretted.

## **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:**  $\mathcal{RH}_{7}$  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>20<sup>th</sup> of this month</u> to enable us to incorporate your contribution in next bulletin, <u>subhashjoshi2107@gmail.com</u>.

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

- With the start of Second year of operation, 1st4<sup>th</sup> Quarterly e-Bulletin <u>Gyan-Vigyan</u> <u>Sarita: शिक्षा</u> shall be brought out 1<sup>st</sup> October'17.
- And this cycle monthly supplement to Quarterly e-Bulletin <u>Gyan-Vigyan Sarita: îश</u>細 aimed to continue endlessly

We believe that this monthly supplements to 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-

Nature is an excellent example of unity in diversity. Atom at its basic constituent level, it comprises particles of different nature. Some of them are of opposite in nature, and experience a strong force of attraction, yet they continue to exist separately and individually; particles of similar nature, having stong force of repulsion continue to exist in vicinity. This has been there since beginning of nature, and shall continue to exist indefinitely. Any unregulated infringement on the other would is disastrous. The secret of coexistence is in respecting others position.

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## **SCIENCE QUIZ : Dec'17**

## Kumud Bala

- Pure acetic acid is known as

   (A) Polyvinyl acetate
   (B) Ethyl acetate
   (C) Glacial acetic acid
   (D) Cellulose acetate
- 2. Name the process of converting vegetable oil to vegetable ghee
  - (A) Hhydrogenation
  - (B) Rancidity
  - (C) Displacement reaction
  - (D) Combination reaction
- 3. What is the pH value of fresh milk? (A) 2 (B) 5 (C) 1 (D) 6
  - A) 2 (B) 5 (C) 1 (D) 6
- 4. Which substance should be stored in a moisture-proof container?
  - (A) Gypsum (B) Plaster of paris
  - (C) Baking soda (D) Sodium chloride
- 5. What type of oxides are formed when non-metals combine with oxygen?(A) Acidic oxides(B) Basic oxides
  - (C) Amphoteric oxides (D) Neutral oxides
- 6. Butanone is a four-carbon compound with the functional group of(A) Carboxylic acid (B) Aldehyde
  - (C) Ketone (D) Alcohol
- 7. Which of the following hydrocarbons undergo addition reactions?
  - (A)  $C_2H_6$  (B)  $C_3H_8$  (C)  $CH_4$  (D)  $C_2H_2$
- 8. Neon has
  - (A) Two shells, both of which are completely filled with electrons
  - (B) The electronic configuration 2,8,2
  - (C) A total of three shells, with four electrons in its valence shell
  - (D) Twice as many electrons in its second shell as in its shell

(Answers to this Science Quiz – Sept'17 shall be provided in Quarterly e-Bulletin

## dt 2<sup>nd</sup> October'17)

### -00-

## <u>Answers to Science Quiz in Nov'17</u>

## **Kumud Bala**

ANSWERS : 1. (B); 2. (B); 3. (B) 4. (B); 5. (A); 6. (A); 7. (D); 8. (D); 9. (B), 10. (D), 11. (B); 12. (A); 13. (C); 14. (D); 15. (C); 16. (D); 17. (B); 18. (C); 19. (C); 20. (C)

- 9. Where does the emulsification of fats take place?
  - (A) Large intestine (B) Small intestine
    - (C) Pancreas (D) Liver
- 10. Which type of surface area makes the gaseous exchange more efficient in lungs
  (A) Nephron (B) Alveolar
  (C) Cytoplasm (D) Chloroplast
- 11. Which type of periodic table has total of 18
- groups (columns) and 7 periods rows? (A) Dobereiner triads
  - (B) Newland's law of octaves
  - (C) Mendeleev's periodic table
  - (D) Modern periodic table
- 12. Which part of the brain maintains equilibrium of the body?A) Fore-brain (B) Bhind-brain (C) Mid-brain (D) Spinal cord
- 13. Which type of actions come under the control of brain(A) Involuntary actions (B) Reflex actions(C)Vvoluntary actions (D)Walking
- 14. The information is conveyed in the form of chemical messengers called
  - (A) Nervous system mechanism
  - (B) Hormonal system mechanism
  - (C) Reflex action
  - (D) Growth
- 15. A sexual reproduction takes place through budding in
  - (A) Amoeba (B) Yeast
  - (C) Plasmodium (D) Leis mania

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## **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 resuming of the journey far beyond ...



