GYAN VIGYAN SARITA:शिक्षा

CV RAMAN QUOTES

" Ask the right questions, and nature will open the doors to her secrets. "

SCOOPWHOOP.com

Sir C.V. Raman published his discovery of Raman Effect on 28th February, 1928

Life is like riding a bicycle.
To keep your balance you must keep moving.

- Albert Einstein

www.DreamThisDay.com

CONTENTS: (*Against Each of the Contents Page Number is Indicated for Convenience*)

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Online Mentoring From Texas

Conceptual Representation
of
Online Mentoring
An Initiative To Bridge Gap between
Passionate Teachers
and
Desperate Students
A Selfless Endeavour
to
Democratize Education
with a sense of
Personal Social Responsibility (PSR)

An Ideal Smart Trainsing hall

Equipments at Mentoring Center
1. Desk-/Lap-top
2. WebCam
3. Headset with Microphone
4. Digital Pen
AND
Broadband-Internet Connection

Cloud Internet
(Linking platform : cloud based with as low bandwidth as possible for seamless connectivity of audio-video-whiteboard across all Six nodes. Presently Google Hangouts is in use)

Equipments at Learning Center
1. Desk-/Lap-top
2. WebCam
3. A Mixer-cum-amplifier with Speakers and Wireless Microphone
5. Overhead Projector.
6. UPS (For Continuous Power Supply to computer, internet modem and L&F)
AND
Broadband-Internet Connection:

Mentoring Centre

Screen Sharing From Mentoring Centre To Learning Centre

Learning centre

Mentoring-cum-Learning Centre (Demo)

Important Links
1. Good Internet Connectivity (Wired Broadband Connection)
2. Subject-wise Coordinator for Each Session to Bridge Learning Gaps between Mentor & Students

Mentoring Centre

Learning Centre - 1

Learning Centre - 2

Learning Centre - 3

Learning Centre - n

Learning Centre-r

Learning Centre-r

Special Features
1. Free and Open to all to adopt. Modify, change, correct
2. Welcomes participation, promotion and facilitation on Zero-Fund-Zero-Asset (ZFZA) basis
3. More details on Technological and Operational – please write on http:// www.gyanvigyansarita.in/contact/

Set-up at Learning Centre

Learning Centre Directly on Desktop

Projector Connected to Computer

Learning Centre With Projector Display

Infrastructural requirement for Centres in Interactive Online Mentoring Sessions (IOMS)

Learning Centre (if asked for by Mentor)		Mentoring Centre (if asked for by Mentor)	
Estimated Capital Cost (One Time)			
Particulars	Cost (in Rs)	Particulars	Cost (in Rs)
Desktop (without monitor)	20,000	Laptop	25,000
Projector	9,000	Projector	-
Web camera	2,000	Web camera	-
Mixer cum amplifier with Speaker and Wireless microphones	14,000	Headset with Microphone	3,000
Total (Max. if nothing is available)	**45,000**	Total	28,000
Wireless Surface Writing Device (WSWD). It shall be required when Learning Centre is ready for collaborative use of Whiteboard.	15,000	Wireless Surface Writing device	15,000
Total with Total with WSWD (*at a later date once IOMS stabilizes*)	60,000	Total with Total with WSWD	**43,000**
Estimated Recurring Cost			
a. Internet charges, based on estimated monthly data transfer which depends upon choice of cloud platform, and tariffs of ISP b. Cloud Platform Charges, to be shared across Learning Centres		Internet charges, based on estimated monthly data transfer which depends upon choice of cloud platform, and tariffs of ISP	
Cloud platform : Google Hangouts is a free Video Conferencing cloud platform. Though it provides free connectivity upto 15 nodes, connectivity of maximum 5 Learning centres is made in IOMS. This self-imposed limitation is to – a) maintain quality of interaction and mentoring, b) open an opportunity for more co-passionate mentors to collectively participate in mentoring deprived and unprivileged children.		IOMS is since an initiative driven with **Personal Social Responsibility (PSR)** operating on **Zero-Fund-&-Zero-Asset (ZFZA)** basis.. The IT Infrastructure with the Mentors has been in use and is working. But, at any stage if upgradation becomes essential, support of facilitators or learning centres would be gratefully welcomed, on ZFZA basis, to maintain continuity of this selfless initiative.. Operating cost of Mentor, if required, shall be supported by Learning Centres	

Specification: These are based on ground level operating experience and need of optimizing the cost on the initiative. This is essential to utilize financial resources, considered scarce, for benefitting more number of students at more number of centres and mentoring centres. These specifications have been updated based on experience of operation of IOMS with available options. MS WhiteBorad a free App of MS office has been tried out in IOMS and is found satisfactory, until a better option is available.

Web Camera: iBall 20.0 HD with a wall mounting

Projector: Portronics POR 624 LED Projector Beam 100 Lumen, Screen Size 130 Inch , 800x480px resolution

Sound System: Ahuja Make PA Mixer Amplifier Model DPA-370, 30 W Max/37W Max, with PA wall speakers PS-300T 10W, and a wireless unit AWM-490V2 Dual Cordless Microphones. This sound input/out when decoupled with USB sound adopter to connect to the computer required echoless environment is achieved in the Classroom and networked mentor and Learning Centres.

Cloud Platform: Google Hangout, a free-ware is used for IOMS in video-conferencing mode. Though it provides pre connectivity upto 15 Nodes, connecting maximum only 5 Learning Centres in one session is envisaged.

Surface Writing Device: HUION make Model WH1409, or Wacom model Intuos with wireless device makes it suitable for communication with base computer in class in an interactive online environment.

UPS: An additional accessory, for uninterrupted continuity of session, based on power availability to be decided by Learning Centre, **not included in above cost estimates.**

Furniture and Lighting: At Learning Centre, as deemed fit by local administration of Learning Centre, **not included in above cost estimates.**

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विकास के लिये जरूरी है : वैज्ञानिक सोच

भारतीय वैज्ञानिक डॉ चंद्रशेखर वेंकट रमन का जन्म 7 नवंबर 1888 को हुआ था। रमन ने वस्तुओं में प्रकाश के बिखरने के सिद्धांत की खोज की थी। उन्होंने इस खोज का नाम 'रमन इफेक्ट'(रमन प्रभाव) रखा था। इस खोज की घोषणा उन्होंने 28 फरवरी 1928 के दिन की थी। रमन इफेक्ट की खोज के लिये भौतिकी का नोबेल पुरस्कार उनको 1930 में मिला।

28 फरवरी को भारत में विज्ञान दिवस रमन प्रभाव की घोषणा के दिन को याद करने के लिये मनाया जाता है। यह दिन जनमानस में वैज्ञानिक अनुप्रयोग के महत्व के संदेश को व्यापक तौर पर प्रसारित करता है।

इस दिन को मनाने का उद्देश्य होता है कि विज्ञान से होने वाले लाभों के प्रति समाज जागरूक बने और लोगों में वैज्ञानिक सोच पैदा हो।

विज्ञान सिखाता है कि हम कैसे आगे बढ़ें। विज्ञान बताता है कि हमारे अंदर की कमियां कैसे दूर होंगी। विज्ञान समझाता है कि हमें सोच समझ कर ही अपने लिये उसका उपयोग करना है।

विज्ञान हमसे कहता है की जब भी कुछ देखो, उसे ध्यान से देखो, उसके होने के कारण को समझो, और फिर उसके उपयोग करने के तरीके पर मनन करो।

वर्ष 1921 में ऑक्सफ़ोर्ड में विश्वविद्यालयों की कांग्रेस में भारत का प्रतिनिधित्व करके जब सी वी रमन जलयान से स्वदेश लौट रहे थे तब उन्होंने भूमध्य सागर के जल का अनोखा नीला व दूधियापन देखा। ऐसा देखकर उनको बड़ा अचरज हुआ।

कलकत्ता विश्वविद्यालय पहुंचकर उन्होंने निर्जीव वस्तुओं में प्रकाश के बिखरने का नियमित अध्ययन शुरू किया।

यह रमन का किसी भी घटना को वैज्ञानिक सोच के साथ देखने का तरीका ही था जिसने उनके अंदर वह जिज्ञासा पैदा की कि जल का अनोखा नीला रंग क्यों था?

लगभग सात वर्ष तक कड़े अध्ययन के बाद रमन अपनी उस खोज पर पहुंचे, जिसे रमन प्रभाव के नाम से जाना जाता है।

हमारा जीवन भी विज्ञान की तरह है, जितनी बार हम अभ्यास करेंगे, पहले से अच्छा परिणाम पायेंगे।

हमें विज्ञान का प्रयोग सुख और शांति के लिये करना चाहिये, न कि विनाश और अशांति के लिये क्योंकि विज्ञान में ही वह शक्ति है जो आम इंसान की जिंदगी को अच्छा बना सकती है। वास्तव में विज्ञान, विश्वास और ज्ञान का समन्वय है।

अगर हम अपने से पूछें कि बल्ब जलता है तो क्या होता है? अथवा, अगर बल्ब नहीं जलता तो क्या होता? अथवा, बिजली रहने पर भी अगर बल्ब नहीं जल रहा है तो ऐसा क्यों है? तब हमें मालूम पड़ेगा कि इन प्रश्नों के उत्तर के लिये तर्कों की जरूरत है। यही तर्क ढूंढ़ना विज्ञान जानना है।

विज्ञान ने अपनी खोजों से दूरियों को घटा दिया है, समय को सिकोड़ दिया है और सोचने की शक्ति को कई गुना बढ़ा दिया है। आज का बालक आज से एक दशक पहले के अपने उम्र के बालक की अपेक्षा कई गुना अधिक समझदार बन गया है और वह विज्ञान की बहुत सी बातों को जानने लगा है।

विकास सतत चलने वाली वह प्रक्रिया है जो समुदाय से होती हुयी व्यक्ति विशेष तक पहुंचती है और यह तब तक चलती रहती है जब तक समुदाय का हर व्यक्ति परिपक्व नहीं हो जाता है। विज्ञान काम करने की वह अद्भुत शैली है जो विकास की गति को बढ़ा देती है और पूरे विकास की राह में उस पर नियंत्रण भी बनाये रखती है।

विज्ञान समाज में अपना योगदान कृषि उत्पादों की लागत घटाकर और उत्पादन बढ़ाकर, किसान की समृद्धि में वृद्धि करके कर रहा है। पर्यावरण को जीवन के अनुकूल बनाने की विधियां खोज रहा है।

विज्ञान ऊर्जा के वैकल्पिक स्रोतों की खोज कर रहा है। आदिवासी बहुल इलाकों में कुपोषण का प्रकोप धीरे-धीरे अच्छी फसलें उगा कर और स्वास्थ्य सुविधायें लाकर कम हो गया है। समय से पहले मौसम की भविष्यवाणी किसान के काम आ रही है जिससे उसकी पैदावार अथवा अन्य काम काज खराब होने से बच रहे हैं।

हमारा जीवन आज पूरी तरह से विज्ञान पर निर्भर हो गया है। हमारे लिये विज्ञान एक सुन्दर उपहार बन चुका है। राजनीति और धर्म का समय अब निकल चुका है। विज्ञान और आध्यात्मिकता का दौर आ चुका है।

विज्ञान अब हमारे सोचने का तरीका बन रहा है। हमें मालूम हो चुका है कि विज्ञान किसी व्यक्ति का अनुसरण नहीं करता है, विज्ञान केवल तथ्य और तर्क का अनुसरण करता है। जिस सीमा पर तर्क और तथ्य साथ नहीं दे पाते हैं, वहीं से विज्ञान उन तथ्यों और तर्कों को त्याग देता है और अपने नये तथ्यों और तर्कों को लेकर चल पड़ता है।

विज्ञान में इतनी विभूति है कि वह काल चिन्हों को मिटा देता है। विज्ञान हमारे घमंड को मिटाने में भी सक्षम है। आज समाज के

हर क्षेत्र में विज्ञान का प्रभाव है। अब बिना विज्ञान जीवन संभव नहीं रह गया है।

प्राचीन काल में जिन बातों की कल्पना भी नहीं की जा सकती थी, आज विज्ञान ने उन्हें संभव कर दिखाया है। मानव चांद पर पहुंच चुका है। मंगल पर अपने यान उतार चुका है। सूर्य के अध्ययन के लिये उसकी तरफ अपना यान भेजने की तैयारी कर रहा है।

नदियों पर बांध बन रहे हैं, पहाड़ों को काटकर पुल बन रहे हैं, समुद्र को लांघकर सात समुंदर पार जाया जा रहा है, वायुयानों से दो स्थानों के बीच की दूरी कम समय में तय की जा रही है, अपने घर से मोबाइल फोन से विश्व के किसी कोने में बैठे व्यक्ति से बात हो रही है।

यही नहीं, अब बटन दबाते ही घर बिजली के प्रकाश से चकाचौंध हो जा रहा है, ठंडक में गर्म हवा मिल रही है, गर्मी में ठंडी हवा मिल रही है, अनेक रोगों को होने से पहले ही टीकों की मदद से रोका जा रहा है, रेडियो और टेलीविजन पर मनोरंजन और समाचारों को आसानी से देखा व पढ़ा जा रहा है, और रेडियो थेरेपी से असाध्य रोगों का उपचार होना संभव हो गया है।

एक बार एक संत से एक व्यक्ति ने पूछा, बुराई क्या है?

संत ने बताया, अच्छाई की कमी ही बुराई है। उसने समझाया, जहां अंधकार होता है, वहां प्रकाश की कमी भर होती है। जैसे ही प्रकाश वहां पहुंचता है, अंधकार स्वयं ही दूर हो जाता है। अंधकार खुद कुछ नहीं होता है।

ठीक इसी प्रकार, विज्ञान भी हमें केवल अच्छाई ही देता है। अगर कोई विज्ञान से विनाश कर रहा है तो वह उसकी अच्छाइयों को नजरंदाज कर रहा है।

ज्ञान विज्ञान सरिता की टीम समाज के पिछड़े और सुविधाओं से वंचित वर्ग के छात्र-छात्राओं में विज्ञान के प्रसार-प्रचार की जो लौ वर्षों से जला रही है, हम इसकी सराहना करते हैं और ईश्वर से प्रार्थना करते हैं कि यह टीम हमेशा शक्तिवान बनी रहे ताकि समाज उन्नति करता रहे और खुशहाल होता रहे।

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Humanity is acquiring all the right technology for all the wrong reasons.

- *R. Buckminster Fuller*

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EVOLUTION OF IOMS

➢ Philosophy of IOMS had its inception in Sarthak Prayash an NGO, in May'2012 in Chalk-N-Talk Mode with stray students.

➢ Its manifestation in the form of e-Bulletin started in 2016, on 2ⁿᵈ October with its First Issue **Subodh पत्रिका**

➢ In May' 2017 the initiative was upgraded to IOMS, in its primitive form, with the efforts of its Shri Shailendra Parolkar

➢ This initiative was reorganized as Gyan Vigyan Sarita in 2017 with its e-Bulletin in the name of **Gyan Vigyan Sarita – शिक्षा**

➢ With this e-Bulletin as Fourth Annual issue, we are stepping in Fifth year of broadening communication to invoke participation of those who can make a difference, for the larger good.

➢ Presently it is a satisfactory working model on 'Minimum Need' basis.

➢ Currently about 75 students in Two rural schools, one is RKM High School in A.P. and other is Army Public School, Dinjan, Assam, are being ng mentored. At Dinjan it is our first step to mentor children of our brave soldiers securing our frontiers

➢ We continue to look forward…..

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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 target students a feel that you care for them, and they are anxiously awaiting to get benefitted by your contributions. We request you to please feel free to send your creation, by **20th of each month** to enable us to incorporate your contribution in next bulletin,* subhashjoshi2107@gmail.com.

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

➢   *With the the release of 1st Monthly e-Bulletin in its consecutive Fourth Year, we are gearing up for next Monthly e-Bulletin Gyan-Vigyan Sarita: शिक्षा due on 1st of ensuing month.*

➢   *This cycle of   monthly supplement e-Bulletin Gyan-Vigyan Sarita: शिक्षा is aimed to continue endlessly, till we get your तन and मन support in this sefless educational initiatice to groom competence to compete among deprived children.*

Formatting Guidelines: (a) Paper Size A4, (b) Fonts: Times Roman (English), Nirmala UI (Hindi), (c) Font Size Title/Author Name/Text: 14pt/12pt/10 pt (d) Margins: top/bottom/left/right – 1"/1"/0.4"/0.4", (e) Photoprofile of author – In 4-5 lines with mail ID and Photo. We will be pleased to provide softcopy of template of an article, in MS Word to the author on advise.

We believe that this e-Bulletins shall make it possible for our esteemed contributors to make its contents rich in value, diversity and based on their ground level work and/or experiences.

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We have learnt that LIFE is neither fast nor sudden leaps;

It grows gradually and sreadily through pits and rises.

We have learnt on every fall, more was needed from us;

Irrespective of how others were.

We have learnt that when tide is against, swim hardest to keep moving ahead;

When in favour swim fastest to create a reserve in case of contingencies.

We have also learnt that reasons are in abundance to justify losses,

But there is only ONE reason to do good beyond self.

LIFE is MUST for sustainable coexistence.

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I have been impressed with the urgency of doing.

Knowing is   not enough; we must apply.

Being willing is not enough; we must do."

\- **Leonardo da Vinci**

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Coordinator's View

Creativity in Learning or Learning Creativity?

*At the outset I express my gratitude to **Shri Dhirendra Chaturvedi**, a close acquaint, who has gifted me a book **Creative Schools** by **Sir Ken Robinson**, an internationally acclaimed educational reformist. It is an excellent treatise-cum-commentary of various reforms in education undertaken across the world and it encompasses imagination of the reader. Though, it opens up new vistas of enrichment, manifestations and actions in every field; yet, human experience cannot be stereotyped. Ken admits that his education is the cause of being what he is, and is equally applicable to all of us.*

*This article is a link in series of my experiences of growing from a lower middle class family into a professional, and after superannuation in pursuit of Ph.D. This was followed by a plunge into passionate endeavor to groom competence to compete among unprivileged children driven with a sense of **Personal Social responsibility (PSR)**. The initiative got an impetus when a small group of few co-passionate persons came forward to complement it. In case readers find our views different from educational theories in vogue or claims in the field, we urge them on the need to proactively take up urgency of reform in education and in a considered manner.*

This subject matter is so intricate and multi-dimensional that its judicious analysis and elaborations deserve a full length book. Nevertheless, this chain of articles is aimed at addressing issues based on our ground level realization in furtherance of education to cultivate creativity among deprived children, while the book can always wait.

Learning leads to creativity or creativity leads to learning? is a question similar to "first egg or hen?" Answer to this question is based on understanding as to *How are education and learning different*? *Is education a means to creativity or an end*?

Learning and education get manifested into a person in his ability to solve problems, an essential virtue. Problems solving is a skill which grows gradually like a spiral. It starts with ability to observe. Observation is beyond seeing and ends up in acquiring details of thing, person or event, and just not capturing of image. These observations lead to analysis of nuances among similar observations, exploring reason of happening, evaluating effects of observations. Any thinking mind tries to evolve ways of optimization of effects of observation. Seldom is the case when there is only one way of optimization. Therefore, making choice of an alternative to optimize the effects depends upon ability of a person to think logically, sensibly and economically considering viability, feasibility and sustainability for coexistence. These abilities are pre-steps of a skill to implement the selected alternative i.e. solution to the problem. Every person is a unique creation of nature and so is the solution and the way it is implemented. Merit of this uniqueness with relevance to prevailing situations is the creativity.

Learning has always been there since beginning of human race, and every child has to make a flat zero start in learning. Ancient thinkers, philosophers and preachers including scientists never had schooling, yet their wisdom grew and radiated their learning in an informal manner. They learnt in school of life and environment around them. Nature,

environment and survival instinct are the best teacher that arouse inquisitiveness to learn and explore. Thus, *informal learning is generally need based and apparently it leads to more creativity; but in the process possibility of reinvention by every learner cannot be ruled out. This makes informal learning slow, random and in a bandwidth narrowed by the environment of the learner*.

In this context, education is a formalization of learning environment in a structured manner that has evolved over last few centuries. We are privileged to have the legacy. This has made education a structured process where learning is similar to climbing a pyramid built on learning of predecessors. Thus, *education is more focused, fast and better mode of learning and provides wider opportunities of creativity than those available in informal learning*.

Above discussions pose a million-dollar question as to *why is there so much hue and cry on creativity in education system in vogue*?

Schools are like potters where structured curriculum and environment is likely to produce similar qualities among students. Uniqueness, in students if any is attributed to the school. This statement is based on premise all students are equally receptive and responsive to mentoring at school, but this is not true even in residential school. Each student brings with him individual, family, social, cultural and economic traits leading to likes and dislikes manifested in unique learning curve of each student. Therefore, *it is unfair to blame school for chopping content of creativity among students*.

Growth of population and civilization has imposed upon education system a demand of numbers both in quantity and

quality to fit into needs of industrialization. It is a necessity to cater to the growing demand. In this scenario industries are under compulsion to produce run-of-the-mill and also for their commercial survival. These industries in turn bank upon education system to get requisite manpower both in quantity and quality. Thus scenario of education system has gradually drifted to a stereo-typed role and loss of creative content. It has become a mean to achieve commercial goals of all the stake holders. Those who fit into the expectations of commercial environment are able to make their fortune, but it is at the cost of their ingenuity. Yet, creative product of schools, in whatever form, is the best fit for innovation and R&D. As regards an industry or commerce creativity is of value as long as it caters to its economics of scale. Thus it constricts space available for ingenuity, innovation and creativity. This scenario of rapid growth has severely influenced education system to adapt a commercial culture. Thus education has become a means for fitting into the commercial environment, putting creativity on the rear seat.

The perception of creativity getting jeopardized in school education has given rise to personalized education for qualitative and fast learning leading to high IQ. But, this premise ignores the fact that learning at school provides a boost to sensitivity and sensibility that are nurtured in a student groomed in social environment. Thus school environment may have lesser contribution in IQ but it certainly has higher contribution to EQ. It observed that persons with higher EQ are more successful in handling real life problems than those with higher IQ. Moreover, cost of personalized tuition, mentoring or education is not affordable to common man, forget the deprived ones. *Thus existence of culture of schools as center of education is inevitable. Therefore, need is not to abandon schools, rather to reinforce them through reforms which makes schools worth expectations and aspirations of society and state. It is a collective responsibility of all those who can make a difference right from elite persons to the state.*

Another dimension of industrial growth is automation. It has sharply clipped not only wings of creativity but also opportunities for work. It creates requirement of new set of skills and that too with a rapid rate of obsolescence. But, education system has a large inertia. This makes the system sluggish and inapt to adapt rapidly of changing socio-economic scenario. This has created new commercial environment of accreditation, benchmarking, tests and examinations leading to changes in perspective of schooling from quality enrichment at learning to high scores, admissions in higher institutes, employability packages etc. Experienced teachers agree that "*high scores are not always commensurate to adroit learning, but an adroit student is always capable of securing high scores*".

Generally, it is seen that exponents of performing art and pure art tend to delink it with maths and science. This is seen as a bias against the latter two. Mathematics while invokes reasoning, the science polishes and refines the reason with cause and effect. It is the mathematics which forms pedestal for gigantic structure of science, engineering and technology.

Every great artist must have had either formal or informal grooming in logic and cause-effect phenomenon which helped him to analyze their observations, make a right choice, implement it correctly and present it effectively. Then only, they could attract attentive relevance of audience. Therefore, students of maths and science who lacks creativity must have learnt them without selfless love as said by **Archimedes** - "*Mathematics reveals its secrets only to those who approach it with pure love, for its own beauty.*" It would not be over-saying that art has been able to take new forms with advent of science and so also art has complemented growth of science through imagination beyond the reachable. In essence creativity has no boundary and it is intrinsic to art and science which are complementary to each other. Education when passionately pursued without getting into monotony and oriented towards score, it helps to harness creativity of every student, the ultimate aim.

Educated people are seen to impose their indispensability based on their knowledge and experience, to the extent possible. Imposition of indispensability is seen to grow as one approaches to superannuation and more after it. Accumulation of information with these elite section of society is definitely more than either beginner or their juniors. But, the basic question remains to be answered - *is ingenuity, innovation and out of box approach an outcome of experience*? Definitely not!!!, rather experienced persons are victim of orthodoxy and biases and are, therefore, less prone to adventurism; it makes them counterproductive and less creative. The pretext taken while doing so is the scenario of US and Europe where practically there is no age of retirement. There work-&-earn till feasible is acceptable because these countries have less human-resource and more opportunities. As against this, countries like India where opportunities are lesser than the human resource. Thus no-retirement-age proposition is subjective and cannot, rather should not be, implanted in India indiscriminately.

Yet, superannuated elite persons with physical and mental fitness and financial independence in countries like India have ample of opportunities to deploy their knowledge, experience and creativity. They can pro-act with a sense of **Personal Social Responsibility (PSR)** in areas of their passion where they could not do justice during their career due to their occupational and family priorities. Moreover, at this age family gets settled in their respective forward path, barring a few exceptions. Spiritually, this age is a gift of GOD, and best stage to give back to the society by perpetuating their professional, moral and intellectual honesty, as well as keep up their ingenuity and creativity. In Indian perspective philosophy this is the वानप्रस्थ आश्रम.

Among many areas, education is the one which offers a great opportunity to collectively complement the existing education system. This is without prejudice or criticism. **Interactive Online Mentoring Session (IOMS)** is one such model which is open to know, add, modify, change or use it the way one considers to be the fit. Best of part of the IOMS is that –

a) it can be operated right from place of stay or work without disturbing personal life,
b) it connects students right from neighborhood to anywhere as long as internet connectivity is available,
c) it aggressively uses IT technology which is becoming increasingly handy,
d) little effort is enough to start sailing as an experienced mentor while keeping the spirits young despite growing old,
e) grooming students deprived of opportunities is –
  i. passing gift to the society,
  ii. a rich legacy for family to feel proud of and
  iii. service to the GOD through men based revered principle that नर सेवा ही नारायण सेवा है .

The above discussions may lead to a perception that commercialization is a negative trait. It is essential to correct that notion with basic philosophy of economics where production implies enhancing value of resources available. This philosophy has steered socio-economic growth of human race and would continue to do so in different forms depending kind of resources in prevalence. Let us take the latest example of e-commerce; it was buzzword about three decades ago. Today right from eatables to domestic consumables, maintenance services, travel plans, cab and innumerable services are commercially available at affordable cost and at the door step. This is an excellent example of creativity, at a commercial scale, even in the growing industrialization and automation; it is for the larger good. It is opening new thought process, work opportunities and socio-economic culture,

Zero-Fund-&-Zero-Asset (ZFZA) model of IOMS is a considered choice in wake of severe commercialization that has crept in educational environment. It has changed the meaning of education from grooming of creativity to fast material gains, in whatever way, an antonym of creativity.

IOMS is a model that uses available technology to mentor students interactively primarily in mathematics, physics and chemistry. Choice of subjects is based on our proficiency and is without prejudice to other subject. It is open to persons with proficiency in other subjects to complement efforts of grooming unprivileged students. This cross-section of students is based, not on discrimination, but on following considerations –

a) as long as a deprived children remain marginalized we will not be able to reap fruits of democracy in independent India,
b) when it comes to giving we try to give that where we are at best,
c) urgency of education cannot wait for our luxury to mentor at convenience,
d) children from affluent section can join IOMS, but without expecting any special treatment,
e) opportunity of learning is open to all subject to adherence of continuity and responsiveness
f) *facilitators/head-of-institution has to ensure at the local level his commitment to the **selflessly operated IOMS.***

In IOMS emphasis is given to -

(a) subject is medium to groom though process
(b) mentoring of concepts is made through their visualization by conducting experiments of concept in their own environment so as to make subject matter intuitive
(c) invoke group dynamics to accelerate them in self-learning and mutual mentoring,
(d) interactive environment during session through bilateral audio/video,
(e) after session students pose their problems, difficulties and doubts through e-messaging,
(f) coordination of the sessions by a local teacher to bridge learning as well as communication gaps,
(g) groom coordinators to a level where they volunteer for becoming an independent torch bearer of IOMS,
(h) in monthly e-Bulletin Gyan Vigyan Sarita-शिक्षा of our initiative a separate column 'Students' Domain' to display and encourage creative contributions of students
(i) limiting to at max Five learning centers in one session for each mentor.
  i. This helps to maintain interaction across students at different learning centers and with the mentor,
  ii. Refrain from monopolization so that more passionate people can volunteer to the initiative of educational reform.

Conclusion: *Creativity, like imagination, has no boundary. It grows gradually with every innovation, be it in any field. Whereas learning is an opportunity to sharpen creativity. In this pursuit education is a means to accelerate integrated learning. Creativity can seldom sustain in isolation or affluence. Darwin's theory of evolution in biological world also applies to creativity; it is quite obvious, since creativity is a manifestation in human being, a biological entity. Let us take first step to collectively complement in upholding creativity in education system, a need to maintain thrill of life.*

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Blessings of My Teacher

My teacher of mathematics, during 1963-67 in school days, continues to inspire me even today, when I am reaching 70 years of age, with blessing before I start my day while he is approaching an age of 90 years. I am greatly blessed!!!

प्रिय सुभाष, स्नेहाशीष,

जीवन में यदि एकाग्रता है, ध्यान है तो सब है, अन्यथा कुछ भी नहीं।

ईश्वर ने हमें अथाह शक्ति दी है, यदि हम उनका उपयोग करना सीख लेंगे तो वे हमारे जीवन में क्रांति ला देंगी।

जीवन में शक्तियाँ, शरीर और मन में हैं। शक्तियों और ऊर्जाओं का सृजनात्मक उपयोग कर लें तो यही जीवन में आनंद ला देंगी।

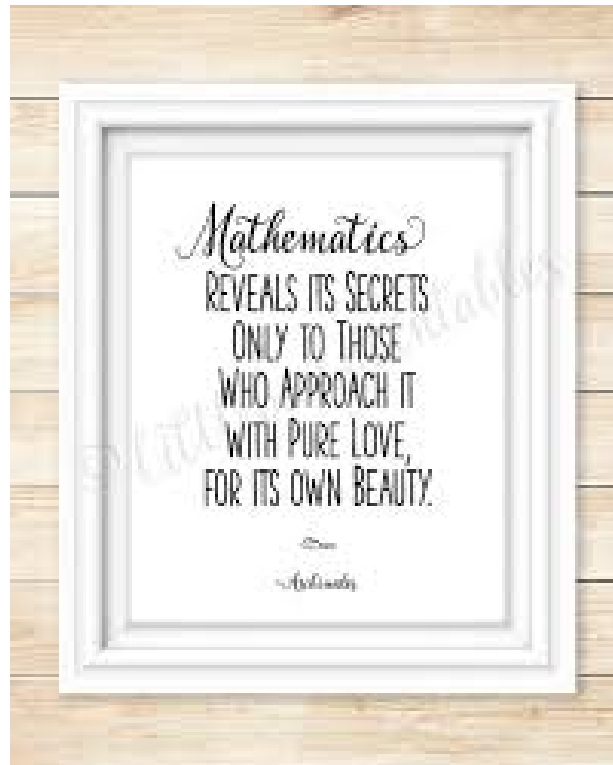हमारा शरीर शुद्ध हो, विचार शुद्ध हों और मन शुद्ध होना चाहिए।

अपना लक्ष निर्धारित करें और उस पर ध्यान केंद्रित करें। लक्ष्य की ओर पहला कदम उठायें, अंतिम कदम अपने आप आ जायेगा ।

सत्यम शिवम् सुंदरम

आर. न. मिश्रा

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<u>An Appeal</u>: for Interactive Online Mentoring Session (IOMS) at your establishment
By Gyan Vigyan Sarita – A non-organizational educational initiative

Philosophy: Socio-economic reform through education with **Personal Social Responsibility** (PSR) in a non-organizational, non-remunerative, non-commercial and non-political manner.

Objective: Groom competence to Compete among un-/under-privileged children from 9th-12th in Maths, Physics and Chemistry, 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, as and when they arise, to the initiative

Operation:

a. **Mode:** Interactive Online Mentoring Sessions (IOMS) since July'16, which has been recently switched over to A-VIEW, web-conferencing S/w, with connectivity upto 5 Learning Centers, with One Mentoring Center.
b. **Participation:** Voluntary and Non-remunerative, Non-Commercial and Non-Political

Involvement:

a. **Promote**r –
  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,
b. **Facilitator** –
  i. Provide space and infrastructure for **Interactive Online Mentoring Sessions (IOMS).** Most of it is generally available, and may need marginal add-on,

  ii. Garner support of elite persons to act as coordinators at the Learning Centre.
c. **Participator** –
  i. As a Mentor,
  ii. As a Coordinator,
  iii. Operational support
  iv. E-Bulletin and Website promotion for increasing its depth and width across target students

Background: *The initiative had its offing in May'12, when its coordinator, a non-teacher by profession, soon after submission of Ph.D. Thesis in 2012, at one of the IITs, under taken after retirement got inspired to mentor unprivileged students.*

The endeavour started with Chalk-N-Talk mode of mentoring unprivileged students starting from class 9th upto 12th. Since then it has gone through many ground level experiences and in July'16 it was upgraded to IOMS, a philosophy in action to reachout to more number of deprived students. Currently regular sessions of IOMS are held regularly for students of class 9th and above at few Learning Centeres. Efforts are being made to integerate more learning centers and mentors to diversify its scope and utilize our full capacity.

*It is a small group of Four persons including **Prof. SB Dhar**, Alumnus-IIT Kanpur, **Shri Shailendra Parolkar**, Alumnus-IIT Kharagpur, settled at Texas, US and **Smt. Kumud Bala**, Retd. Principal, Govt. School Haryana. More details of the initiative are available on our website and operational aspects of can be online accessed at IOMS .*

*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 above at **Involvement**, to make the mission more purposeful and reachable to target children.*

Contact: Dr. Subhash Kumar Joshi, **Coordinator,** Gyan Vigyan Sarita.

Address: #2487, Mahagun Moderne, Sector-78, NOIDA, UP– 201309, **(M):+91-9711061199,**

e-Mail ID: subhashjoshi2107@gmail.com**, Website: http://www.gyanvigyansarita.in**

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अंदाज ए बयां

भूतपूर्व स्वर्गवासी श्री......

-समीर लाल 'समीर'

जबलपुर में हमारे एक भूतपूर्व स्वर्गवासी मित्र श्री नारायण तिवारी जी रहते हैं. भूतपूर्व स्वर्गवासी सुनने में थोड़ा अटपटा लगता है मगर वो उपर हो रहे समस्त क्रिया कलापों को इतने आत्म विश्वास और द्ढ़ता से बताते हैं कि उनके पूर्व में स्वर्ग मे रहवास पर स्वतः ही विश्वास सा हो जाता है.

हमारे एक और मित्र हैं मुकेश पटेल. ईश्वर की ऐसी नजर कि अच्छे खासे खाते पीते घर का यह बालक अगर किसी भिखारी के बाजू से भी निकल रहा हो तो भिखारी उसे बुलाकर कुछ पैसे दे दे. चेहरे पर पूर्ण दीनता के परमानेन्ट भाव. मानो भुखमरी की चलती फिरती नुमाईश. भर पेट खाना खा कर भी निकले तो लगे कि न जाने कितने दिन से भूखा है. हँसता भी तो लगता कि जैसे रो रहा है.

सड़क पर क्रिकेट खेलते समय जब किसी के घर में गेंद चली जाये तो हम लोग मुकेश को ही भेजा करते थे गेंद लेने. उसे डांटना तो दूर, अगला गेंद के साथ मिठाई नाश्ता कराये बिना कभी विदा नहीं करता था. अपने चेहरे के चलते वह सतत एवं सर्वत्र दया का पात्र बना रहा. होली, दशहरे की चंदा टीम का भी वो हमेशा ही सरगना रहा और हर घर से चंदा मिलता रहा. अब तो उसका बड़ा व्यापार है. बैंक से लेकर इन्कमटैक्स वाले तक सब उस पर दया का भाव रखते हैं. आज तक उसने किसी को घूस नहीं दी. बैंक वाले लोन देने के साथ साथ चाय पिला कर भेजते हैं. लोन की किश्त भरने जाते हैं तो बैंक निवेदन करने लगता है कि जल्दी नहीं है चाहें तो अगले महीने दे दीजियेगा. इन्कम टैक्स का क्लर्क भी बिना नाश्ता कराये उन्हें नहीं जाने देता.

जहाँ मुकेश को अपने ऊपर ईश्वर की इस विशेष अनुकम्पा पर अभिमान था वहीं हमारे भूतपूर्व स्वर्गवासी मित्र नारायण के पास इस स्थिति के लिये भी कथा है कि मुकेश का चेहरा ऐसा क्यूँ है.

भू.पू.स्व. श्री नारायण बताते हैं कि वहाँ ऊपर कई फेक्टरियाँ हैं. भारत की अलग, अमरीका की अलग, चीन, अफ्रीका, जापान सब की अलग अलग. वहीं स्त्री पुरुषों का निर्माण होता है. सबके कालिटी कन्ट्रोल पूर्व निर्धारित हैं. अमरीकी गोरे, अफ्रिकी काले, भारत के भूरे आदि. सबकी भाव भंगीमा भी बाई डिफॉल्ट कैसी रहेगी, यह भी तय है. जैसे दोनों हाथ नीचे, पांव सीधे, मुँह बंद आदि. यह बाई डिफॉल्ट सेटिंग है, अब यदि किसी को हाथ उठाना है, तो उसे हरकत एवं प्रयास करना होगा और जैसे ही प्रयास बंद होगा, हाथ पुनः डिफॉल्ट अवस्था में आ जायेगा यानि फिर नीचे लटकने लगेगा.

ऐसा ही चेहरे की भाव भंगिमा के साथ होता है. बाई डिफॉल्ट आपके चेहरे पर कोई भाव नहीं होते. न खुश, न दुखी. विचार शून्य सा चेहरा. अब यदि आपको खुश होना है तो ओंठ फैलाईये, दांत दिखाईये और हा हा की आवाज करिये. इसे खुश हो कर हंसना कहते हैं. जैसे ही आप इसका प्रयास बंद कर देंगे पुनः डिफॉल्ट अवस्था को प्राप्त करेंगे अर्थात विचार शून्य सा चेहरा-बिना किसी भाव का.

कई बार जल्दीबाजी में, जब कन्टेनर रवाना होने को तैयार होता है और कुछ मेटेरियल की जगह बाकी है, तब कुछ लोग जल्दी जल्दी लाद दिये जाते हैं. वही डिफेक्टिव पीस कहलाते हैं. उन्हीं में से एक उदाहरण मुकेश हैं जिनकी हड़बड़ी में चेहरे की डिफॉल्ट सेटिंग दीनता वाली हो गई. उन्हें सामान्य दिखने के लिये प्रयास करना होगा और जैसे ही प्रयास बंद, पुनः डिफॉल्ट अवस्था यानि दीनता के भाव.

यह सारी बातें नारायण इतने आत्म विश्वास से बताते थे कि लगता था वो ही उस फेक्टरी के मैनेजर रहे होंगे जो इतनी विस्तार से पूरी कार्य प्रणाली और निर्माण प्रक्रिया की जानकारी है. तभी तो सब उन्हें भूतपूर्व स्वर्गवासी की उपाधि से नवाजते थे.

उनके ज्ञान का विस्तार देखते हुए एक बार हमने भी जिज्ञासावश प्रश्न किया कि नारायण भाई, आप तो कह रहे थे कि भारत के लिये त्वचा का रंग भूरा फिक्स है. फिर यहाँ गोरे और हमारे रंग के लोग कहाँ से आ गये?

भू.पू.स्व. नारायण जी ने तुरंत अपने संस्मराणत्मक अंदाज में कहना शुरु किया कि दरअसल भारत की फैक्टरी के सुपरवाईजर विश्वकर्मा जी बहुत जुगाड़ू टाइप के हैं. जब पेन्ट खत्म होने लगता है तो कभी तारपीन ज्यादा करवा देते है तो कभी कोई और मिक्स करवा देते हैं.

कभी अमरीकी फेक्टरी का और कभी अफ्रिकी फेक्टरी का बचा पेन्ट मार देते हैं मगर मिला जुला कर, जोड़तोड़ कर काम निकाल ही देते हैं. इसीलिये भारत में भी कुछ लोग गोरे पैदा हो जाते हैं और अगर अफ्रिका वाला ज्यादा पेन्ट मार लाये तो तुम्हारे जैसे. किन्तु बाकी ऐसा नहीं करते वो काम रोक देते हैं. इसीलिये अफ्रिका में कभी कोई गोरा नहीं पैदा होता और न अमरीका में काला. इसी से उनकी फैक्टरी भी मटेरियल के इन्तजार में कई कई दिन बंद रहती है तो प्रोडक्शन भी कम होता है. आज तक मटेरियल की कमी के कारण भारत वाली फेक्टरी में काम नहीं रुका. हर साल सबसे अनवरत संचालन का अवार्ड भी विश्वकर्मा जी को ही मिलता है. इसीलिये तो हमारे यहाँ सभी फेक्टरियों में उनकी पूजा होती है.

हम तो सन्न रह गये कि वाह रे विश्वकर्मा जी, आप तो अवार्ड पर अवार्ड लूट रहे हो, जगह जगह पूजे जा रहे हो और

खमिजियाना भुगतें हम!! बहुत खूब!

लोकप्रिय चिट्ठाकार समीर लाल व्यवसाय से चार्टर्ड एकाउंटैंट हैं। आजकल वे कैनेडा में रहते हैं। उन्होंने कहानी लिखना पाँचवीं कक्षा में ही शुरु कर दिया था। आप कविता, गज़ल, व्यंग्य, कहानी, लघु कथा आदि अनेकों विधाओं में दखल रखते हैं| भारत के अलावा कनाडा और अमेरिका में मंच से कई बार अपनी प्रस्तुति कर चुके हैं। आपका ब्लॉग "उड़नतशतरी" हिन्दी ब्लॉगजगत में एक लोकप्रिय नाम है।

ई-मेल: sameer.lal@gmail.com

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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.

Growing into an expert, is a process during which 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) Mathematics*,   b)* Physics *, and c)* Chemistry*. 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 examinationsand a guide to theirsolutions in a structured manner, as a dynamic exercise to catalyse the conceptual thought process.*

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Ayurveda- Health Care

Prevention of Diseases Caused by Vata Imbalance

Dr Sangeeta Pahuja

Helpful Herbs and Diet and lifestyle for prevention of diseases caused by Vata Imbalance have been discussed in this article.

Vata consists of vayu or air. Qualities of vata are dry, light, cool, rough, subtle and Mobile.Vata predominant prakriti means that these qualities express themselves generously throughout your mental, emotional and physical makeup.

Vata is responsible in controlling all types of movements.

As said in AYURVEDA -

पित्त पंगु, कफ पंगु,पंगवो मल धातवः। वायु न यत्र नियन्ते, तत्र गच्छन्ति मेघवत।

It means no movement is possible without vata.

When there is imbalance in vata dosha, it may lead to neurological disorders, respiratory disorders, cardiac problems, gastrointestinal Disorders etc. Diseases are more pronounced during the old age.

Vataj Prakriti people generally suffer from joint problems like joint pain, joint crapitus, dry skin, cracked heels, sleeplessness, feeling of loneliness, weekness of bones and muscles, lack of appetite, indigestion, irregular menstrual periods,cold hands and feet, constipation, malabsorption, Emaciation etc.

As I have already described about the helpful diet and lifestyle for Vataj Prakriti in the first volume of Follow Ayurveda and stay Healthy.

In this article I will write about the helpful herbs for Vataj Prakriti to stay Healthy.

Common causes of Vata Imbalance are -Stress, Anxiety, worry, fear, traveling, lack of sleep, eating less than your body type, Dry, light, cold And raw food, leftover food, irregular daily routine,Night Awakening, caffeine and other stimulants,refined sugar, suppression of urges,over exertion, prolonged exposure to windy conditions,loud noises etc.are the aggravating factors for Vata imbalance.

Vata Pacifying Herbs:
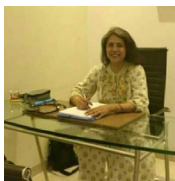
Ashwagandha ((Withania Somnifera): In Ayurveda Ashwagandha is termed as Rasayan or Rejuvenating herb that helps the body to cope up with physical and emotional stress. It's an immunomodulator herb.

Ashwagandha is an evergreen shrub that grows in India, middle East and parts of Africa. This herb is also called Indian Ginseng or winter cherry. It is considered one of the most important herbs in Ayurvedic medicine system.

Ashwagandha is typically beneficial for Vata types as it calms the nervous system and improve the concentration and helps to focus the mind.

Strengthen the immune system, Reduce the stress, anxiety and depression without causing drowsiness, lowers the cholesterol, stabilizes blood sugar, reduce the degenerative changes, has anti-inflammatory properties, enhances sexual potency for both men and women, anticancer properties, reduce cortisol levels in chronically stressed individuals, can boost testosterone and increase fertility in men, increase the muscle mass and strength. It is cardioprotective as it may lower the cholesterol and triglycerides, improve brain function and memory. It used to treat Arthritis, insomnia, stress, gastrointestinal issues, diabetic nephropathy, nervous breakdown etc.

Ashwagandha is considered a pain-reliever that acts on the nervous system to prevent pain signals from being sent.

According to studies, it has been found very helpful in Alzheimer's also.

Ashwagandha may be used in powdered form in dosage ranging from 450mg to2g. It is also available in Capsule form or as liquid extract.

Ashwagandha is generally considered well tolerated in appropriate dosage.

But always consult your doctor for advantages or disadvantages of any herb according to your body constitution for long term use.

Author is an Ayurvedic Medical Practitioner. She did B.A.M.S. from M.D. University, Rohtak. She has consultation centres at Delhi and Noida. She is keenly interested in spiritual, women and social developmental activities. Contact No.: 9953967901,

e-Mail - sangeeta.pahuja3@gmail.com

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SICKLE CELL ANAEMIA

Prof. Dr. (Mrs.) Mrinalini Sant

This is a hereditary disease due to presence of haemoglobin S in patient's red blood cells. This is the abnormal haemoglobin of sickle cell disease and is much more insoluble in the reduced form than as oxycompounds. It is characterized by sickle-shaped erythrocytes due to presence of an abnormal type of haemoglobin (haemoglobin S).

Geographical distribution: In India Lehmann and Kutbush first discovered this disease in tribes of South India.

This condition occurs in Nigeria, Uganda, America, West Indian Negroes, South Italy, Greece, Turkey and India. In India it is common in tribal and backward communities (20-35%). Prevalence of heterozygous varing from 1-40%. This condition is described in Gond, Mahar, Pana, Haddi, Kosti, Kundbi, Teli, Munda, Bhil, Konda, Koya, and Kurmi community.

According to Indian Council of Medical Research this occurs in workers of tea garden in Assam, people living at the bank of Godawari river, workers of bidi karkhana in Maharashtra, tribals of Bihar, Orissa, Rajasthan, and Chhattisgarh. In Madhya Pradesh it is seen in Jhabua, Mandala, and Betul district.

Cause: In normal individuals haemoglobin A is present in RBCs but in sickle cell disease red blood cells contain haemoglobin S. Haemoglobin S differs from haemoglobin A, glutamic acid which is normally present in 6th position at beta chain is replaced by valine, therefore the RBCs which are normally biconcave become sickle shaped and are destroyed by reticuloendothelial system. The haemoglobin S moves slower on electrophoresis gel and polymerizes into an insoluble linear crystalloid that induces fatal changes in the red cells that have been exposed to low oxygen.

Classification: Sickle cell anaemia is classified into different types:

1.Heterozygous sickle cell trait

2. Homozygous sickle cell anaemia

3. Sickle cell thalassaemia

4. Haemoglobin S/E disease

5. Haemoglobin S/C disease

Heterozygous sickle cell trait: There are no signs and symptoms. Patient can lead his normal life. Sometimes there may be anaemia, haematuria (presence of blood in urine) and respiratory infections. Sickle cells may be formed after climbing at high altitude, aeroplane travelling and after exercise. These patients do not suffer from falciparum malaria.

Homozygous sickle cell anaemia: It is a hereditary disorder. In child genes through parents transmit HbS. If mother and father both have haemoglobin S then the child suffers from homozygous sickle cell anaemia.

Heterozygous sickle cell trait: If mother or father has haemoglobin S than in 50% of individuals HbS replaces HbA.

Homozygous Sickle Cell Anaemia

Clinical features: It is common in females. Symptom appears at the age of 6 months. The high level of haemoglobin F in the newborn protects the child for first 4 to 6 months.

 Delayed growth: Patients have stunted growth, loss of weight, kyphosis, less height, prominent frontal bones, and mongoloid facies.

Pain in abdomen: Sometimes there is severe pain in abdomen with rigidity. In such cases if surgery is performed due to wrong diagnosis of acute abdomen leads to death.

Infections: There is increase susceptibility to infection due to decrease resistance (depressed immunity). In sickle cell disease due to decrease resistance leads to pneumonia, osteomyelitis, encephalitis, and typhoid. Salmonella, Mycoplasma, Staphylococcus aureus, Haemophilus influenzae and parvovirus B19 are common pathogens.

Oral manifestations

(i)   In sickle cell disease, oral mucosa may be pale or yellowish due to haemolytic jaundice.

(ii)   There is anesthesia of the mandibular nerve, pulpitic pain and pulpal necrosis, which can be ascribed to the microvascular occlusions that tend to affect organs with terminal circulation.

(iii) The patients with sickling disorders are more likely to have pain which is indistinguishable from toothache presumably due to pulpal infarcts.

(iv) In areas of osteoporosis and erosion followed by osteosclerosis in mandible there is Salmonella osteomyelitis,

(v)   Dental mal-occlusion may be present secondary to expansion of the bone marrow space.

(vi)   There is greater incidence of caries in young patients, but no increase in periodontal disease.

(vii) Craniofacial features such as maxillary protrusion and more forward growth of the mandible with significantly retruded maxillary and mandibular incisors have been documented in children with sickle cell disease.

(viii) X-ray skull shows widening of medullary spaces, thinning of cortical bone, and sparseness of trabeculae, which produces a hair-on-end appearance. Intraoral periapical radiographs reveal "step ladder" like trabeculae between contagious posterior teeth. There is osteoporosis and appearance of large irregular areas of radiolucency

(ix) Mongoloid facies with high cheekbones and bimaxillary proganthism, flat face, swelling over eyelid and depressed nose is present.

Haemolytic crisis: Dehydration, exercise, anoxia, excessive cold, mental tension and ingestion of sulpha drugs, causes, sickling of RBCs inside body, this causes excessive haemolysis of RBCs leading to anaemia and jaundice.

Sickling in arteries lumen causes obstruction of blood flow and causes infarction of bones, brain, spleen and kidney.

Leg ulcers: In sickle cell anaemia large indolent and deep ulcers are formed most commonly around the ankle of the older child. Stasis of RBCs has a major role.

Hand foot syndrome: Sickle cell dactylitis presents as a hand-foot syndrome early in life. Painful swelling of both hands and feet due to avascular necrosis of phalangeal bones is characteristic of this condition. Oateonecrosis of the femoral head and of the nutrient artery is seen commonly.

Spleen: spleen undergoes multiple infarction and atrophy. This autosplenectomy is unique for sickle cell anaemia.

Liver: During a haemolytic crisis sudden onset of fever, right upper quadrant abdominal pain increasing jaundice and progressive hepatomegaly is due to sickling in the liver and kuffer cell hyperplasia.

Kidney: Renal medullary necrosis and ischaemic medulla gives rise to haematuria.

Central nervous system: Obstruction of cerebral blood vessels causes infarction, and haemorrhages gives rise to headache, convulsion, hemiplegia, and mental abnormality. Most of the patients expire before reaching puberty.

Cardiopulmonary system: The heart shows features due to a hyperdynaemic circulation. There is enlargement of heart, tachycardia, and systolic and diastolic murmur.

Lung suffers repeated infarction that manifest as acute chest syndrome composed of chest pain, dusnea fever, and pulmonary infiltration.

Sickle chest syndrome Severe chest pain is associated with symptoms such as severe abdominal pain, muscle and joint pain, high temperature cough sputum production, shortness of breath and low oxygen level results in circulatory collapse.

Eyes: Neovascularization follows retinal vessel obstruction with arteriovenous aneurysms. Haemorrhage, scarring, retinal pigment detachment, deposition of brown coloured pigment and blindness are natural consequences.

Leg ulcers: They are common in all haemolytic anaemias. In sickle cell large indolent and deep ulcers are formed most commonly around the ankle of the older child. Stasis of RBCs has a major role.

Fig. showing chronic leg ulcers

Gall stones: Breakdown of RBcs may be the cause. Bilirubin is the side effect of breakdown. High levels of bilirubin may lead to gallstones.

Infections: In sickle cell anaemia due to decrease (immunity) leads to pneumonia, osteomyelitis, encephalitis, and typhoid. Salmonella, mycoplasma, staphylococcus aureus, Haemophilus influenza and parvovirus B19 are common pathogens.

Genitals: In males, in sickle cell anaemia there is improper development of gonads and secondary sex characters priapism, a painful persistent erection of the penis often occurs, this is because of vascular stasis and accentuated sickling within the corpora cavernosa. In females sterility and during pregnancy intrauterine growth retardation and increased fetal wastage are commonly seen and are due to placental vasculature becoming involved in the sickling process.

Laboratory diagnosis: Features of haemolysis are uncojugated bilirubinaemia, urobilinogenuria, haematuria, increased alkaline phosphatase and isoenzymes both bone and liver.

Peripheral smear: shows normocytic normochromic anaemia, sickle cells in peripheral smear, normoblasts, target cells, Howell-jolly bodies, spherocytes, polychromasia, basophilic stippling and pappenheimer bodies after splenectomy. Reticulocyte count is markedly increased.

Sickling test: Blood is mixed with on a slide with a chemical reducing agent such as sodium metabisulphite or sodium dithionite covered with a cover glass, and incubated at room temperature up to 1 hour or more. The reducing agent deoxygenates the haemoglobin in the red cells providing the condition for the containing Hbs to sickle.
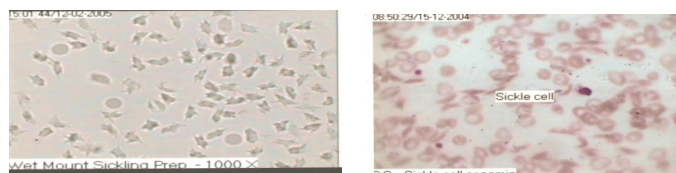

Fig. showing sickling phenomenon

Peripheral smear from a case of sickle cell
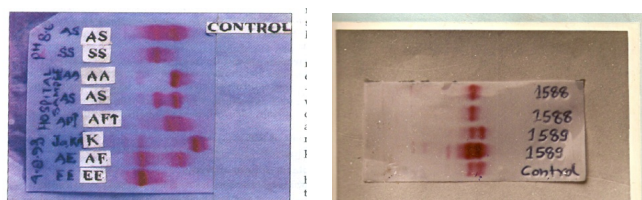
Anaemia showing presence of sickle cells.

Fig. showing different haemoglobins

(Normal and abnormal) on Hb electrophoresis

Haemoglobin electrophoresis stabilizes the diagnosis.

Antenatal diagnosis is possible by the techniques of polymerase   chain reaction for sickle cell gene on cells obtained by aminocentesis, chorionic villus biopsy or direct fetal blood sampling.

Newborn screening programmers of sickle cell disease have recently been initiated in Maharastra, Gujarat Orissa and Chattisgarh.

Prevention: Patients with haemoglobin S should avoid dehydration, anoxia, excessive exercise, and prevention from cold, mental tension, air journey, high altitude and ingestion of sulpha drugs

Health education, mass screening and marriage counseling can prevent the disease.

Treatment:

1 Repeated blood transfusion

2. Splenectomy causes improvement in many patents

3. Administration of folic acid for regenerating bone marrow.

4. Ingestion of sodium bicarbonate and sodium citrate.

5. Nitric oxide: The patient has low levels of nitric oxide in their blood. It helps keep blood vessels open and reduce stickness of red blood cells.

6. Antibodies and vaccination for prevention from infection

7. Bone marrow transplant: Bone marrow transplantation in children with sickle cell disease involves replacing the abnormal stem cells residing in bone marrow with healthy cells from eligible brother or system.

   Hospitals providing bone marrow transplant are in Delhi, Bombay, Chennai, Banglore, Noida, Guragaon Hydrabad, and Cochin. Cost of bone marrow transplant varies from 9 lakhs to 35 lakhs

8. Some children with the disease have been successfully treated with blood stem cells but it's not a simple process.

9. **Gene therapy**: Inserting a normal gene into bone marrow of people with sickle cell anaemia with result in normal haemoglobin. The defective gene while reactivating another gene responsible to produce fetal haemoglobin which is a type of haemoglobin in newborn

Author is MD (Path) frm Netaji Subhash Chandra Medical College, Jabalpur. She had a distinguished career in teaching over a span of thirty-eight years. He has been associated with postgraduare teaching and research activities in various medical colleges of Madhya Pradesh. She has authored three book in the field of pathology.

E-mail: mrinalini_sant@yahoo.co.in

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I grew up in a family of secrets; there was a lot of pathology in the family.

-   *Naomi Judd*

Relevance of Past in PRESENT and FUTURE

Prakash Kale

Spiritual Gurus, Motivational Speakers, Management Experts etc. all do emphasize importance of "an individual being present in PRESENT". But contrary to it, when it comes about society and nations, spiritual gurus (?), political leaders etc. exhorts masses to take pride in, preserve, follow or take revenge of wrong done in past etc. and also to sacrifice present for the sake of future. What is good for an individual *is it applicable at the level of Society and /or Nation*? If it is also applicable for Society and Nation, then any talk about taking shelter under past (continuing it) or dreaming about future at the cost of PRESENT should be suicidal for Society and Nation. *What about future of "New" PRESENT democratic set up when the followers believe in past*? Further, can a society/ nation aspire to be economically FUTURE oriented, progressive, strong etc when its social, psychological fabric is emphasizing or immersed in past. *What can be the synergetic interplay of Past, Present and Future*?

W*hy it is important to be present in PRESENT*? When someone has too much past and not enough of present, mind is preoccupied by Guilt, Regret, Resentment, Grievances, Sadness, Bitterness and all forms of non forgiveness. Similarly, when someone has too much future and not enough present he feels Unease, Anxiety, Tension, Stress and Worry. All the above things are "the dysfunction" of MIND whose existence itself depends on past and future and these states of mind hamper or reduce the productivity as well as joy and happiness of human being. Observe the many ways in which unease, discontent and tension arises within us through unnecessary judgment, resistance to what IS, and denial of NOW. On the other hand, Present does not have mind it is just a BLISS. Glimpse of love and joy are brief moments of deep peace which are possible whenever a gap occurs in the stream of thought created by mind. The mind is essentially a survival machine and its functions are attack and defense against other minds, gathering, storing and analyzing information. Further, as humans have become increasingly identified with their mind, most relationships (individual, society or nation wise) are not rooted in PRESENT and so turn in to a source of pain and become dominated by problems and conflict.

The mental unease/ unrest/ conflict etc caused by past or future imagination in the society/ country is only an outward reflection of an inner psychic state of mind. So, we should be more concerned in what goes on inside us, than what happens outside. If we get inside right, the outside will fall into place. Now, why dwelling in past and future is bad for society or nation? First there are good chances that perception about what we have actually experienced and

seen or heard in our own lifetime changes over time and then we feel that what we perceived earlier was wrong. If it happens about our own experience, then (secondly) what is guarantee that long past and future which we have not experienced and will not experience but have emotions (described in previous paragraph) about it and acting (for and against something, someone or some community) based on what is reaching us through books, lectures, history books and so on has reached/ reaching us correctly or will come out as projected/ predicted.

What we call "History" (Historical imagination) is the narration about past and our experience is that over a period narration of history changes. The king who fought British was called patriotic, but is now labeled communal and the leader whom we read as communal is now described as patriotic. Leftist historian present that whatever meaningful is in India have come from west and right leaning historian connect everything to a glorious ancient past. Such contradictory version abounds in every aspect, be it role of Mughals (enriched/destroyed culture), 1857 (mutiny/ independence war), independence struggle (violent /non violent) and so on. We do not know who is right and who is wrong; ultimately what reaches us is narration of Victorious party. Once we have narration/ belief, it is not too hard to find evidence to substantiate it. But ultimately it is a version out of many. Our experience of near future (today's present but twenty- thirty years back future, technological imagination) also, (which was either projected as dream world or dooms day) has not come true. To give an example, take the case of 2020 vision of India dreamed by APJ Kalam in 1998 or danger of population explosion (now called demographic dividend), both have not materialized. We have also seen how different persons have made political career for self or have become business tycoon just by showing illusionary images of future for common people or nation. That is why sometimes we have to doubt the motive of history writer or motivator for bright future. In language of science, it can be said with certainty that what reaches us through a prism is a partial colored light, and full white light never reaches us.

Further, based on a version of past, creating a victim identity (for self or society or nation) or (wrong) belief that other people and what they did to us are the reason for what we are now, our present condition, for our emotional pain or our inability to be our true self is not correct. Reason is (perception may be wrong and), it causes only bitterness without any inner urge to improve ourselves. Then, who suffers from this victim identity, denial of present and/or cutting off relationship with the individual/ community cause of pain in us? It is fallacy that the people isolating

other do not suffer. ***Both suffer as love is natural hate is deliberate.*** Social isolation of/ by otherwise healthy, well-functioning individuals /community eventually results in psychological and physical disintegration of both side. It also harms physical health due to increased wear and tear of body (caused by systems response to stress). Consequently, society and nation also suffer. Another example of mutual suffering – nuclear war heads and /or Bio-war heads etc are considered today's biggest threats to humanity's existence ONLY because someone who is too much engrossed in past (trying to take revenge) or future (trying to become superpower etc) will decide to use them.

So, best thing is to accept that it was our inability to overcome challenge, whether it is political or cultural, of that (past) time, and accept that, we are responsible for what we are today. It is just like a student standing second in a class exam. What we expect from him? Accept that student coming first is better than him and try to improve self, without creating any negativity about student standing first. In proverbial term "to shorten a line without touching it" is to "draw a bigger line than the first one". It will change course of action, and opens up door for self improvement as well as dialogue. We can speak to the person/ group (believed to be cause of unease/ unrest/ conflict) concerned and express fully what we feel and drop the negativity that our mind has created around the situation. It absolves bitterness and we can interact based on merit and demerit of each individual/community based on PRESENT. Further, based on premise that opposite is complementary we can overall increase the economic well being of nation by utilizing the skills and attitude (we are lacking) of that other. Anything else does not serves purpose whatsoever except to strengthen a false sense of self.

In spite of whatever said above regarding PRESENT and its usefulness, Society and Nation do have a past - future orientation / imagination. Past-oriented/ historically imagined societies are concerned with traditional values, family etc. and ways of doing things and hate to change. They look to the past for inspiration, motivation, sustenance, hope, guidance and direction and direct their efforts and resources in what already exists. These societies are risk averse and prefer the mother tongue. They feel that global intercourse threatens the specificity and individuality and wants to protect traditions from the intrusion of the international market and culture. Historical imagination is frequently employed ideologically and can pave the way for fundamentalism; Nationalism and racism are deeply rooted here in. However, it would be unwise to conclude that historical imagination is always unnecessary; without it there is no poetry, religion, ethics, ceremonies, symbols, allegories, and holidays.

On the other hand, future-oriented or technological imaginative societies have a great deal of optimism about the future. They think they can shape it and view it as a matter of planning, doing and controlling. These cultures invest their efforts and resources in an ever-changing view of what the future may hold. They are, inevitably, more abstract, more imaginative and creative. They are risk-centered and risk-assuming cultures. In the spirit of technological imagination, the newest is always the best—be it invention, discovery, fashion, idea and so on. The spirit of the technological imagination is the spirit of progress, the betterment of society. Every conflict is taken as sign of malfunction and to a problem that needs to be solved, especially social problems. Science shares the spirit of it and is the offspring of it. It is universalistic, as technology binds and bolsters the world: all computer engineers speak the same language, and the economy is global. However, technological imagination also can evolve into a kind of fundamentalism.

Past-oriented societies include India, China (has since taken a break from past), Britain, Japan etc. The United States and, increasingly, Brazil, are examples of future-oriented societies. Additionally, though historical imagination provides modern wars with ideologies, technological imagination provides them with weapons. The past or future orientation of a culture is fundamental to its existence and almost impossible to reconcile with differently held views. However, in view of what we discussed above and even if we consider PAST correct we have to evaluate its relevance in PRESENT (DEMOCRACY) for FUTURE (economic progress).

One of the greatest political inventions of modern times is Democracy. Churchill's well-known saying "democracy is a fairly bad political institution, yet still the best ever invented". It is the best because modernity can best reproduce itself within the framework of democracies; democracies have the greatest potential to secure the freedom of the individual. Further, democracy is an imperfect political order, as all political orders are. ***Where there is perfection, there can be neither action nor criticism, yet irritation for imperfection remains.*** Only where there is unjust distribution can one make a case for distributive justice; only where many things are wrong can one make the case to set it right. Democracy opens the door for making such claims; it opens the territory of future-orientedness in politics. Democracy, while offering space for the dynamics of modernity, gives the ***future-orientedness in politics on to historical foundation.*** Democratic institutions are the embodiment of the future in the present, for they offer the opportunity not just for future-oriented action, but also for future-oriented negation (disapproval). A byproduct of democracy is the kind of constitution that works as a political foundation. ***It is not a natural foundation (not being natural is its strength,***

future orinted as well as its weakness, try to break from past), for as the name suggests, it is constituted; In the modern world, freedom can be founded if the constitution is behaving like the *arche* (element or principle of a thing), the fundament to which (ideally) all laws have to take recourse.

Even though present democracy is for future, the "New" democratic societies/ nations have come into being after certain past, having left that past (?), and embarked upon something new. Every new democracy is between past and future and the past (non democratic) and the future (democratic) are entirely different. Here political institutions have been created and the freedom for political actions does exist, yet the attitudes necessary to maintain these institutions are sometimes absent due to shadow of past. Does the past of the new democracies is necessary and/or their future free? Question is whether or not the (shadow of) past is still in the present—and if yes, how. Shadow of past can be there by way of former social and economic elite remain in place, and continued old attitudes and mentalities. Past can be still there in present by way of traditions, ways of life, cultural priorities, and spiritual aspirations.

Remember it is an orientation, that can shape every aspect of behavior/ governance and, when the orientations are not matched within or without groups or communities, the clashes are obvious. Thus the two kinds of imagination—historical and technological —are fighting a constant battle in (present) Democracy and the battle is carried out under the burden and pressure of adaptation. Technological imagination enforces rapid adaptation; historical imagination supports resistance. One needs to adapt in the time between past and future, to the rule of law, including civil and human rights; to a market economy, including the global market; to the latest technology. But it takes time to adjust. In the new democracies adjustment is partial, for one has to adjust from the requirements of nondemocratic and economically noncompetitive social and political systems, to other, differently democratic and economically competitive, social and political systems. It needs time and cannot happen as abruptly as the change of political institutions and economic systems themselves. One can perhaps import the wording of a democratic constitution and can introduce fair laws in a short time, but one cannot produce law-abiding citizens. One can privatize enterprises, but one cannot introduce the entrepreneurial spirit from one day to the next. *Further, the efficacy of actions taken and decisions made in present for the future from the vantage point of the future can be limited by this past.* Individuals should be aware of the limits of contestation (ie. dispute and argument) and that the future of the present is a future within this limit.

The new democracies have to determine where those limits are and what constraints exist. (Constraints can come from past tradition as well as aspiration of future.) Constraints are the framework, the limit, on the space for free action while preserving the freedom of action. *Needless to say, questions about the past in the present and the answers to those questions substantially influence questions concerning the future of the present—ideas, strategies, options, wishes of political and social actors.* What is at stake is learning how to live constantly and continuously between past and future: how to cope with the tension between historical imagination and technological imagination; how to accept life in a state of uncertainty, in the process of constant trial and error, in contingency and freedom which sets its own limits.

The present always can be better than it is without the shadow of past and future. But there is no escape from, society or nations having past and future. The past remaining in present does limits the present in at least two different ways: first, in the preservation of traditional attitudes and behavior, which needs to adjust to new circumstances and second, in the fear of both the ghosts of the past and of the risks of the future. While democracy (constitution) takes its course correction based on past and future. *Past too has to modify as per requirement of present and future.* Likewise, our future is limited by past and present. What is required is proper mix of each in PRESENT, so that overall wellbeing of citizen- economic, social and spiritual is achieved. Not one single aspect (past, present and future) should overshadow other. In other words having discussed importance of future orientation of society for economic well being and (present) democracy being prerequisite to achieve it, we can say past should be used as a stepping stone for leap forward and not as burden over our head retarding pace of our progress or joy of today. *Having too much past in our psyche, is like participating in a race with front of our car in opposite direction and driving in reverse gear. We just cannot hope to win the race.*

Author is M.Sc.(Physics) and a retired Banker. During his career he was also a faculty, at CBD Staff College of Indian Bank, Mumbai. Post retirement he was associated with IFBI, a joint venture of ICICI Bank and NIIT, for skill development of newly recruited bank officers, and NIBM, Pune RBI's Apex College for Executive Training.
E-mail: kaleprakash23@gmail.com   Blog: Kale's point of View.

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रास्ते मुश्किल तो क्या ?

मृणालिनी घुळे

रास्ते मुश्किल तो क्या?
दूर हो मंज़िल तो क्या ?

डगमगाना नहीं
आस को खोना नहीं

ठोकरों में विघ्न हों
लक्ष्य में संकल्प हो

हौसला टूटे नहीं
सब्र भी छूटे नहीं

शिशिर का जाना है तय
बहार का आना है तय

इसलिए चलते रहो
राह पर बढ़ते रहो
अगर सच्ची है लगन....

कभी खुद से मिलकर तो देखो ....

डॉ. संगीता पाहुजा

कभी खुद से मिलकर तो देखो
अचरज न हो तो कहना।

खुद से प्रश्न पूछकर तो देखो
सब राज खुल न जाएं तो कहना।

हर अच्छाई को निखारने और,बुराई को सुधारने का प्रण
न हो जाए तो कहना।

अपने गुणों, अवगुणों का विश्लेषण करके तो देखो
जीवन लक्ष्य न मिल जाए तो कहना।

कभी खुद से मिलकर तो देखो
अति व्यस्त। न हो जाओ तो कहना।

मायावी दुनिया में रहकर, अंत:करण में झांक कर तो
देखो,हरिदर्शन कर
स्वयं से प्रेम न हो जाए तो कहना।

अपनी प्रतिभा को पहचान कर तो देखो
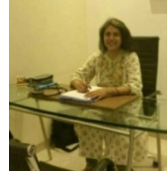खुद से मित्रता न हो जाए तो कहना।

आत्मविश्लेषण करके तो देखो
हीरे की तरह तराशे न जाओ तो कहना।

कभी खुद से मिलकर तो देखो!
कभी खुद से मिलकर तो देखो।।

कवियत्री एक सामाजिक चिंतक एवं विचारक हैं | आपकी कविताएँ वर्तमान पर्यवेक्ष्य में बुद्धि-जीवियों को उनके सामाजिक उत्तरदायित्व के प्रति उन्हें चिंतन के लिए प्रेरित करती हैं | आपकी लेखनी प्रादेशिक एवं राष्ट्रीय स्तर पर प्रकाशित है।
ई-मेल: mrinalinighule46@gmail.com

कवियत्री आयुर्वेदिक चिकित्सक हैं | आपने B.A.M.S. की उपाधि M.D. University, रोहतक से प्राप्त की | आपके दिल्ली एवं नॉएडा में परामर्श केंद्र है | धार्मिक, नारी एवं समाज उत्थान कार्यों में आपकी विशेष रूचि है|
संपर्क: मो. क्र.- 9953967901,
ई-मेल : sangeeta.pahuja3@gmail.com

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If you can find a path with no obstacles, it probably doesn't lead anywhere

- Frank A. Clark

—00—

The Man He Killed

Thomas Hardy

This poem was written in year 1902 prior to 1st World War. Even after more than a century its relevance is resembles to the gallantry, valour and humanity prevalent in Indian defense forces.

Original Poem

Had he and I but met
        By some old ancient inn,
We should have sat us down to wet
        Right many a nipperkin!

But ranged as infantry,
        And staring face to face,
I shot at him as he at me,
        And killed him in his place.

I shot him dead because —
        Because he was my foe,
Just so: my foe of course he was;
        That's clear enough; although

He thought he'd 'list, perhaps,
        Off-hand like — just as I —
Was out of work — had sold his traps —
        No other reason why.

Yes; quaint and curious war is!
        You shoot a fellow down
You'd treat if met where any bar is,
        Or help to half-a-crown.

अनुवाद

मुकेश आनंद

अगर तुम और मैं मिल जाते कहीं,
अनजाने किसी पुराने सराय के बाहर
हम एक दूसरे के साथ बैठ कर बाँटते दुःख,
छलकाते कई जाम और पैमाने।

लेकिन हम सेना में थे,
और एक दूसरे के आमने सामने,
मैं ने उस पर गोली चलाई और उसने मुझ पर,
और उसको मार दिया उसके ही जगह पर।

मैं ने उसको गोली मार दी क्योंकि-
क्योंकि वह मेरा दुश्मन था।
वैसे ही, वह मेरा वाकई दुश्मन था,
ये बिल्कुल स्पष्ट था, फिर भी;

उसने सेना में भर्ती होने का सोचा, शायद,
बेरोजगार होगा- जैसे मैं था-
कोई काम नहीं होगा- तो बेच दिया होगा सब कुछ,
भर्ती होने का कोई और कारण नहीं था।

हाँ, अजीब उत्सुकता ही युद्ध है!
आप किसी को गोली से मार देते हैं
जिससे आप मिलते किसी रेस्ट्रो बार में तो पिलाते,
या थोड़ी बहुत करते मदद।

अनुवादक एक अधिवक्ता एवं सामाजिक कार्यकर्ता हैं| सामाजिक विषयों पर पाठन, चिंतन –मनन, लेखन एवं उन पर कार्यान्वन उनकी अभिरुचि है |

E-mail ID: lawexcel@gmail.com

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Inetellectualism is not about criticizing or advising without any responsibility of implementation; it is about taking upon responsibility of actions for the larger good.

—00—

एक माँ का एहसास

भावना मिश्रा

इन सुखद एहसास के अलवा एक माँ को कई कष्टों का भी सामना करना पड़ता है। जैसे की पेट मे लात मारना, दिन मे सोना रात को जगना, खाने मे नखरा करना आदि आदि। बच्चे के सिहकन मात्र से ही माँ की आकुल्ता बढ जाती है। माँ तो माँ होती उसकी तुलना नही किया जा सकता है।

लेकिन सुनकर दुःख तब होता है कि- जब वही बच्चे बड़े होकर अपनी माँ को ही भुल जाते है। कभी वृद्धाश्रम, तो कभी उनके हाल पर ही मरने के लिए छोड़ देते है।

घिन्न तब आती है जब यही युवक अपने जननी को तिरस्कार करते दिखते है।

फ़िर भी- *माता कुपुत्रो जायेत कचिदपि कुमाता न भवति।* (**भावार्थ:** पुत्र कुपुत्र होता है लेकिन माता कभी कुमाता नहीं होती)

कितना खूबसूरत है न जब माँ बनते हैं,
वो अहसास, कितना अच्छा लगता,
सब के चेहरे कैसे खिल जाते है,
घर में खुशियाँ छा जाती है।

सभी सगे सबंधी खुश हो जाते है,
सब बधाईयाँ देते,
वह अहसास कमाल का होता हैं,
उसे शब्दों में बयां करना मुश्किल होता है।

सब खाने खिलाने के लिए परेशान रहते हैं,
माँ कहती तेजी से मत चला करो,
दादी कहती छत पे मत जाया करो,
सासू माँ कहती ज्यादा काम मत किया करो,
नानी कहती भारी मत उठाया करो।

सब नसीहत देते रहते है
सब का नज़रियाअलग-अलग होता है,
कितने सारे सपने देखते हैं,

कोई कहता मेरे जैसा होगा,
कोई कहता बिल्कुल बाप पे जाएगा।
कोई कहता माँ जैसी होगी,
ससुर जी कहते माँ जैसी गोरी होगी,
दादा कहते बाप के कलर जैसा होगा,

कोई कहता बेटी चाहिए
घर में लक्ष्मी आयेगी,
घर में खुशियाँ ही खुशियाँ भर देगी,
कोई कहता बेटा चाहिए,
वंश को आगे बढ़ाने वाला चाहिए ।

लेखिका कला संकाय से स्नातक तथा एक गृहणी हैं। वे अपने पुत्र मन्न और पुत्री नव्या के साथ अपने परिवार तथा बुजर्गों की सेवा का आनंद लेती हैं। संगीत (गायन) ,नृत्य एवं भ्रमण इनके शौक हैं।

ई -मेल : bhawna.ragini@gmail.com

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The value of a college education is not the learning of many facts but the training of mind to think.
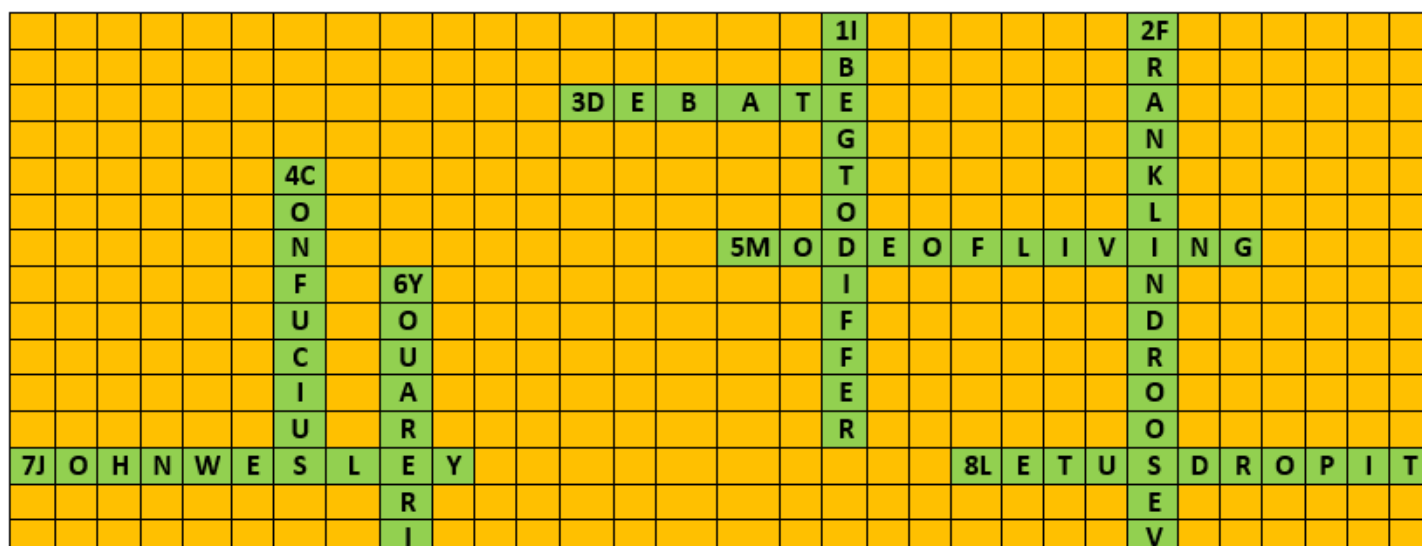
- **Albert Einstein**

Answers: Science Quiz- January'2020

Kumud Bala

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

—oo—

ANSWER: CROSSWORD PUZZLE January'2020
(Agreeing to Disagree)

Prof. S.B. Dhar

Crossword answers:

- 1I (down): I B E G T O D I F F E R
- 2F (down): F R A N K L I N D R O O S E V
- 3D (across): D E B A T E
- 4C (down): C O N F U C I U
- 5M (across): M O D E O F L I V I N G
- 6Y (down): Y O U A R E R I
- 7J (across): J O H N W E S L E Y
- 8L (across): L E T U S D R O P I T

—oo—

Compunication (Computer with Communication capability i.e. internet) has forged the world, which is otherwise fragmented into narrow boundaries, into a global village. All that we need to do is to connect the most deprived persons through strings of education. Compunication provides the much needed solution in the form of Virtual Class Rooms.

—oo—

Nothing is more important than education,
because nowhere are our stakes higher;
our future depends on the quality of education of our children today.
                                            - Arnold Schwarzenegger

Tips to Get Rid Of Examination Fear - Feb 2020

Kumud Bala

Examination fear is one of the common things which you can find in every student who is going to attend exams. The best solution for this issue is that the students need to maintain a clam and peaceful mind. And it is the responsibility of parents and teachers to make it possible. Along with it, the students should prepare well for exams without having any fear or anxiety.

"Keep calm and exam success"

For better understanding, we have split it into two sections.

(i) **Things to do before the exam**:

Stay positive

Preparation is primary key that helps

Eat well, but don't over eat

Have enough sleep

No-cheating pledge

Perform

Yoga

(ii) **Things to do during the exam**:

Wake up and start early for your day

Be focused

Understand the question well and answer peacefully

Avoid last minute preparation and hurry

"Trust yourself you know more than you think you do"

Tips to overcome exam fear and anxiety:

1. **Start revising early:** it will avoid panic at the moment.

2. **Your own timetable**: you need to create your own timetable for all the 7 days of the week.

3. **Chart out:** make a rough sketch of the units or chapters that you need to prepare.

4. **Mix of subjects:** studying the same subject will make you feel bored or mind dull. Take a mix of two subjects.

5. **Target for the day:** so having a target for the day, you are sure to revise well before the exam.

6. **Allocate time for breaks**: Making a timetable is not an easy task. While making, do make time for breaks in between. You might get up for your bath or using the washroom, you need to wash your clothes, you need to clean the room, etc. All these can be considered a break. Breaks bring back enthusiasm while studying.

7. **Sleep well:** students are advised to take a minimum of 6-7 hours of sleep during the night. You can then cope up with the study the next day.

8. **Heading and subheadings:** While making notes, it is useful to separate the topics with heading and subheading below it. It not only makes the points to be separated out but helps the students to remember what the main subjects under it were.

9. **Using a flow chart:** Students can adapt the method of drawing flowchart to remember the various steps involved. Such flowcharts are quite easy to remember while revising.

10. **Share with someone:** It is better to share out your feeling with a mentor or your parent. Explaining about the stress and exam tension will make you understand what the real cause is for it. After that, you would be sure to dissipate the fear which will not come up again.

11. **Don't compare with your friends:** Everyone has different ways to study and understand the subject. Never make a comparison on the subjects you have done with your friend.

12. **Visualize positivity:** Whenever you are preparing for exams visualize that you will pass the exam. Never allow the thought of failure to ruin your exam preparation.

13. **Physically active:** Studying throughout the day is sure to cause you more anxiety of completing the portions. Taking time out to play games which you like is a stress buster. There are various options for such stress busters. Riding your bicycle for a short distance, going for a short walk, going to the gym, doing gardening, doing any other house chores are some sort of activities that will de-stress and refresh your mind.

14. **Have a balanced meal:** Students often tend to skip a meal or breakfast during exam time. It's a grave mistake that they make. Skipping does not solve your problem. In fact, skipping meals is going to deprive

your brain of vital nutrients. Hence, you need to take proper intake of proteins and carbohydrates. Intake of essential nutrients helps you to focus well.

15. Practice meditation: In spite of all the work, if you still seem that you cannot overcome fear and anxiety, and then try out meditation in the early morning. Meditation would bring your mind to focus.

"Don't strive for high grade, always strive for higher learning"

The author is a veteran teacher and a regular contributor of Growing With Concepts – Chemistry and Science Quiz in this e-Bulletin for nearly Four Years and mentor of Chemistry in IOMS of this initiative.

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EDUTAINMENT - A WORTHWHILE OBSESSION

Akanksha Kashyap

"It doesn't matter whether you like it or not you just have to do it." This familiar words reflect a bitter truth - acadamics as inevitable burden. You better accept this and learn to live with it. But suddenly education has become friendly! It ask something changing questions like: Does learning have to be stressful? Can there be no respite from study bordem?

A massive brainstorming has led to promising solution "EDUTAINMENT."

A Chinese proverb on learning goes like this "Tell me I'll forget. Show me I will remember. Involve me I will understand." So creative learning would mean creative involvement, and this is what entertainment is all about. It's being used for a plethora of phenomena from video games to learner centre teaching, musical equation and a whole lot more. But its not recent occurrence. Aren't the Panchatantra Jataka tales after all model lessons?

Group study is said to be the best way to beat the stress the teens feel that they are all in the same soup and will find a way out. What if your friends decided to go on a Saturday night and you are racking your brain over physics, who do you turn to? Obviously the answer to this question is internet. How many times claim that learning on the internet is relaxing and productive. Student say that readings of outside textbook make it real and interesting and it makes everything look simple. More students admit that when they think of history as a story with funky characters they can we collect more facts. And yeah it is actually true!

Sadly most of the students have not many ideas on making maths interesting. They either claim to be naturally gifted maths whizzes or the unfortunate rest whose slog to scrap through the exams. Nevertheless, there is an unanimous agreement that work and play Need to mingle n merge . Once said "college is not the place to go for ideas". But does it really have to be that way ? Today's teams are grabbing out for the Pinnacle of creativity and spontaneity , so what about edutainment, your best blossoming years are yet to come.......!

Author is a student of class 9th at Army Public School, Dinjan, Tinsukia District, Assam. She is a participant of Interactive Onle Mentoring Sessions held at the school.
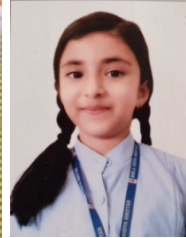
E-mail ID: abisweety83@gmail.com

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Education is not filling of a pail, but lighting of a fire.

- *William Buttler Yates*

—00—

Navya Nayan

Student of Class 4th, Birla Vidya Niketan, Delhi

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GOAL SETTING

Sumeet Jadhav

A picture of achievable good is set by many people for us. People from our community and those who have accomplished their goals set benchmarks. However, what happens with one does not become a trend. The simple reason is that each one of us is built with different DNA and characteristics that we use to make our choices. Comparison to what others have done and succeeded leads to pressure and losing one's self purpose. This often leads to either wrong choices and deters us from finding true purpose, or leading us to follow path set by others.

Now let us discuss how goals come into existence. Establishing concrete goals involves making a plan and logically breaking it down into an actionable to-do list. This defines our short term and long term goals. Short term goals are those that we can attain in near future, is a preparation for our life's very purpose.

Establishing goals provide a base to build one's dream and enrich our lives. Achieving each milestone towards these goals involves pride or encourages pride in our parents and mentors; it makes us even more focused. This gives us the confidence to face challenges, test our skills and know our pain points.

For most of us, our goals are a manifestation of the way we communicate with our environment and our experiences. In school or places of learning our teachers and mentors are the biggest influence. And of course, the society at large our community, friend circle and family play a critical role.

Mindfulness about the those key elements help us to focus on the right decisions for our career and life. Conversely being aware of weakness is the first step to working towards overcoming them and seeking support in areas where needed. Knowledge is the key to building skills that are relevant to achieving goals but not the least we should ensure that we stay on our path.

"*Learn Share Grow*
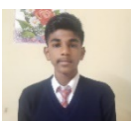
Author is a student of class 9th at Army Public School, Dinjan, Tinsukia District, Assam. He is a participant of Interactive Onle Mentoring Sessions held at the school.

E-mail ID: apsdinjan@gmail.com

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Fox And The Shadow

Natchya Tiwari

Long long ago, there was a little fox. It was walking home. On the way, a tiger came up and tried to eat the little fox but the little fox said with tears, "Please please, please! don't eat me. I am just a little fox." Hearing this, the tiger felt pity and released it.

Time passed and passed. One day in the morning, fox was walking down the aisle. The sun was shining in its front. It suddenly turned back and saw its shadow. The fox thought that if my shadow was so big, it meant that I was also too big.

Once the fox thought like that it walked with full of arrogance. Not long had it moved on, the tiger showed up. The fox said to the tiger, "I am bigger than you now; you should kneel in front of me and pay respect to me".

When the tiger heard so, he was very angry and said to the fox, "Last time, I didn't eat you because I thought you were just a little pity fox but this time I wouldn't let you go because you are full of arrogance and you don't know how to respect others." The tiger devoured the fox and ate it.

Moral of the Story:

One should not be overconfident. One should not be arrogant. One must have respects for both seniors and juniors. One must not think of being greater or superior than others because doing so leads to a big failure in the future.

Author is a student of CRM School in Chiangrai (Thailand). She studies in Grade 8. Her hobbies are swimming, playing basketball, badminton & bicycling. She loves reading books. She is fond of writing short stories. She believes that one should always live by the rules because staying with the rules generates discipline. Discipline is very necessary for the students.
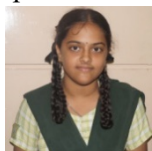
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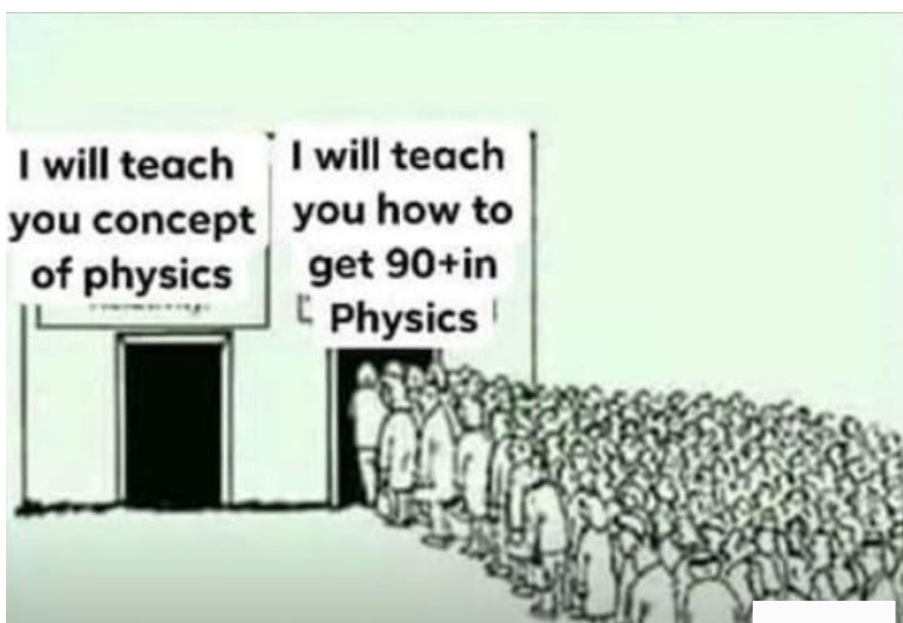
Natural Resources

M.Hari Chandana

Any resource that we obtain from nature is a natural resource. The way we use these resources is really cruel and we must have to reform if we wish our children to have a blissful life. Any resource that we obtain from nature is a natural resource such as land, sunlight, water, Resources, oil and gases and so on. We haven't inherited these from our fathers but borrowed from our children. The way we use these resources is really cruel and we must have to reform if we wish our children to have a blissful life. A Renewable resource is one which is created by Mother Nature time and again and is believed to never exhaust like wind, sunlight, water and land. On the other hand, we have exhaustible resources and the best thing about these is that no matter how well we know about their near end we continue to consume at a tremendous rate. If one takes a glance to our daily activities one could easily spot that it doesn't exist without the natural resources. It has been found that the exhaustible resources would come to an end by the end of the century, if the present rate of consumption continues. We as Indians consumes 500 cubic kilometers of water, 900 million tons of wood, 24 quadrillion British thermal units of energy every year. Almost all of our land is under human control. Just think how our children or they would live without these resources. However, we still can have as much hope as there are stars in the sky. We can follow 3R's Reduce, Reuse, Recycle in our day to day consumption. Other than these fundamentals, we have to create awareness, promote afforestation and rainwater harvesting. We have to save energy. In the course, economical and administrative record can also contribute. We have to bring reforms in ourselves socially, mentally, emotionally if we don't want our children to suffer the curse. It's not you or I who is going to do this but it's all of us who must have to do this not for ourselves but for those from whom we have borrowed these.

Compiler is a student of Class XIth at Ramakrishna Mission High School, Sithanagram, Vijaywada, A.P. She is a participant in IOMSs at the school.E-mail ID: rkmvschool@gmail.com

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Motivation

J.J.S.N.Ganesh

Motivation is a powerful, yet tricky beast. Sometimes it is really easy to get motivated, and you find yourself wrapped up in a whirlwind of excitement. Other times, it is nearly impossible to figure out how to motivate yourself and you're trapped in a death spiral of procrastination. This page contains the best ideas and most useful research on how to get and stay motivated.

This isn't going to be some rah-rah, pumped-up motivational speech. (That's not my style.) Instead, we're going to break down the science behind how to get motivated in the first place and how to stay motivated for the long-run. Whether you're trying to figure out how to motivate yourself or how to motivate a team, this page should cover everything you need to know.

Scientists define motivation as your general willingness to do something. It is the set of psychological forces that compel you to take action. That's nice and all, but I think we can come up with a more useful definition of motivation.

So what is motivation, exactly? The author Steven Pressfield has a great line in his book, the of effect, which I think gets at the core of motivation. To paraphrase Pressfield, "At some point, the pain of *not* doing it becomes greater than the pain of doing it."

In other words, at some point, it is easier to change than to stay the same. It is easier to take action and feel insecure at the gym than to sit still and experience self-loathing on the couch. It is easier to feel awkward while making the sales call than to feel disappointed about your dwindling bank account.

This, I think, is the essence of motivation. Every choice has a price, but when we are motivated, it is easier to bear the inconvenience of action than the pain of remaining the same. Somehow we cross a mental threshold—usually after weeks of procrastination and in the face of an impending deadline—and it becomes more painful to *not* do the work than to actually do it.

Compiler is a student of Class XIth at Ramakrishna Mission High School, Sithanagram, Vijaywada, A.P. He is participations in IOMSs being held at the school. E-mail ID: rkmvschool@gmail.com

—00—

What Matters to a Child?

These are few compositions of a child stydying in class 3

Popcorn!

Pop, pop, popcorn, popping in the pot!
Pop, pop, popcorn eat it while it's hot!

Pop, pop, popcorn, butter on the top!
When I eat popcorn, I can't stop!

PIZZA!

Pizza, pizza, it is delicious!
When I eat it I can't stop!

th has cheese, sauce and vegetables,
and eat it when it is cold
Pizza, pizza I like,
What I told!

Burger!

Burger, burger, it is delicious!
When wat it, I don't feel jealous.

It has cheese, vegetables and patty,
And at when it is hot!
Burger, burger, I like burger,
It is tasty, I love it a lot!

The Silent Mischief Maker

I know a funny little man,
As quite a mouse
Who does the mischief,
That is done in every house!

No one ever sees his face
Yet we all agree
That every plate we break
Was cracked by nobody!

Mannan, the autor, is a student of class 3 at Birla Niketan. He loves music, painting, playing, besides eating.

—00—

Education breeds confidence.

Confidence breeds hope.

Hope breeds peace.

-   Confucius

—00—

Problems are meant to be solved; every solution open doorway to new problems. This is an endless journey to discovery of nature.

We are, what we are, because of rigorous efforts of countless persons.

—00—

Roots of education are bitter, but the fruit is sweet.

-   *Aristotle*

—00—

Growing With Concepts - Mathematics

LET'S DO SOME PROBLEMS IN MATHEMATICS-XVI

Prof. SB Dhar

Mathematics is the engine behind Science. It has both an inherent logic and beauty. It provides the structure and models from which physicists, chemists, biologists, medics, engineers, economists and social scientists build an understanding to construct the tools to improve our lives.

Mathematics in Oxford embraces this power and diversity by combining its pure and applied form in one department and one building, ensuring collaborations both within and beyond Oxford.

There are three and four year degrees in Mathematics (BA/MMath) and also in the various joint courses: Mathematics and Statistics (BA/MMath), Mathematics and Computer Science (BA/MMathCompSci) and Mathematics and Philosophy (BA/MMathPhil). There is also a fourth year stream – Mathematics and Theoretical Physics – whereby students study for an MMathPhys.

Admissions to these courses are done through Mathematics Admissions Test (MAT). This test lasts for 2½ hours.

All applicants are to attempt the first ten multiple-choice questions, and then four from six longer questions depending on their proposed degree.

Information about admissions, the University, and colleges is on the University website

www.ox.ac.uk/admissions .

THE SYLLABUS IS ALMOST SAME AS IN INDIA IN STANDARD XII BUT REALLY IN BETTER POSITION.

We are selecting some of the QESTIONS that have been asked in the Mathematics Admission Test for the candidates who applied for Mathematics at Oxford University/Imperial College London/University of Warwick.
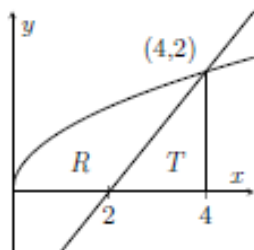
QUESTIONS

1. The area of the region bounded by the curve $= \sqrt{x}$, the line $y = x - 2$ and the x-axis is equal to

   (a) 2   (b) $\frac{5}{2}$ (c) 3   (d) $\frac{10}{3}$ (e) $\frac{16}{3}$

   Hint:

   The curves intersect each other when *x=4.*

   The required area of region R in the sketch= $\int_0^4 \sqrt{x}dx - \frac{1}{2}.2.2 = \frac{10}{3}$

   Hence option (d) is correct.

2. Let $f(x) = 2x^3 - kx^2 + 2x - k$. For what values of the real number k does the graph *y=f(x)* have two distinct real stationary points?

   (a) $-2\sqrt{3} < k < 2\sqrt{3}$

   (b) $k < -2\sqrt{3} - 3 \ or \ 2\sqrt{3} < k$

   (c) $k < -\sqrt{21} - 3 \ or \ \sqrt{21} - 3 < k$

   (d) $-\sqrt{21} - 3 < k < \sqrt{21} - 3$

   (e) *all values of k*

   Hint:

   In order to have the two distinct real stationary points we require *4k²-48* to be positive.

   Hence option (b) is the correct answer.

3. The function $y = e^{kx}$ satisfies the equation

$$\left(\frac{d^2y}{dx^2}+\frac{dy}{dx}\right)\left(\frac{dy}{dx}-y\right)=y\frac{dy}{dx} \quad \text{for}$$

(a) no values of k

(b) exactly one value of k

(c) exactly two distinct values of k

(d) exactly three distinct values of k

(e) infinitely many values of k

Hint:

On putting the values of the derivatives in the given equation, we get,

$(k^2e^{kx}+ke^{kx})(ke^{kx}-e^{kx})=k^2 2kx$

Since e^{kx} is never zero, hence on dividing both sides by e^{2kx}, we get

$k(k+1)(k-1)=k \Rightarrow$ k=0, k=$\sqrt{2}, k=-\sqrt{2}$

4. The minimum value achieved by the function

$$f(x) = 9cos^4x - 12cos^2x + 7 \text{ equals}$$

(a) 3   (b) 4   (c) 5   (d) 6   (e) 7

Hint:

$f(x) = 9cos^4x - 12cos^2x + 7$

$\quad$ =(3cos^2x-2)^2 + 3

Therefore, the minimum value is 3. Hence option (a) is the correct answer.

5. A sequence a_n has the property $a_{n+1} = \frac{a_n}{a_{n-1}}$ for every n ≥ 2. Given that a_1=2 and a_2=6, what is a_{201}?

(a)$\frac{1}{6}$ (b)$\frac{1}{3}$ (c)$\frac{1}{2}$ (d) 2   (e) 3

Hint:

On calculation,

The first few terms are 2, 6, 3, $\frac{1}{2}$, $\frac{1}{6}$, $\frac{1}{3}$, 2, 6,…..
This sequence is repeating after every six terms

and 2017 divided by 6 leaves remainder 1. Hence the answer is option (d).

6. Let *a,b,c* and *d* be real numbers. The two curves $y = ax^2 + c$ and $y = bx^2 + d$ have exactly two points of intersection precisely when

(a) $\frac{a}{b}<1$ (b) $\frac{a}{b}<\frac{c}{d}$ (c) *a<b* (d) *c<d*

 (e) *(d-c)(a-b)>0*

Hint:

$y = x^2c = bx^2 + d$ if and only if

$(a-b)x^2 = (d-c)$

If *(a-b)* = 0 then we have either no solutions if *c≠d* or have infinitely many solutions if *c=d*.
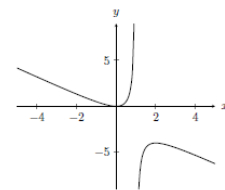
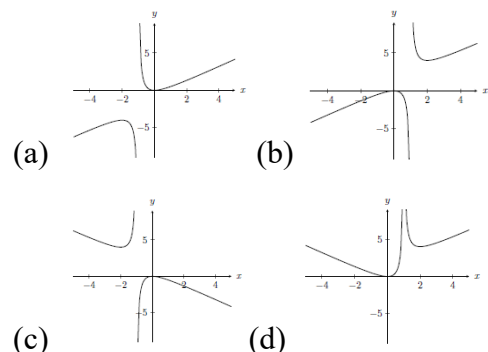Otherwise we can divide by *(a-b)* and get
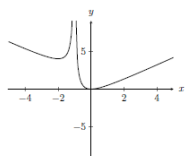
x²=(d-c)/(a-b)

It will have two roots if it is > 0 or

(d-c)(a-b) > 0 on multiplying Nr and Dr by (a-b)².

7. The diagram below shows the graph of *y=f(x)*.

The graph of *y=-f(-x)* is drawn in which of the following diagrams?

(a)   (b)

(c)   (d)

(e)

Hint:

$y = f(-x)$ is a reflection in the y-axis, where

$y = - f(x)$ is a reflection in x-axis. Combining these two facts the correct answer is option (c).

8. If $f(x) = x^2 - 5x + 7,$ what are the coordinates of the minimum of $y = f(x - 2)$?

(a)$\left(\frac{5}{2}, \frac{3}{4}\right)$ (b) $\left(\frac{9}{2}, \frac{3}{4}\right)$ (c) $\left(\frac{1}{2}, \frac{3}{4}\right)$

(d) $\left(\frac{9}{2}, \frac{-5}{4}\right)$ (e) $\left(\frac{5}{2}, \frac{-5}{4}\right)$

Hint:

f(x) = x^2 − 5x + 7 or,

f(x − 2) = (x − 2)^2 − 5(x − 2) + 7

$= \left(x - \frac{9}{2}\right)^2 + \frac{3}{4}$

Obviously, it is minimum value when

$x - \frac{9}{2} = 0$ i.e. when $x = \frac{9}{2}$ i.e., $\frac{3}{4}$

So, *f(x-2)* is minimum at $\left(\frac{9}{2}, \frac{3}{4}\right)$.

Option (b) is correct.

9. Let *a* and *b* be positive integers such that *a+b* = 20. What is the maximum value that *a²b* can take?

(a) 1000   (b) 1152   (c) 1176

(d)1183   (e)1196

Hint:

Let A= a²b= a²(20-a)

Let us use concept of calculus for maxima and minima, and differentiate w.r.t *a* and equate it to 0,

$a = \frac{40}{3} \Rightarrow$ closest integer 13 hence

b= 20-13=7 in integral form.

On putting values, option (d) is the correct answer.

10. The parabolas with equations $y = x^2 + c$ and $y^2 = x$ touch (that is, meet tangentially) at a single point. It follows that c equals

(a) $\frac{1}{2\sqrt{3}}$ (b) $\frac{3}{4\sqrt[3]{4}}$ (c) $\frac{-1}{2}$ (d)$\sqrt{5} - \sqrt{3}$ (e)$\sqrt{\frac{2}{3}}$

Hint:

The curves meet and have the same slope, i.e.,

$y = x^2 + c = \sqrt{x}$ ….(i)

$2x = \frac{1}{2}x^{-\frac{1}{2}}$ ….   (ii)

On solving these two equations for x, c=$\frac{3}{4\sqrt[3]{4}}$

Hence option (b) is correct.

11. In this question *a* and *b* are real numbers, and *a* is non-zero. When the polynomial *x²-2ax+a⁴* is divided by *x+b* the remainder is 1. The polynomial *bx²+x+1* has *(ax-1)* as a factor. It follows that *b* is

(a) 1 only   (b) 0 or -2   (c) 1 or 2

(d)1 or 3   (e) -1 or 2

Hint:

Using remainder theorem,

$f(-b) = 1$

$\Rightarrow b^2 - 2ab + a^4 = 1$ ….(i)

By factor theorem,

$f\left(\frac{1}{a}\right) = \frac{b}{a^2} + \frac{1}{a} + 1 = 0$ …. (ii)

On solving these two equations,

$2a^4 - a^2 = 1 \Rightarrow a =$ -1 or 1

hence $b=$ -2 or 0,

and so the answer is option (b).

12. Let $a,b,c > 0$ and $a \neq 1$. The equation $\log_b(b^x)^x + \log_a\left(\frac{c^x}{b^x}\right) + \log_a\left(\frac{1}{b}\right)\log_a c = 0$
has a repeated root when

(a) $b^2 = 4ac$ (b) $b = \frac{1}{a}$ (c) $c = \frac{b}{a}$

(d) $c = \frac{1}{b}$ (e) $a=b=c$

Hint:

Given

$\log_b(b^x)^x + \log_a\left(\frac{c^x}{b^x}\right) + \log_a\left(\frac{1}{b}\right)\log_a c = 0$

$\Rightarrow \quad x^2\log_b b + x\log_a c - x\log_a b + (\log_a 1 - \log_a b)\log_a c = 0$

$\Rightarrow x^2 + x\log_a c - x\log_a b - \log_a b.\log_a c = 0$

$\Rightarrow (x + \log_a c)(x - \log_a b) = 0$

Since the equation has repeated roots, hence

$-\log_a c = \log_a b \quad \Rightarrow \log_a\left(\frac{1}{c}\right) = \log_a b \quad \Rightarrow$
Answer is option (d)

13. Which of the following integrals has the largest value? You are not expected to calculate the exact value of any of these.

(a) $\int_0^2 (x^2 - 4)\sin^8(\pi x)dx$

(b) $\int_0^{2\pi}(2 + \cos x)^3 dx$

(c) $\int_0^\pi \sin^{100}x\,dx$

(d) $\int_0^\pi (3 - \sin x)^6 dx$

(e) $\int_0^{8\pi} 108(\sin^3 x - 1)dx$

Hint:

(a) $(x^2 - 4)\sin^8(\pi x) \leq 0$ as $(x^2 - 4)$ is negative when x lies between 0 and 2.

(b) $(2 + \cos x)$ will always be positive as it translates the $y = \cos x$ graph positively along y-axis, so the integral will be positive and less than 54π between the given limits.

(c) *the maximum* value of $\sin^{100}(x)$ is 1 and so the value of the integral between 0 and π must be $\leq \pi$

(d) *between* 0 *and* π the smallest   (3-$\sin x)^6$ can be 64π.

(e) $\sin^3(x)$ -1 will always be less than 0.

So the answer is option (d)

14. There is a unique real number α that satisfies the equation $\alpha^3 + \alpha^2 = 1$. Show that $0 < \alpha < 1$. Also show that $\alpha^4 = -1 + \alpha + \alpha^2$.

Hint:

$\alpha^3 + \alpha^2 = 1 \Rightarrow \alpha^2(1+\alpha) = 1$

Case I

If $\alpha \leq -1 \Rightarrow \alpha^2(1+\alpha) \leq 0$

Case II

If $-1 < \alpha < 0 \Rightarrow \alpha^2(1+\alpha) < \alpha^2 < 1$

Case III

If $\alpha \geq 1 \Rightarrow \alpha^2(1+\alpha) \geq 2$

Hence $0 < \alpha < 1$ is the only possibility.

Second Part:

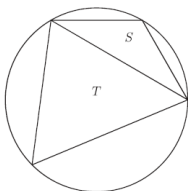$\alpha^3 + \alpha^2 = 1 \Rightarrow \alpha^3 = 1 - \alpha^2 \Rightarrow \alpha.(\alpha^3) = (1-\alpha^2).\alpha$

$\Rightarrow \alpha^4 = \alpha - \alpha^3 \Rightarrow \alpha^4 = \alpha - (1-\alpha^2)$

$\Rightarrow \alpha^4 = -1 + \alpha + \alpha^2$

15. Two triangles S and T are inscribed in a circle, as shown in the diagram below. The triangles have respective areas s and t and S is the smaller triangle so that s < t. The smallest value that $\frac{4s^2+t^2}{5st}$ can equal is

   (a) $\frac{2}{5}$ (b) $\frac{3}{5}$ (c) $\frac{4}{5}$ (d) 1   (e) $\frac{3}{2}$

   Hint:

   $\frac{4s^2+t^2}{5st} = \frac{1}{5}\left(\frac{4s}{t} + \frac{t}{s}\right)$

   Using AM-GM inequality,

   $\frac{\left(\frac{4s}{t}+\frac{t}{s}\right)}{2} \le \sqrt{\frac{4s}{t}\cdot\frac{t}{s}} = 2$

   That is,

   $\frac{s}{t} = \frac{1}{2}$

   Hence minimum value of $\frac{4s^2+t^2}{5st} = \frac{1}{5}\left(\frac{4}{2} + 2\right) = \frac{4}{5}$

16. A positive rational number q is expressed in friendly form, if it is written as a finite sum of reciprocals of distinct positive integers. For example, $\frac{4}{5} = \frac{1}{2} + \frac{1}{4} + \frac{1}{20}$. Express the following numbers in friendly form: $\frac{2}{3}, \frac{2}{5}, \frac{23}{40}$.
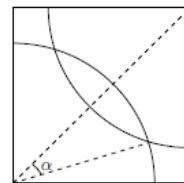
   Hint:

   $\frac{2}{3} = \frac{1}{2} + \frac{1}{6} = \frac{1}{3} + \frac{1}{4} + \frac{1}{12}$

   $\frac{2}{5} = \frac{1}{3} + \frac{1}{15} = \frac{1}{4} + \frac{1}{10} + \frac{1}{20}$

   $\frac{23}{40} = \frac{1}{2} + \frac{1}{20} + \frac{1}{40}$

17. A horse is attached by a rope to the corner of a square field of side length 1. What length of rope allows the horse to each precisely half the area of the field? Another horse is placed in the field, attached to the corner diagonally opposite from the first horse. Each horse has a length of rope such that each can reach half the field.
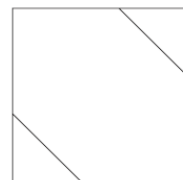

   Hint:

   It is required that the area of the sector is $\frac{r^2\theta}{2} = \frac{\theta}{2} = \frac{\pi}{2}$ as a quarter circle is formed.

   Hence the length of roe required is $\sqrt{\frac{2}{\pi}}$

18. An irregular hexagon with all sides of equal length is placed inside a square of side length 1, as shown below in the diagram (not to scale). What is the length of one of the hexagon sides?

   (a) $\sqrt{2} - 1$ (b) $2 - \sqrt{2}$ (c) 1

   (d) $\frac{\sqrt{2}}{2}$ (e) $\sqrt{2} + 2$

   Hint:

   Let the length of one of the sides of the hexagon be p, then the side of the square is equal to *p+(1-p)=1*. Then as the hexagon side forms a triangle in each corner of the square, using Pythagoras theorem,

   p²=(1-p)²+(1+p)²

   On solving, *p=2±2√2,* but since the length is less than 1, hence option (b) is the correct option.

The author, 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.

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

—00—

CROSSWORD PUZZLE February'2020 : RAMAN EFFECT

Prof. SB Dhar

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	2															
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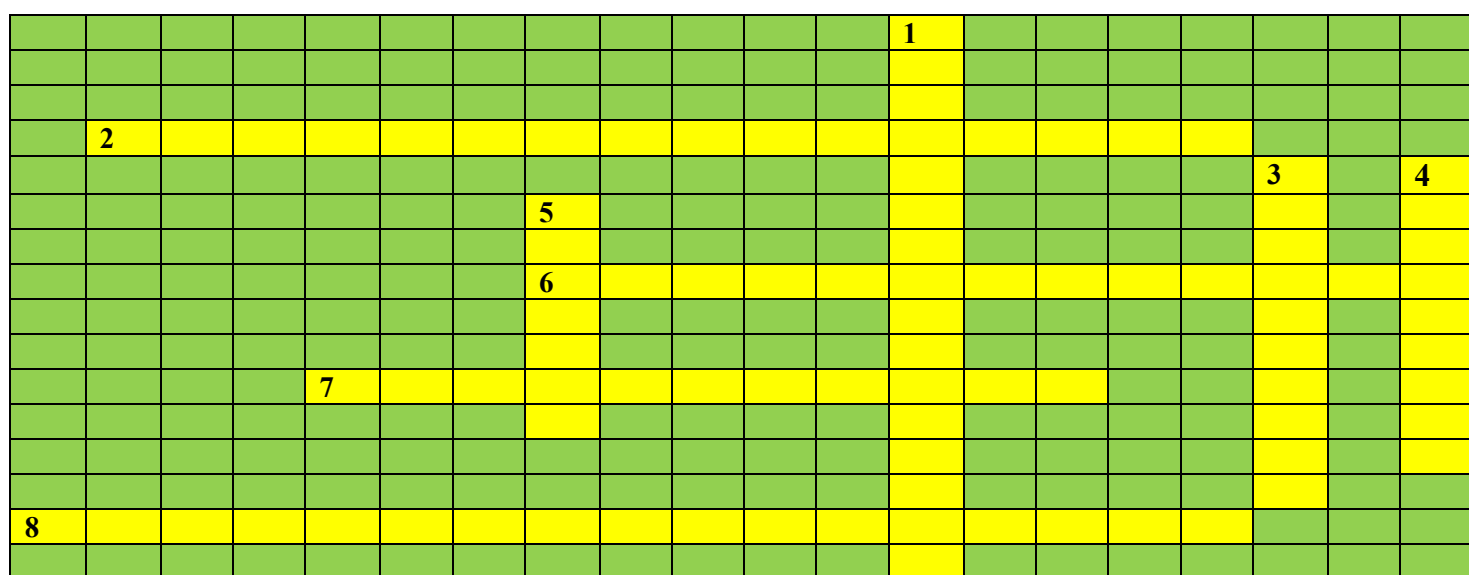
ACROSS

2 Raman Amplification is used in

6 Spectrum of the scattered photons is called

7 Inelastic scattering of photons by matter is called

8 Rotational energy is examined by

DOWN

1 CV Raman is known as

3 Student with whom Raman discovered Raman Effect

3 Student with whom Raman discovered Raman Effect

4 Author of the Sensations of Tone

5 Who said: "Science can only flower out when there is an internal urge"?

—00—

Answer to this Crossword Puzzle shall be provided in next issue of this e-Bulletin

—00—

Growing with Concepts : Physics

Wave and Motion : Sound Waves
Selected Problems And Concept of Intensity of Sound

Practice of solving problems makes concepts so intuitive that one would find it easy to visualize how the concepts are playing role in various phenomenons occurring around. This helps to sharpen observation followed by enhancement in analytical capability, a pre-requisite for creative and innovation of a person of worth. After touch sound is the first experience of every child after birth. In this set of problems in respect of vibrations of strings have been incorporated with necessary illustrations involving first principles, to the extent possible.

Solving typical problems on a gradual increase in complexity helps to build power of visualization of concepts that are essential in understanding a problem/n observation and evolving solution/answer. At this stage simpler calculations are being skipped in elaboration, with a hope that reader would be able to decipher intermediate steps.

Competitive examinations and more particularly in real life rarely expose to problems solved. Yet ability to solve such problems that one is groomed, it enhances competence to handle unknown problems speedily and correctly with a greater degree of clarity and confidence, an essential attribute of thought process needed for success in life.

Mentors' Manual is one of the dimensions of the Gyan Vigyan Sarita through which efforts are being made to reach out to remote teachers through our experience of mentoring unprivileged children who are disconnected from us by virtue of multiple barriers. Direct interaction has been possible through Interactive Online Mentoring Sessions (IOMS) a working model of connecting unprivileged children in a selfless manner. This experience is being disseminated to the teachers spread out by writing of chapters of an open source Mentors' Manual. Simple Harmonic Motion is First and Sound is Second of the Three parts of chapter Three covering Waves, Sound and Optics..

Science is a subject not to learn but a matter of realization through experiments and its visualization in surrounding. Every student is not equipped either to conduct experiment or an environment for visualization of science in his surroundings. This is where simulation is a technique to verify the concepts and study effect of variation in parameters related to the concept. Repetition of efforts in reinventing wheel is circumvented through structured learning of science.

India, growing digital, provides optimism to every student to be able to have an access to virtual laboratory, where without any physical laboratory, involving consumption of equipment and material, it is possible to carry out experiments in an e-environment which is non-destructively. There are some excellent videos available on the web either free or on price which provides an experience of different kinds through simulation of the concepts, The only problem with this is of sequencing and

scaling of concepts and selection of an appropriate video out of a big list of search results. This abundance is distracting to students. But, mentors are best person to use these videos to modulate and upgrade their illustrations.

It creates a question; can one wait for suitable virtual labs to become available to each student to gain proficiency in concepts? Definitely not! then the only way to get going on acquiring proficiency in concepts and their applications, soon after learning them; this application is solving problems of variety. The key is to have patience and perseverance, to acquire proficiency without consumption of any other resource except time which is available with students.

Here, Question Banks include problems from various sources and they are being supported with illustrations. These illustrations are not just solutions but an attempt to bring home use of basics involved in solving a problem. In an effort to compile problem there some good text books including those authored by Prof. H.C. Verma and a team of authors Robert Resnick, David Halliday and Kenneth S. Krane and many more. Some objective questions from different examinations have also been included. These questions are graded and authors have attempted to incorporate all concepts covered in the book. Thus it necessitates a student to read each chapter carefully before taking up questions.

Some students may find illustrations to be a bit lengthy and dwelling into basics more than what they require. These students, who are in abundance, not directly connected to us,. However, if they want to use this resource they are requested have patience.

Few question with their illustrations are drawn from Part-2, Set-3, on Sound and are appended here. The complete set of 90 questions is being uploaded as a free web-resource.

This initiative of a small group of passionate persons is aimed at to mentor unprivileged children and is driven with a sense of Personal Social Responsibility (PSR) in a non-organizational, non-remunerative, non-commercial and non-political manner. You are welcome to add value to this initiative by way of suggestion, advising correction or new type of questions. Or any other form that suits to your competence and convenience.

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Intensity of Sound in Gaseous Medium

Equations of travelling waves forms basic premise to analyze behaviour of waves in gaseous medium. It involves consolidation of mechanics thermodynamic properties of gases together with wave mechanics.

Displacement and Pressure Waves in Gaseous Medium: Huygens Wave Theory (HWT) explains propagation of waves. Let us consider an area A of the wave-front of a wave emanated at a large distance and travelling in X-direction. The wave-front is always perpendicular to the direction of propagation of wave. Sound is a pressure wave which causes displacement of particles. Accordingly, displacement of particles of medium from its mean position is a progressive wave is –

$$s = s_0 \sin \omega \left(t - \frac{x}{v} \right) \dots (1)$$

Here, s_0 is the amplitude of the displacement, ω is angular velocity of displacement of particles of medium, and x is the distance travelled by the wave in time t and v is the velocity of propagation of wave.

Let us consider an element of medium of thickness Δx as shown in the figure below.
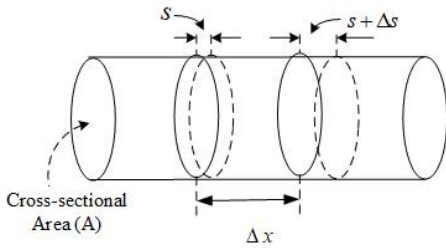
During, the progression of wave through a an element of gaseous medium Δx, displacement of particles in cross-section P is s and displacement of particles in cross-section Q is $s + \Delta s$. Thus change in volume $(V = A\Delta x)$ of the element Δx is $\Delta V = A\Delta s$ …(2)

Thus volumetric strain is –

$$\frac{\Delta V}{V} = \frac{A\Delta s}{A\Delta x} \Rightarrow \frac{\Delta V}{V} = \frac{\Delta s}{\Delta x} \dots (3)$$

On differentiating (1) w.r.t. x we get -

$$\frac{\Delta s}{\Delta x} = (-) \left[\frac{s_0 \omega}{v} \cos \omega \left(t - \frac{x}{v} \right) \right]$$

Accordingly, with (3) we get

$$\frac{\Delta V}{V} = (-) \left[\frac{s_0 \omega}{v} \cos \omega \left(t - \frac{x}{v} \right) \right] \dots (4)$$

Considering the bulk modulus of the medium to be B, as per definition –

$$B = \frac{\Delta p}{-\frac{\Delta V}{V}} \Rightarrow (-) \frac{\Delta V}{V} = \frac{\Delta p}{B} \dots (5)$$

Here (-)ve sign indicates compressibility of gas which causes decrease in volume on increase of pressure and vice-versa.

Correlating (4) and (5) we get

$$\frac{\Delta p}{B} = (-)(-) \left[\frac{s_0 \omega}{v} \cos \omega \left(t - \frac{x}{v} \right) \right]$$

$$\Delta p = \frac{B s_0 \omega}{v} \cos \omega \left(t - \frac{x}{v} \right)$$

Since, Δp is the change in pressure at any point x ant an instant t and in terms of wave equation it is represented as change in instantaneous pressure about the mean value of pressure in the medium. Thus transformation of displacement equation of wave in the form of pressure equation is –

$$p = \frac{B s_0 \omega}{v} \cos \omega \left(t - \frac{x}{v} \right) \Rightarrow p = p_0 \cos \omega \left(t - \frac{x}{v} \right) \dots (6)$$

Thus pressure amplitude is $p_0 = \frac{B s_0 \omega}{v} = Bk \dots (7)$.

Here, k is wave number such that $k = \frac{\omega}{v} = \frac{2\pi f}{v} = \frac{2\pi}{\lambda}$

Speed of Sound Wave in Gaseous Medium: Pressure equation of a travelling wave (6) determined from displacement equation (1) is now used to determine transfer of power $P = \frac{\Delta W}{\Delta t} = \frac{F \Delta x}{\Delta t}$ from Classical Mechanics; it shall be forming starting point of determining intensity of sound, a bit later in this chapter. Using (6) instantaneous force on cross-section A of element Δx is –

$$F = p \times A = \frac{AB s_0 \omega}{v} \cos \omega \left(t - \frac{x}{v} \right) \dots (8)$$

Differentiating (8) w.r.t. x leads to -

$$\frac{F}{\Delta x} = \frac{AB s_0 \omega}{v} \left[-\frac{\omega}{v} \sin \omega \left(t - \frac{x}{v} \right) \right]$$

$$= -\frac{AB s_0 \omega^2}{v^2} \sin \omega \left(t - \frac{x}{v} \right) \dots (9)$$

Acceleration of mass of medium in the element $m = \rho V \Rightarrow m = \rho A \Delta x$ here ρ is the density of the medium is –

$$a = \frac{F}{m} = \frac{F}{A\rho \Delta x} \Rightarrow a = \frac{1}{A\rho} \left(\frac{F}{\Delta x} \right) \dots (10)$$

Combining (9) and (10) we have

$$a = \frac{1}{A\rho} \left(-\frac{AB s_0 \omega^2}{v^2} \sin \omega \left(t - \frac{x}{v} \right) \right)$$

It leads to

$$a = -\frac{Bs_0\omega^2}{\rho v^2} \sin \omega \left(t - \frac{x}{v}\right) \dots (11)$$

Double differentiation displacement equation (1) w.r.t. t also gives acceleration particles of medium

$$a = -s_0\omega^2 \sin \omega \left(t - \frac{x}{v}\right) \dots (12)$$

Combining expressions of acceleration of particles of medium in (11) and (12) we have

$$\frac{Bs_0\omega^2}{\rho v^2} \sin \omega \left(t - \frac{x}{v}\right) = s_0\omega^2 \sin \omega \left(t - \frac{x}{v}\right) \Rightarrow \frac{B}{\rho v^2} = 1 \,.$$

It leads to speed of propagation of sound wave in gaseous medium as

$$v = \sqrt{\frac{B}{\rho}} \dots (13)$$

This equation is similar to equation speed of propagation of sound in solids where $v = \sqrt{\frac{Y}{\rho}}$ where $B \to Y$. Whereas in liquids speed of propagation of soundwave remains the same as that for gaseous medium $v = \sqrt{\frac{B}{\rho}}$.

Yet there are certain parameters of gases which influence speed of sound through it, and are being analyzed.

As per Ideal Gas Equation (IGE)

$$pV = nRT \Rightarrow \frac{pV}{T} = \text{Constant} \dots (14)$$

Rate of compression and rarefaction during propagation of sound wave is so fast that heat developed in the process does not transfer to the environment. This makes it an adiabatic process. Accordingly,

$$pV^\gamma = \text{Constant} \dots (16)$$

$$\gamma = \frac{C_p}{C_V} \dots (17)$$

Here, C_p is specific heat capacity of gas at constant pressure and C_V is specific heat capacity of gas at constant volume.

Newton postulated that during wave propagation in gaseous medium heat transfer during compression and rarefaction takes place between the molecules in close vicinity. Accordingly, he assumed that temperature of medium in the process remains unchanged. Hence, taking partial differentiation of Boyle's Law-

$$pV = \text{constant} \Rightarrow p\Delta V + V\Delta p = 0 \Rightarrow p = \frac{\Delta p}{-\frac{\Delta V}{V}} \dots (18)$$

Comparing (5) and (18) we have $B = p \dots (19)$.

Accordingly, another form of expression for speed of sound in gaseous medium is

$$v = \sqrt{\frac{p}{\rho}} \dots (19)$$

Taking logarithm of (16) we get

$$\log p + \gamma \log V = \text{Constant}$$

Further, on partial differentiation $\frac{1}{p}\Delta p + \frac{\gamma}{V}\Delta V = 0$, It can be organized as $\frac{\Delta p}{-\frac{\Delta V}{V}} = \gamma p$. This together with (13) and (5) leads to more realistic form of speed of sound in gaseous medium as

$$v = \sqrt{\frac{\gamma p}{\rho}} \dots (20)$$

Air, the most common medium of propagation of sound, has $\gamma = 1.4$.

Effect of Temperature, Pressure and Humidity on Speed of Sound in Air

As per IGE (14) density of a medium is $\rho = \frac{m}{V}$. Therefore, for a given medium $V \propto \frac{1}{\rho} \dots (21)$.

Thus, IGE can be transformed into $\frac{p \times \frac{1}{\rho}}{T} = \text{Constant}$ or

$$\frac{p}{\rho} \propto T \dots (22)$$

Combining (20) and (22) we get $v \propto \sqrt{\gamma T}$ or $v \propto \sqrt{T}$. This leads to *effect of temperature on speed* of sound as

$$\frac{v_1}{v_2} = \sqrt{\frac{T_1}{T_2}} \dots (23)$$

But change of pressure p in a given space i.e. volume V under constant temperature T leads to proportionately larger number of molecules which from (14) leads to $\frac{p}{\rho}$ constant and therefore there is no *effect of variation of pressure* on speed of sound.

As regards humidity it changes composition of the gaseous medium with the ingress of water molecules in the form of vapour. This keeping temperature and pressure *same effect of density* of the medium accordingly $v \propto \frac{1}{\sqrt{\rho}}$. Accordingly,

$$\frac{v_1}{v_2} = \sqrt{\frac{\rho_2}{\rho_1}} \dots (24)$$

Intensity of Sound: As wave propagates there is transmission of energy, and *Intensity of Sound is average power crossing a unit area of cross-section of the medium which is perpendicular to direction of propagation of sound as per HWT.* Though intensity of sound is related to loudness it is also related to frequency.

Intensity if sound is analyzed using basic concepts of mechanics to displacement equation of wave at (1) and pressure equation of wave at (6). These equations are reproduced for convenience

$$s = s_0 \sin \omega \left(t - \frac{x}{v} \right)\ldots (1)$$

$$p = \frac{B s_0 \omega}{v} \cos \omega \left(t - \frac{x}{v} \right)\ldots(6)$$

Going back to area of cross-section A of the waveform as per HWT, the medium shall experience a forward force $F = pA$ and forward power transfer shall be $P = F\frac{ds}{dt} = Ap\frac{ds}{dt}$. In this form combining derivative of displacement equation (1) w,r,t. t and pressure equation of wave (6) we get instantaneous power transmission

$$P = A\left[p_0 \cos \omega \left(t - \frac{x}{v} \right) \right]\left[s_0 \omega \cos \omega \left(t - \frac{x}{v} \right) \right]\ldots(25)$$

Here, $p_0 = \frac{B s_0 \omega}{v}$ which is transformed into $B = \frac{p_0 v}{s_0 \omega}\ldots(26)$.

Accordingly, power of wave is

$$p = A\left[\frac{B s_0 \omega}{v} \cos \omega \left(t - \frac{x}{v} \right) \right]\left[s_0 \omega \cos \omega \left(t - \frac{x}{v} \right) \right]$$

$$= \frac{A B \omega^2 s_0^2}{v} \cos^2 \omega \left(t - \frac{x}{v} \right)$$

$$= \frac{A B \omega^2 s_0^2}{2v}\left[1 + \cos \left(2\omega \left(t - \frac{x}{v} \right) \right) \right]\ldots(27)$$

The equation (27) has two components, one of them is constant $\frac{A B \omega^2 s_0^2}{2v}$ while the other component is sinusoidal $\frac{A B \omega^2 s_0^2}{2v} \cos \left(2\omega \left(t - \frac{x}{v} \right) \right)$ having its average value Zero. Accordingly, average power transmitted by wave is

$$p_{av} = \frac{A B \omega^2 s_0^2}{2v}\ldots (28)$$

Therefore, as per definition intensity of sound is

$$I = \frac{p_{av}}{A} \Rightarrow I = \frac{\frac{A B \omega^2 s_0^2}{2v}}{A} \Rightarrow I = \frac{B \omega^2 s_0^2}{2v} \Rightarrow I = \frac{2\pi^2 f^2 s_0^2 B}{v} \ldots(29)$$

The intensity of sound can be used in different form by transforming variables as under.

Using (7) in (29) average speed of sound in terms of pressure amplitude is

$$I = \frac{B \omega^2 s_0^2}{2v} \times \frac{vB}{vB} = \left(\frac{\omega B s_0}{v} \right)^2 \times \frac{v}{2B} \Rightarrow I = \frac{p_0^2 v}{2B} \ldots(30)$$

Further, using (13) to transform (30), we have

$$I = \frac{p_0^2 v}{2B} \times \frac{v}{2B} \Rightarrow I = \frac{p_0^2 v}{2\left(\sqrt{B}\right)^2} \Rightarrow I = \frac{p_0^2 v}{2\left(v \times \sqrt{\rho}\right)^2}$$

$$I = \frac{p_0^2}{2v\rho}\ldots(31)$$

Few more variants of (29) and its transformations can be obtained for intensity of sound to use the available data.

References:

1. Concepts of Physics, Vol-1, *by H C. Verma*
2. Physics, Volume-1, *by Robert Resnick, David Halliday and Kenneth S. Krane*
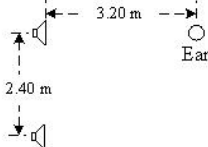3. niversity Physysics, Sears & Zemansky's, *by Hugh D. Young and Roger A. Freedman*
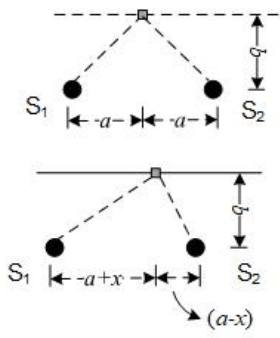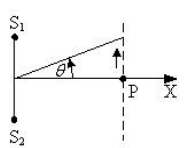
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Wave and Motion : Sound – Selected Questions with Illustrations

Q-01	The speed of sound as measured by a student in the laboratory on a winter day is 340 m/s when the room temperature is 17^{0}C. What speed will be measured by another student repeating the experiment on a day when the room temperature is 32^{0}C.
I-01	Speed of sound in air is $v = \sqrt{\frac{\gamma P}{\rho}}$ …(1) where, $\gamma = \frac{C_p}{C_v}$, pressure of the gas P and density gas is $\rho = \frac{m}{V}$. Further as per Ideal Gas Equation $pV = nRT \Rightarrow T = \left(\frac{P}{R}\right) \times \frac{V}{n} \Rightarrow T \propto \frac{1}{\rho}$…(2). Since P and R are constants. Therefore, combining equations (1) and (2) we have $v = \sqrt{\frac{\gamma P}{\frac{1}{T}}} \Rightarrow v = \sqrt{\gamma P T}$…(3) Here, T is temperature in thermodynamic scale i.e. Kelvin. In initial case $T_1 = 10^0C \Rightarrow T_1 = 273 + 17 = 290$ K and speed of sound $v_1 = 340$ m/s. In case 2 temperature changes to $T_2 = 32^0C \Rightarrow T_2 = 273 + 32 = 305$ K.

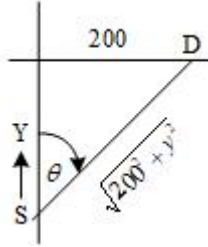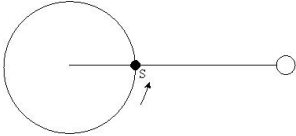|	
	Since we are required to determine speed of sound at where only temperature changes, keeping other parameters same, using (3) we have $\frac{v_2}{v_1} = \sqrt{\frac{T_2}{T_1}} \Rightarrow v_2 = \sqrt{\frac{T_2}{T_1}} \times v_1$. Using the available data $v_2 = \sqrt{\frac{305}{290}} \times 340$ or $v_2 = 348.9$ m/s and using principle of SDs **answer is $v_2 = 349$ m/s**.
Q-02	The absolute temperature of air in a region linearly increases from T_1 to T_2 in a space of width d. Find the time taken by a sound wave to go through the region in terms of T_1 , T_2 , d and the speed of sound v at 273 K. evaluate this time for $T_1 = 280$ K, $T_2 = 310$ K, $d = 33$ m and $v = 330$ m/s.
I-02	Using ideal gas properties and that sound wave is gases travel adiabatically we know that $v \propto \sqrt{T}$…(1). It is given that in space of width d temperature varies linearly from T_1 to T_2 . Therefore, at any distance x from the boundary of temperature T_1 the temperature shall be $T_x = T_1 + \frac{T_2 - T_1}{d} \times x \Rightarrow T_x = \frac{T_1 d + (T_2 - T_1)x}{d}$. Time taken by sound to travel through a thin film of medium of thickness Δx , assuming temperature in the thin film to be uniform, $\Delta t_x = \frac{\Delta x}{v_x}$. Using (1) we have $\frac{v_x}{v_1} = \sqrt{\frac{T_x}{T_1}} \Rightarrow v_x = \sqrt{\frac{T_x}{T_1}} \times v_1$…(2). Therefore, time taken by sound to cross the given space would be $\int_0^t dt_x = \int_0^d \frac{dx}{v_x} \Rightarrow t = \int_0^d \left(\frac{1}{v_1} \times \sqrt{\frac{T_1}{T_x}} \right) dx \Rightarrow t = \frac{1}{v_1} \times \int_0^d \left(\sqrt{\frac{T_1}{\left(\frac{T_1 d + (T_2 - T_1)x}{d} \right)}} \right) dx$. This leads to $t = \frac{\sqrt{T_1 d}}{v_1} \int_0^d \left(\frac{1}{\sqrt{T_1 d + (T_2 - T_1)x}} \right) dx$. Say, $T_1 d + (T_2 - T_1)x = u$ we have $dx = \frac{du}{(T_2 - T_1)}$, $t = \frac{\sqrt{T_1 d}}{v_1} \times \int_0^d \left(\frac{1}{\sqrt{u}} \right) \frac{du}{(T_2 - T_1)}$. It leads to $t = \frac{\sqrt{T_1 d}}{v_1} \times \frac{1}{(T_2 - T_1)} \times \left[2u^{\frac{1}{2}} \right]_0^d$. It, further solves into $t = \frac{\sqrt{T_1 d}}{v_1} \times \frac{\sqrt{d}}{(T_2 - T_1)} \left[T_2^{\frac{1}{2}} - T_1^{\frac{1}{2}} \right]$. This simplifies into $t = \frac{2d \times \sqrt{T_1}}{v_1 \left(T_2^{\frac{1}{2}} + T_1^{\frac{1}{2}} \right) \left(T_2^{\frac{1}{2}} - T_1^{\frac{1}{2}} \right)} \times \left(T_2^{\frac{1}{2}} - T_1^{\frac{1}{2}} \right) \Rightarrow t = \frac{2d \times \sqrt{T_1}}{v_1 \left(T_2^{\frac{1}{2}} + T_1^{\frac{1}{2}} \right)}$…(3) Given that speed of sound at 273 K is $v = 330$ m/s. Hence, using (2) we have $v_1 = v \times \sqrt{\frac{T_1}{273}}$…(4). On combining (3) and (4) we have $t = \frac{2d \times \sqrt{T_1}}{\left(v \times \sqrt{\frac{T_1}{273}} \right) \left(T_2^{\frac{1}{2}} + T_1^{\frac{1}{2}} \right)} \Rightarrow \boldsymbol{t = \frac{2d}{v} \times \frac{\sqrt{273}}{(\sqrt{T_2} + \sqrt{T_1})}}$, **This is the answer of first part in the algebraic form.** Numerical value of the time using the given data is $t = \frac{2 \times 33}{330} \times \frac{\sqrt{273}}{(\sqrt{310} + \sqrt{280})} \Rightarrow \boldsymbol{t = 0.096}$ **i.e. 96 ms.** **Thus answers are $\frac{2d}{v} \times \frac{\sqrt{273}}{(\sqrt{T_2} + \sqrt{T_1})}$, 96 ms.** **N.B:** This an excellent problem involving integration of mathematics with the concepts of physics.
Q-03	Calculate the bulk modulus of air from the following data about a sound wave of wavelength 35 cm travelling in air. The pressure at a point varies between $(1.0 \times 10^5 \pm 14)$ Pa and the particles of the air vibrate in simple harmonic motion of amplitude 5.5×10^{-6}m.
I-03	Bulk modulus of elasticity material is $B = \frac{\Delta p}{\frac{\Delta V}{V}} \Rightarrow B = \frac{\Delta p V}{\Delta V}$. It is given that pressure varies between $(1.0 \times 10^5 \pm 14)$ Pa $\Rightarrow \Delta p = 14$ Pa, or . $\Delta p = 14$ N/m². Given that wavelength $\lambda = 0.35$ m and maximum displacement i.e. amplitude of vibration of air particles is $\Delta x = 5.5 \times 10^{-6}$ m and maximum angular strain in the medium is $\frac{\Delta V}{V} = \frac{\Delta x}{\frac{\lambda}{2\pi}} \Rightarrow \frac{\Delta V}{V} = \frac{2\pi \Delta x}{\lambda}$. This leads to required bulk modulus of air is $B = \frac{\Delta p}{\frac{2\pi \Delta x}{\lambda}} \Rightarrow B = \frac{\lambda \Delta p}{2\pi \Delta x}$. Substituting, the available data $B = \frac{0.35 \times 14}{2\pi (5.5 \times 10^{-6})} = 0.14 \times 10^6 = 1.4 \times 10^5$ N/m² is the answer. **N.B.:** This problem solution correlating concept of strain in bulk elasticity applied to waves viz. amplitude corresponding to maximum displacement, and wavelength corresponding to volume of gas under consideration. Since in propagation of sound waves particles of medium keep oscillating about their mean

	position and hence volume of the medium experiencing bulk deformation in wave is taken corresponding to its amplitude. Factor 2π converts displacement to angle displacement required in bulk modulus.
Q-04	A source of sound operates at 2.0 kHz, 20 W emitting sound uniformly in all directions. The speed of sound in air is 340 m/s and density of air is 1.2 kg/m³. (a) What is the intensity at a distance of 6.0 m from the source? (b) What will be the pressure amplitude at this point? (c) What will be the displacement amplitude at this point?
I-04	It is given that source of frequency 2.0 kHz and power $p = 20$ Wof sound is emitting sound uniformly in all directions. Speed of sound is $v = 340$ m/s in air of density 1.2 kg/m². **Part (a):** With the given emission of sound by the source, its intensity at a distance R from the source is $I = \frac{p}{4\pi R^2} = \frac{20}{4\pi 6^2} = 0.044$ W/m² or **I = 44 mW/m², is the answer of part (a).** **Part (b):** Intensity of sound in terms pressure amplitude (ΔP), speed of sound in air (v) and density of air (ρ) is of sound wave at a point is $I = \frac{(\Delta P)^2}{2v\rho} \Rightarrow \Delta P = \sqrt{2v\rho I}$. Using the available data we have $\Delta P = \sqrt{2 \times 340 \times 1.2 \times 0.044} = $ **6 N/m² is the answer of part (b).** **Part (c):** Relationship of intensity of sound in terms of displacement amplitude (S_0), is $I = \frac{(\omega S_0)^2 B}{2v}$. The bulk modulus $B = \frac{p_0}{\frac{\Delta V}{V}} = \frac{p_0}{2\pi\left(\frac{S_0}{\lambda}\right)} = \frac{p_0}{2\pi\left(\frac{S_0 f}{\lambda f}\right)} = \frac{p_0}{\left(\frac{2\pi f S_0}{\lambda f}\right)} = \frac{p_0}{\frac{\omega S_0}{v}} = \frac{v p_0}{\omega S_0}$. Here, p_0 is the pressure amplitude expressed as Δp in [part (b) above. Thus Intensity of sound $I = \frac{(\omega S_0)^2}{2v} \times \frac{v p_0}{\omega S_0}$. It leads to $I = \frac{\omega S_0 p_0}{2}$. Therefore, displacement amplitude $S_0 = \frac{2I}{2\pi f p_0}$. Using the available data we have $S_0 = \frac{2 \times 0.044}{2 \times \pi \times 2.0 \times 10^3 \times 6} = $ **1.2×10^{-6} m, is the answer of part (c).** **Thus answers are (a) 44mW/m² (b) 6.0 pa (c) 1.2×10^{-6}m** N.B.: **(1)** Pressure, Power, Pressure Amplitude and Density symbols look similar and therefore they need to be handled carefully. **(2)** Determination of intensity of sound is a culmination of wave equation, displacement and pressure equations of wave, power transmitted by a wave. Moreover, it involves basic principles of mechanics, gas equations, isothermal and adiabatic processes etc. It is a very much involved derivation and hence has been exclusively brought out in Preamble. **(3)** Expression for intensity of sound wave has many variants and choice of a variant in a problem depends upon known variables. This becomes explicit in illustrations of the three parts of this problem.
Q-05	Sound with intensity larger than 120 dB appears painful to a person. A small speaker delivers 2.0 W of audio output. How close can the person get to the speaker without hurting his ears?
I-05	Intensity of sound at a distance d from the source is $I = \frac{P}{4\pi d^2}$. Further, intensity of sound in dB is expressed as $\beta = 10\log_{10}\frac{I}{I_0}$ where $I_0 = 10^{-12}$ W/m². Thus $\beta = 10\log_{10}\frac{\frac{P}{4\pi d^2}}{I_0} \Rightarrow \beta = 10\log_{10}\frac{P}{(4\pi d^2)\times I_0}$. Using the given data $120 = 10\log_{10}\frac{2}{(4\pi d^2)\times 10^{-12}} \Rightarrow 120 = \log_{10}\left(\frac{2}{(4\pi d^2)\times 10^{-12}}\right)^{10} \Rightarrow 10^{120} = \left(\frac{2}{(4\pi d^2)\times 10^{-12}}\right)^{10}$. It leads to $10^{12} = \frac{2\times 10^{12}}{(4\pi d^2)} \Rightarrow d^2 = \frac{1}{2\pi} \Rightarrow d = \sqrt{\frac{1}{2\pi}} \Rightarrow d = \sqrt{\frac{1}{2\pi}} = 0.398$ m or **$d = 0.40$ m or 40 cm.**
Q-06	Two stereo speakers are separated by a distance of 2.40 m. A person stands at a distance of 3.20 m directly in front of one of the speakers as shown in the figure. Find the frequencies in the audible range (20-20000 Hz) for which the listener will hear a minimum sound intensity. Speed of sound in air is 320 m/s.
I-06	Distance of listener from one speaker is $x_1 = 3.2$ m while from the another speaker, as per Pythagoras Theorem is $x_2 = \sqrt{(3.2)^2 + (2.4)^2} = 0.8\sqrt{4^2 + 3^2} \Rightarrow x_2 = 0.8 \times 5 = 4$m. Accordingly, $\Delta x = x_2 - x_1$, or

$\Delta x = 0.8$. The frequency range is $f_{min} = 20$ Hz to $f_{max} = 20000$ Hz.

Minimum intensity of sound is head in case of destructive interference for which $\Delta x = (2n + 1)\frac{\lambda}{2}$, which translates in frequency domain as $\Delta x = (2n + 1)\frac{v}{2f} \Rightarrow f = (2n + 1)\frac{v}{2\Delta x}$. Here $n \in W$ and possible values are 0, 1, 2,3…. Such that $f_{min} \leq f \leq f_{max}$. Thus using the available data on the $f_{min} \leq (2n + 1)\frac{v}{\Delta x}$ or $f_{min} \leq (2n + 1)\frac{320}{2 \times 0.8} \Rightarrow 20 \leq 200(2n + 1) \Rightarrow 2n + 1 \geq \frac{1}{10} \Rightarrow 2n \geq \frac{1}{10} - 1 \Rightarrow 2n \geq -\frac{9}{10} \Rightarrow n \leq \frac{9}{20}$. Now analyzing the inequality for maximum frequency $200(2n + 1) \leq f_{max} \Rightarrow 200(2n + 1) \leq 20000$. It leads to $2n + 1 \leq 100 \Rightarrow n \leq$ int$\left(\frac{99}{2}\right) \Rightarrow n \leq 49$. **Thus, desired frequencies in answer are $200(2n + 1)$ where $n = 0, 1, 2, 3 … 49.$**

N.B.: Required frequencies are determined using mathematics of inequalities.

Q-07	Two sources of sound S_1 and S_2 emitting waves of equal wavelength 20.0 cm are placed with a separation of 20.0 cm between them. A detector can be moved on a line parallel to S_1S_2 and at a distance of 20.0 cm from it. Initially, the detector is equidistant from the two sources. Assuming that the waves emitted by the sources are in phase, find the minimum distance through which the detector should be shifted to detect a minimum of sound.

I-08 Initial distance of detector from source S_1 be d_1 and of source S_2 be d_2. It will be seen that initial path length of detector from both the sources is $l_1 = l_2 = \sqrt{a^2 + b^2}$. When detector shifts through a distance x along a line parallel to the line joining the two sources, the difference in path lengths is $\Delta l' = l'_1 - l'_2$. And it works out to $\Delta l' = \sqrt{(a + x)^2 + d^2} - \sqrt{(a - x)^2 + d^2}$. Here, $a = \frac{20}{2} = 10$ cm, $d = 20$ cm. Accordingly $\Delta l' = \sqrt{(10 + x)^2 + 20^2} - \sqrt{(10 - x)^2 + 20^2}$,

It solves into $\Delta l' = \sqrt{100 + x^2 + 20x + 400} - \sqrt{100 + x^2 - 20x + 400}$ or $\Delta l' = \sqrt{500 + x^2 + 20x} - \sqrt{500 + x^2 - 20x}$…(1)

Initially, $\Delta l = l_1 - l_2 = 0$ and both the sources are emitting equal wavelengths $\lambda = 20$ cm which are in same phase hence maximum intensity would occur. But, for first occurrence minimum intensity $\Delta l' = \frac{\lambda}{2} = \frac{20}{2} \Rightarrow \Delta l' = 10$ cm…(2).

Equating (1) and (2) we have $10 = \sqrt{500 + x^2 + 20x} - \sqrt{500 + x^2 - 20x}$. Squaring the last expression $100 = (500 + x^2 + 20x) + (500 + x^2 - 20x) + 2\sqrt{(500 + x^2 + 20x)(500 + x^2 - 20x)}$. It further leads to $100 = 2(500 + x^2) + 2\sqrt{(500 + x^2)^2 - (20x)^2} \Rightarrow \sqrt{(500 + x^2)^2 - (20x)^2} = -(450 + x^2)$. Again squaring this expression $(500 + x^2)^2 - (20x)^2 = (450 + x^2)^2 \Rightarrow (500 + x^2)^2 - (450 + x^2)^2 = (20x)^2$. It further simplifies into $50(950 + 2x^2) = 400x^2 \Rightarrow 950 + 2x^2 = 8x^2 \Rightarrow 6x^2 = 950 \Rightarrow x^2 = \frac{950}{6}$. It leads to $x = \sqrt{\frac{950}{6}} \Rightarrow x = \pm 12.6$ cm.. **Thus, answer is minimum distance by which detector should be shifted to perceive minimum intensity of sound is 12.6 cm.**

N.B.: Here algebraic solution will become longer and hence numerical values have been used to determine Δl for simplification. It is a good example of optimizing algebraic and numerical solution.

Q-09 Two speakers S_1 and S_2 driven by the same amplifier are placed at $y = 1.0$ m and $y = -1.0$ m. The speakers vibrate in phase at 600 Hz. A man stands at a point on the X-axis at a very large distance from the origin and starts moving parallel to the Y-axis. The speed of sound in air is 330 m/s.

(a) At what angle θ will the intensity of sound drop to a minimum for the first time?
(b) At what angle will he hear a maximum of sound intensity for the first time?
(c) If he continues to walk along the line, how many more maxima can he hear?

I-09	It is given that $d = \lvert \pm 1.0 \rvert$ and $d \ll D$ and hence $y \approx D\theta$, $AB = y\sin\theta$ and $0Q \approx OP$. At P which is equidistant from the given speakers S$_1$ and S$_2$ since sound waves would in-phase and hence intensity of the sound would be maximum.

When detector moves through a distance y along a line parallel to S$_1$ and S$_2$ deflection of line joining mid of S$_1$ and S$_2$ to Q from that of P would be through an angle $\theta \approx \frac{y}{D}$.

In new position Q path length from source S$_1$ is $l_1 = S_1Q$ and from source S$_2$ it is $l_2 = S_2Q$, therefore path difference $\Delta l = l_2 - l_1 \approx S_2R = 2d\sin\theta$. With the given information $D \gg$ Geometrically angle $RS_1S_2 \approx QOP = \theta$. Further, with given data wavelength of the sound $\lambda = \frac{v}{f} \Rightarrow \lambda = \frac{330}{600} = \frac{11}{20} = 0.55$ m. Now taking each part separately,

Part (a): For first minimum intensity to occur $\Delta l = \frac{\lambda}{2} \Rightarrow 2d \cdot \sin\theta = \frac{0.55}{2} \Rightarrow \theta = \sin^{-1} 0.1375 \Rightarrow \theta = 7^0 55'$, or $\boldsymbol{\theta = 7.9^0}$, **is the answer of part (a).**

Part (b): For first maximum sound intensity the requirement is $\Delta l = \lambda = 2d \cdot \sin\theta_1 \Rightarrow \sin\theta_1 = \frac{\lambda}{2d}$, or $\theta_1 = \sin^{-1}\frac{0.55}{2} \Rightarrow \theta_1 = 15^0 58'$, , or $\boldsymbol{\theta_1 = 16^{\,0}}$ **is the answer of part (b).**

Part (c): With this logic maxima would continue to occur as per $\Delta l = n\lambda$ and accordingly for successive maxima

$\boldsymbol{n = 2}$; $\Delta l_2 = 2\lambda = 2d \cdot \sin\theta_2 \Rightarrow \sin\theta_2 = \frac{2\lambda}{2d} = 0.55 \Rightarrow \theta_2 = \sin^{-1} 0.55 \Rightarrow \boldsymbol{\theta_2 = 33^0 20' = 33.3^0}$

$\boldsymbol{n = 3}$; $\Delta l_3 = 3\lambda = 2d \cdot \sin\theta_3 \Rightarrow \sin\theta_3 = \frac{3\lambda}{2d} = 0.825 \Rightarrow \theta_3 = \sin^{-1} 0.825 \Rightarrow \boldsymbol{\theta_3 = 55^0 35' = 55.6^0}$

$\boldsymbol{n = 4}$; $\Delta l_4 = 4\lambda = 2d \cdot \sin\theta_4 \Rightarrow \sin\theta_4 = \frac{4\lambda}{2d} = 1.1$ since for any angle $-1 \leq \sin\theta \leq 1$ and $\sin\theta_4$ is progressively increasing and maximum intensity would not occur $\Delta l > 3\lambda$

Hence, answer for part (c) is 33.3^0 and 55.6^0

Thus answers are (a) 7.9^0 (b) 16^0 (c) Two at 33.3^0 and 55.6^0

N.B.: It is seen that-

a) θ is not quite small to be approximated $\sin\theta \approx \theta$

b) $\Delta l = n\lambda = 2d \cdot \sin\theta \Rightarrow \theta = \sin^{-1}\left(\frac{n\lambda}{2d}\right)$ is a non-linear function and hence displacements for successive maxima cannot be determined linearly $\Delta l = n\lambda = 2d \cdot \theta$ |
| Q-10 | Figure shows two coherent sources S$_1$ and S$_2$ which emit sound of wavelength λ in phase. The separation between the sources is 3λ. A circular wire of large radius is placed in such a way that S$_1$S$_2$ lies in its plane and the middle point of S$_1$S$_2$ is at the center of the wire. Find the angular positions θ on the wire for which constructive interference takes place. |
| I-10 | With the given figure and data combined a more elaborative figure is drawn. Distance of a point P from source S$_1$, source S$_2$ and center of the circular wire O are S$_1$P = l_1, S$_2$P = l_2, OP = r respectively. Then $l_1 = \sqrt{(r\cos\theta + 1.5\lambda)^2 + (r\sin\theta)^2}$ and $l_2 = \sqrt{(r\cos\theta - 1.5\lambda)^2 + (r\sin\theta)^2}$. These two distances are simplified into $l_1 = \sqrt{r^2 + 3r\lambda\cos\theta}$ and $l_2 = \sqrt{r^2 - 3r\lambda\cos\theta}$. Thus for constructive interference $\Delta l = l_1 - l_2 = n\lambda \Rightarrow n\lambda = (r^2 + 3r\lambda\cos\theta)^{\frac{1}{2}} - (r^2 - 3r\lambda\cos\theta)^{\frac{1}{2}}$. Accordingly,

$n = \frac{r}{\lambda}\left[\left(1 + 3\frac{\lambda}{r}\cos\theta\right)^{\frac{1}{2}} - \left(1 - 3\frac{\lambda}{r}\cos\theta\right)^{\frac{1}{2}}\right]$. Given that $r \gg \lambda \Rightarrow \frac{r}{\lambda} \ll$ and $\cos\theta \leq 1$, hence $3\frac{\lambda}{r}\cos\theta \ll$. Thus both the terms are simplified using Binomial theorem which states that $\sqrt{1+x} = 1 + \frac{1}{2}x - \frac{1}{8}x^2 + \frac{1}{16}x^3 - \frac{5}{128}x^4$ and $\sqrt{1-x} = 1 - \frac{1}{2}x - \frac{1}{8}x^2 - \frac{1}{16}x^3 - \frac{5}{128}x^4$, here when $x \ll$ all terms containing higher order of x can be ignored. |

Applying, this binomial approximation we have $n = \frac{r}{\lambda}\left[\left(1 + \frac{1}{2} \times 3\frac{\lambda}{r}\cos\theta\right) - \left(1 - \frac{1}{2} \times 3\frac{\lambda}{r}\cos\theta\right)\right]$, it leads to $n = \frac{r}{\lambda}\left[3\frac{\lambda}{r}\cos\theta\right] \Rightarrow n = 3\cos\theta \Rightarrow \cos\theta = \frac{n}{3}$.

Now that $n \in W$ and $\cos\theta \leq 1$ possible values of n are 0, 1, 2, 3. Accordingly, -

➤ for n = 0 $\Rightarrow \cos\theta = \frac{0}{3} = 0 \Rightarrow \theta = \frac{\pi}{2} = 90^0$

➤ for n = 1 $\Rightarrow \cos\theta = \frac{1}{3} \Rightarrow \theta = 70^0 42' \approx 70.5^0$

➤ for n = 0 $\Rightarrow \cos\theta = \frac{2}{3} \Rightarrow \theta = 48^0 42' \approx 48.5^0$

➤ for n = 0 $\Rightarrow \cos\theta = \frac{3}{3} = 1 \Rightarrow \theta = 0^0$

These are angular positions of P in 1st quadrant, its vertical images shall occur in 2nd Quadrant with angles $(180 - 90)^0 = 90^0, (180 - 70.5)^0 = 109.5^0, (180 - 48.5)^0 = 131.5^0, (180 - 0)^0 = 180^0$, Diagonal images shall occur in 3rd quadrant with angles $(180 + 90)^0 = 270^0, (180 + 70.5)^0 = 250.5^0, (180 + 48.5)^0 = 228.5^0, (180 + 0)^0 = 180^0$. In fourth quadrant angles of the images shall be $-90^0, -70.5^0$, and 0^0.

Thus answer is 0^0, 48.5^0, 70.5^0, 90^0 and similar points in other quadrants.

N.B.: This problem involves application of binomial theorem.

Q-11 | A bat emitting an ultrasonic wave of frequency 4.5×10^4 Hz flies at a speed of 6m/s between two parallel wall. Find the two frequencies heard by the bat and the beat frequency between the two. The speed of sound is 330 m/s.

I-11 | **Insert Figure** When bat is flying at $V_b = 6$ m/s, between two walls X and Y, producing the waves of frequency produced by the bat is $f = 4.5 \times 10^4$ Hz. Velocity of sound in air is $V = 330$ m/s. It is important to note that during reflection there is no change of frequency. As per Doppler's effect $f' = f\left(\frac{V-V_o}{V-V_s}\right)$

Apparent frequency of waves interacting between wall-Y and the bat is analyzed in two parts –

(i) *Frequency f_Y perceived by the wall-Y in front of the bat:* in this case $V_o = 0$ and $V_s = V_b = 6$ m/s. Accordingly, using the available data $f_Y = f\left(\frac{V-V_o}{V-V_s}\right) \Rightarrow f_Y = f\left(\frac{330}{330-6}\right) \Rightarrow f_Y = f\left(\frac{330}{324}\right)$

(ii) *Frequency f_Y' of the wave reflected from wall-Y as perceived by the bat:* in this case bat is the observer and travelling against the direction of the reflected wave and hence $V_o = -6$ m/s, while the wall-Y has acting as a source has $V_s = 0$. Therefore, $f_Y' = f_Y\left(\frac{V-V_o}{V-V_s}\right) \Rightarrow f_Y' = f_Y\left(\frac{330-(-6)}{330}\right)$. It leads to $f_Y' = f\left(\frac{330}{324}\right)\left(\frac{336}{330}\right) \Rightarrow f_Y' = f\left(\frac{336}{324}\right)$ Hz.

Likewise, apparent frequency of waves interacting between wall-X and the bat is analyzed in two parts –

(i) *Frequency f_X perceived by the wall-X behind the bat:* in this case $V_o = 0$ and $V_s = -V_b = -6$ m/s. Accordingly, using the available data $f_X = f\left(\frac{V-V_o}{V-V_s}\right) \Rightarrow f_X = f\left(\frac{330}{330-(-6)}\right) \Rightarrow f_X = f\left(\frac{330}{336}\right)$

(ii) *Frequency f_X' of the wave reflected from wall-X as perceived by the bat:* in this case bat is the observer and travelling the direction of the reflected wave and hence $V_o = 6$ m/s, while the wall-X has acting as a source has $V_s = 0$. Therefore, $f_X' = f_X\left(\frac{V-V_o}{V-V_s}\right) \Rightarrow f_X' = f_X\left(\frac{330-6}{330}\right)$. It leads to $f_X' = f\left(\frac{330}{336}\right)\left(\frac{324}{330}\right) \Rightarrow f_X' = f\left(\frac{324}{336}\right)$ Hz.

Thus, frequency of beats is $n = |f_Y' - f_X'| \Rightarrow n = \left|f\left(\frac{336}{324}\right) - f\left(\frac{324}{336}\right)\right| \Rightarrow n = (4.5 \times 10^4)\left|\frac{336}{324} - \frac{324}{336}\right|$. It solves to $n = 3.3 \times 10^3 = $ **330 Hz is the answer.**

Q-12 | A sound source, fixed at the origin, is continuously emitted sound at a frequency of 660 Hz. The sound travels in air at a speed of 330 m/s. A listener is moving along the line at $x = 336$ m at a constant speed of 26 m/s. Find the frequency of the sound as observed by the listener when he is –

(a) At $y = -140$ m
(b) At $y = 0$

	(c) At $y = 140$ m
I-12	This is a problem of Doppler's effect where apparent frequency is $f' = f\left(\frac{V-V_o}{V-V_s}\right)$ and given that velocity of source of frequency $f = 660\ Hz$ is given to be $v = 26$ m/s and observer is moving along a line $x = 336$ m i.e. the line is parallel to Y-axis. Velocity of sound is $V = 330$ m/s. Sound since travels radially and hence V remains constant, velocity of source $V_s = 0$ since it fixed at origin, but velocity of observer w.r.t. sound is changing in each of the three cases and that would affect apparent frequency as under – **Case(a):** In this case velocity of observer w.r.t. sound is $V_o = v\cos(-\theta) = v\cos\theta$, here, with the given data $\tan\theta = \frac{336}{140} \Rightarrow \cos\theta = \frac{1}{1+\tan^2\theta} \Rightarrow \cos\theta = \sqrt{\frac{1}{1+\left(\frac{336}{140}\right)^2}} \Rightarrow \cos\theta = 0.38$. It is shown in the figure that V_o is against velocity of sound and hence it will be (-)ve. Accordingly, using the available data $f'_a = f\left(\frac{V-(-V_o)}{V}\right) \Rightarrow f'_a = f\left(\frac{V+V_o}{V}\right) \Rightarrow f'_a = 660\left(\frac{330+26\times0.38}{330}\right) = $ **680 Hz, is answer of part (a).** **Case (b):** In this case $\theta = 90^0$ and hence $V_o = v\cos 90^0 = 0$ and hence $f'_b = f\left(\frac{V-0}{V}\right) \Rightarrow f'_b = f = 660$ Hz is answer of part (b). **Case(c):** In this case velocity of observer w.r.t. sound is $V_o = v\cos(-\theta) = v\cos\theta$, here, with the given data $\tan\theta = \frac{-140}{338} \Rightarrow \cos\theta = \frac{1}{1+\tan^2\theta} \Rightarrow \cos\theta = \sqrt{\frac{1}{1+\left(\frac{336}{140}\right)^2}} \Rightarrow \cos\theta = 0.38$. It is shown in the figure that V_o is in the direction of the velocity of sound and hence it will be (+)ve. Accordingly, using the available data $f'_c = f\left(\frac{V-V_o}{V}\right) \Rightarrow f'_c = 660\left(\frac{330-26\times0.38}{330}\right) = $ **640 Hz, is answer of part (c).** **Thus answers are (a) 680 Hz (b) 660 Hz (c) 640 Hz.**
Q-13	A train running at 108 kmph towards east whistles at a dominant frequency of 500 Hz. Speed of sound in air is 340 m/s. (a) What frequency will a passenger sitting near the open window hear? (b) What frequency will a person standing near the track hear whom the train has just passed? (c) A wind starts blowing towards east at a speed of 36 kmph. Calculate the frequency heard by the passenger in the train and by the person standing near the track.
I-13	This is the case of Doppler's effect and apparent frequency $f' = f\left(\frac{V-V_o}{V-V_s}\right)$ is required to be determined where velocity of train $v_t = 108$ kmph which equates to $v_t = \frac{108\times1000}{3600} = 30$ m/s. Velocity of sound is $V = 340$ m/s and its frequency is $f = 500$. Taking each part separately – **Part (a):** Passenger (the observer) is sitting inside train which is blowing whistle. Thus velocities of passenger and whistle with respect to train are Zero and hence $f' = f\left(\frac{V-0}{V-0}\right) \Rightarrow \boldsymbol{f' = f = }$ **500 Hz, is answer of part (a).** **Part (b):** Observer is standing on the ground near the track and train (the source) has just passed the observer, therefore, velocity of source shall be against direction of sound and it shall be (-)ve. Accordingly, $f' = f\left(\frac{V-V_o}{V-(-V_s)}\right) \Rightarrow f' = 500\left(\frac{340-0}{340-(-30)}\right) \Rightarrow \boldsymbol{f' = }$ **459 Hz is the answer of part (b).** **Part (c):** When wind is blowing with a velocity $V_w = 36$ kmph $\Rightarrow V_w = \frac{36\times1000}{3600} = 10$ m/s, which is medium of the propagation of sound effective velocity of sound is $V' = V \pm V_w$; the V_w is additive when wind is blowing in the direction of propagation of sound and subtractive when it

	is blowing in opposite direction. Accordingly, taking effect of blowing wind formula of Doppler's effect gets slightly modified as $f' = f\left(\frac{V' - V_0}{V' - V_s}\right)$. This part has two cases same as that of part (a) and part (b) respectively. And they shall be solved with identical data except that V is replaced with V'. Accordingly – **Case 1:** Apparent frequency for the passenger is $f' = f\left(\frac{V' - 0}{V' - 0}\right) \Rightarrow f' = f =$ **500 Hz is answer of part (c-1).** **Case 2:** Apparent frequency of the observer standing near the track is $f' = f\left(\frac{V' - V_0}{V' - (-V_s)}\right) \Rightarrow f' =$ $500\left(\frac{(340 - 10) - 0}{(340 - 10) - (-30)}\right) \Rightarrow f' =$ **458 Hz is answer of part (c-2).** **Thus answers are (a) 500 Hz (b) 459 Hz (c-1) 500 Hz and (c-2) 458 Hz.**
Q-14	A source moving on the ground along the Y-axis with a speed of 22 m/s emits a pulse of sound at a frequency 4000 Hz. The pulse reaches a listener situated on the ground at the position (660 m,0) when the source reaches the origin. Find the frequency of the sound received by the listener at the instant the source crosses the origin. Speed of sound in air is 330 m/s.
I-14	Let at t=0, the position of the source moving along Y-axis is $(0, y)$ with velocity $v = 22$ m/s, a pulse of sound produced at this position reaches listener situated at (660 m,0) when the source reaches the origin as shown in the figure; this implies $V_0 = 0$. Thus time (t) taken by source and sound pulse to travel the distance SO and SL is same and hence as per geometry $t = \frac{y}{v} = \frac{y}{22} = \frac{\sqrt{y^2 + (660)^2}}{330} \Rightarrow (15y)^2 - y^2 = (660)^2 \Rightarrow$ $14 \times 16 \times y^2 = (660)^2$. It leads to $y = \frac{660}{\sqrt{224}}$. At the position or instance of creation of sound pulse, velocity of source along the velocity of sound $V_s = V\cos\theta = 22 \times \frac{y}{\sqrt{y^2 + (660)^2}} \Rightarrow V_s = 22 \times \frac{\frac{660}{\sqrt{224}}}{\sqrt{\left(\frac{660}{\sqrt{224}}\right)^2 + (660)^2}} \Rightarrow V_s = 22 \times \frac{1}{\sqrt{225}} \Rightarrow V_s = \frac{22}{15}$. As per Doppler's effect apparent frequency $f' = f\left(\frac{V - V_0}{V - V_s}\right)$. Using the available data $f' = 4000\left(\frac{330}{330 - \frac{22}{15}}\right) \Rightarrow f' = 6017.9$ or $f' =$ **6018 Hz, is the answer.** **N.B.:** Calculation of velocity of source along the line of travel of sound pulse at the instance of emission is to be taken into account, is key to the solution.

Q-15	A small source of sound S of frequency 500 Hz is attached to the end of a tight string and is whirled in a vertical circle of radius 1.6 m. The string just remains tight when the sources is at the highest point.
	   (a) An observer is located in the same vertical plane at a large distance and at the same height as the center of the circle as show in the figure. The speed of sound in air is 330 m/s and $g = 10$ m/s². Find the maximum frequency heard by the observer.
	   (b) An observer is situated at a large distance vertically above the center of the circle. Find the frequency heard by the observer corresponding to the sound emitted by the source when it is at the same height as the center.

I-15	When an object tied to a string is whirled vertically condition of minimum velocity for the string to just remain tight is when particle moves in a circular trajectory of radius $r = 1.6$ m is $\frac{mv^2}{r} = mg \Rightarrow v = \sqrt{rg} \Rightarrow v = \sqrt{1.6 \times 10} \Rightarrow v = 4$ m/s. It is given that observer is at a large distance aligned to the center of circle and hence velocity of source at its highest position A $V_{sA} = 4$ m/s. At the lowest position B velocity of source V_{sB} shall be determined with the principle of conservation of energy $\frac{1}{2}mV_{sB}^2 = \frac{1}{2}mV_{sA}^2 + mgh$. It leads to $V_{sB}^2 = V_{sA}^2 + 2gh \Rightarrow V_{sB}^2 = 4^2 + 2 \times 10 \times 2r \Rightarrow V_{sB}^2 = 16 + 2 \times 10 \times 2 \times 1.6 \Rightarrow V_{sB}^2 = 80$. It

solves into $V_{SB} = 8.9$ m/s. As per Doppler's effect apparent frequency is $f' = f\left(\frac{V-V_0}{V-V_s}\right)$. Now, taking each part separately –

Part (a): Maximum apparent frequency to the observer denominator of the expression of Doppler's Effect is minimum. This would occur when V_{SB} which greater than V_{SA} is in the direction of the sound and accordingly using the available data $f' = f\left(\frac{V-V_0}{V-V_{sA}}\right) \Rightarrow f' = 500\left(\frac{330}{330-8.9}\right) \Rightarrow \boldsymbol{f' = 514}$ **Hz** is the answer of part (a).

Part (b): In respect of positions C and D when source is at the height of the center as per conservation of energy velocity of source would be $\frac{1}{2}mv'^2 = \frac{1}{2}mV_{SA}^2 + mgr \Rightarrow v'^2 = 4^2 + 2\times 10 \times 1.6 \Rightarrow v'^2 = 16\times 3 \Rightarrow v' = 4\sqrt{3} = 6.9$ m/s. Not it is has two cases with observer situated vertically above center of the circle.

Case 1: When source is at C, as shown in the figure velocity of source is in the direction of the propagation of sound and hence it is positive or $V_{sC} = 6.9$ m/s and hence apparent frequency shall be $f'' = f\left(\frac{V-V_0}{V-V_{sC}}\right) \Rightarrow f'' = 500\left(\frac{330}{330-6.9}\right) \Rightarrow \boldsymbol{f'' = 511}$ **Hz.**

Case 2: When source is at D, as shown in the figure velocity of source is against the direction of the propagation of sound and hence it is negative or $V_{sD} = -6.9$ m/s and hence apparent frequency shall be $f''' = f\left(\frac{V-V_0}{V-V_{sD}}\right) \Rightarrow f''' = 500\left(\frac{330}{330-(-6.9)}\right) \Rightarrow \boldsymbol{f''' = 490}$ **Hz.**

Thus answers are (a) 514 Hz   (b) 490 Hz and 511 Hz

Q-16	A source emitting a sound of frequency f is placed at a large distance from an observer. The source starts moving towards the observer with a uniform acceleration a. Find the frequency heard by the observer corresponding to the wave emitted just after the source starts. The speed of sound in the medium is V.
I-16	This problem involves application of Doppler's effect but not of the standard formulation, rather instance diagram shown since velocity he source is constantly changing with uniform acceleration. Let D is the distance between the source and time period the first cycle of the sound wave emitted by the source at $t = 0$ to reach the observer $t_1 = \frac{D}{V}$. Time period of the wave is $T = \frac{1}{f}$ and before emitting the second cycle the source having velocity expressed by Second equation of Motion $d = \frac{1}{2}aT^2\Big|_{u=0}$ and distance required to travel by the second cycle emitted at $t = T$ to reach the source is $D' = D - d$ and time taken in this travel is $t_2 = T + \frac{D'}{V} \Rightarrow t_2 = T + \frac{D-d}{V}$. Thus time period of the wave apparent to the observer is duration between two successive cycles just after the source starts, at which apparent frequency is required to be determined, and it is $T' = T + (t_1 - t_2) \Rightarrow T' = \left(T + \frac{D-d}{V}\right) - \frac{D}{V} \Rightarrow T' = T - \frac{d}{V} \Rightarrow T' = T - \frac{1}{2V}aT^2 \Rightarrow T' = \frac{1}{f} - \frac{1}{2V}a\frac{1}{f^2} \Rightarrow T' = \frac{1}{f} - \frac{a}{2Vf^2} \Rightarrow T' = \frac{2Vf-a}{2Vf^2}$. Therefore, frequency of the wave apparent to the observer situated at a large distance from observer is $f' = \frac{1}{T'} \Rightarrow f' = \frac{1}{\frac{2Vf-a}{2Vf^2}} \Rightarrow f' = \frac{2Vf^2}{2Vf-a}$ is the answer. **N.B.:** This solution involves application of Doppler's Effect from its basic principle. Here, deliberately frequency is represented by f instead of v and velocity by V instead of v as generally used to avoid confusion to students not very much conversant with difference between notations v and v.
Q-17	A stationary source is emitting sound at a fixed frequency f_0, which is reflected by two cars approaching the source. The difference between the frequencies of sound reflected from cars is 1.2% of f_0. What is the difference in the speeds of the cars (in kmph) to the nearest integer? The cars are moving at constant speeds much smaller than the speed of sound which is 330 m/s.
I-17	Frequency of the signal f_0 Hz produced by a stationary source ($V_s = 0$) The signal is reflected back by two cars moving at a speeds v_1 and v_2 respectively. Given that difference in frequency of the reflected sound from the two cars Δf is 1.2% of f_0. It is required to determine difference in speeds of the two cars. This

problem is solved be determining apparent frequency $f_1^"$ of car-1 first and using it to determine $f_2^"$, to reach end result.

Car-1: Initially velocity of car approaching the source is against the speed of sound and hence it shall be (-) ve, accordingly $V_o = -v_1$. Thus frequency apparent to the car as per Doppler's effect is $f' = f\left(\frac{V-V_o}{V-V_s}\right) \Rightarrow f_1' = f_0\left(\frac{330-(v_1)}{330}\right) \Rightarrow f_1' = f_0\left(\frac{330+v_1}{330}\right)$.

The source perceiving the reflected sound the car is a source of frequency f_1' moving in the direction of sound and hence it is (+)ve and in this case $V_s = v_1$. While, the operator being stationary $V_o = 0$. Hence, apparent frequency of the reflected sound to the operator is $f_1^" = f_0\left(\frac{330+v_1}{330}\right)\left(\frac{330}{330-v_1}\right) \Rightarrow f_1^" = f_0\left(\frac{330+v_1}{330-v_1}\right)$.

Car-2: In case of Car-2 the process is same as that of Cae-1 except that v_1 is replaced with v_2, accordingly, we shall have $f_2^" = f_0\left(\frac{330+v_2}{330-v_2}\right)$.

Thus $\Delta f = \frac{|f_1^" - f_2^"|}{f_0} \times 100 \Rightarrow 1.2 = \frac{\left|f_0\left(\frac{330+v_1}{330-v_1}\right) - f_0\left(\frac{330+v_2}{330-v_2}\right)\right|}{f_0} \times 100 \Rightarrow 1.2 = \left|\left(\frac{330+v_1}{330-v_1}\right) - \left(\frac{330+v_2}{330-v_2}\right)\right| \times 100$. It is given that $v_1 \ll 330$ and $v_2 \ll 330$ and hence $\frac{v_1 v_2}{330^2} \ll$ and hence ignored. It further solves into $\frac{1.2}{100} = \left|\left(\frac{330+v_1}{330-v_1}\right) - \left(\frac{330+v_2}{330-v_2}\right)\right| \Rightarrow \frac{1.2}{100} = \left|\frac{2\times330\times(v_1-v_2)}{330^2}\right|$. Let $\Delta v = |v_1 - v_2|$ Accordingly, $\frac{1.2}{100} = \frac{2\Delta V}{330} \Rightarrow \Delta V = \frac{1.2\times330}{200}$. It leads to $\Delta V = 1.98$ m/s or 7.1 kmph. Since answer is asked in nearest integer and hence **difference in speeds of cars is 7 kmph is the answer.**

N.B.: In this problem approximation plays an important role in simplification of solution.

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Problems are meant to be solved; every solution open doorway to new problems. This is an endless journey to discovery of nature.

We are, what we are, because of rigorous efforts of countless persons.

—00—

*I don't think anybody anywhere can talk about the future...
without talking about education.
Whoever controls the education of our children controls our future.*

- Wilma Mankiller

—00—

*Modern cynics and skeptics... see no harm in paying those
to whom they entrust the minds of their children
a smaller wage than is paid to those to whom
they entrust the care of their plumbing.*

- John F. Kennedy

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Growing with Concepts: Chemistry

IMPORTANT COMPOUNDS OF BORON

<div align="right">

Kumud Bala

</div>

Some useful compounds of boron are borax and orthoboric acid.

BORAX ($Na_2B_4O_7.10H_2O$) or $Na_2[B_4O_5(OH)_4].8H_2O$:
It occurs as tincal in dried up lakes. It is also called sodium tetra borate decahydrate. It has been found that crystalline borax contains tetra nuclear units of $[B_4O_5(OH)_4]^{-2}$. Hence, its correct formula can be written as $Na_2[B_4O_5(OH)_4].8H_2O$.

**Structure of $[B_4O_5(OH)_4]^{-2}$:**
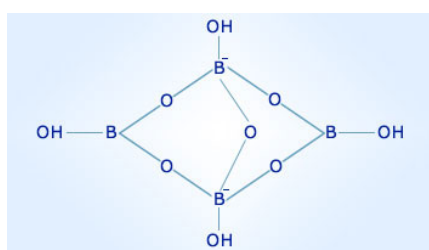
Preparation:
(i) ***From tincal***: Naturally occurring borax is called tincal. Tincal is obtained from dried up lakes contains about 50% borax. It is boiled with water and filtered to remove insoluble impurities of clay and sand etc. The filtrate is concentrated when crystals of borax separate out.
(ii) ***From colemanite:*** The mineral colemanite ($Ca_2B_6O_{11}$) is finely powdered and is boiled with sodium carbonate solution.

Ca_2B_6 O_{11} $+2Na_2CO_3$ $\rightarrow^{heat}$ $Na_2B_4O_7$ $+2NaBO_2+2CaCO_3\downarrow$
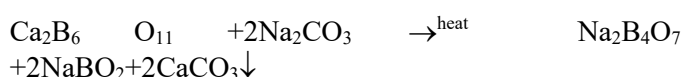
The precipitate of calcium carbonate thus formed is removed by filtration. The filtrate is concentrated and cooled when crystals of borax separate out. Sodium metaborate ($NaBO_2$) present in the mother liquor can be converted into borax ($Na_2B_4O_7$) by passing a current of CO_2 through it.

$4NaBO_2 + CO_2 \rightarrow Na_2B_4O_7 + Na_2CO_3$
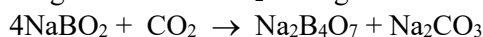
(iii) ***From boric acid***: By neutralizing boric acid with sodium carbonate.

$4H_3BO_3 + Na_2CO_3 \rightarrow Na_2B_4O_7 + 6H_2O + CO_2$

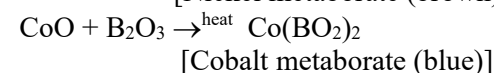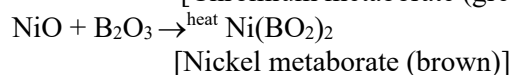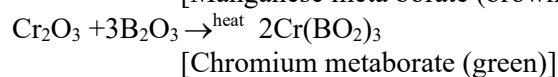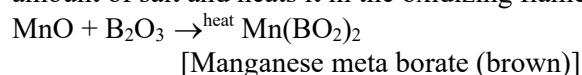On cooling crystals of borax i.e., $Na_2B_4O_7.10H_2O$ separate out.

Properties: It is a white crystalline solid. It is less soluble in cold water but more soluble in hot water. It gets hydrolyzed with water to form alkaline solution.

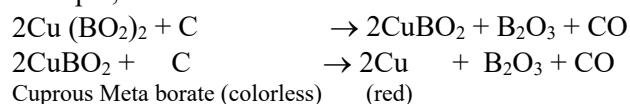Borax is therefore used as a water softener and cleaning agent.

$Na_2B_4O_7 + 7H_2O \rightarrow^{heat} 2Na^+ +2OH^- + 4H_3BO_3$
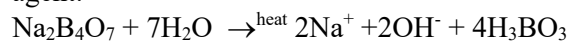
Borax bead test: It is used for detection of some colored ions like Cu^{+2}, Ni^{+2}, Cr^{+3}, Ca^{+2}. Borax is first heated strongly on a platinum wire loop. On heating, it loses water molecules of crystallization and ultimately melts into a transparent bead.
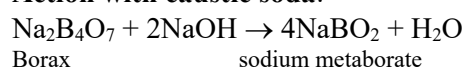
$Na_2B_4O_7.10H_2O \rightarrow^{heat} 2NaBO_2 + B_2O_3 + 10H_2O$

B_2O_3 (boric anhydride) reacts with certain metal salts to form metaborates having specific colors. Nature of basic radical can be predicted, such as Ni^{+2}, Co^{+2}, Cr^{+2}, Cu^{+2}, Mn^{+2} etc. The hot transparent bead is touched with small amount of salt and heats it in the oxidizing flame.
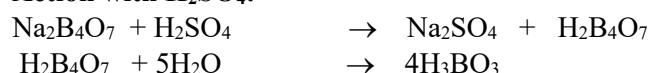
$MnO + B_2O_3 \rightarrow^{heat} Mn(BO_2)_2$
[Manganese meta borate (brown)]

$Cr_2O_3 +3B_2O_3 \rightarrow^{heat} 2Cr(BO_2)_3$
[Chromium metaborate (green)]

$NiO + B_2O_3 \rightarrow^{heat} Ni(BO_2)_2$
[Nickel metaborate (brown)]

$CoO + B_2O_3 \rightarrow^{heat} Co(BO_2)_2$
[Cobalt metaborate (blue)]

Certain metaborates are reduced to the free metal by the carbon present in the reducing flame of the burner. For example,

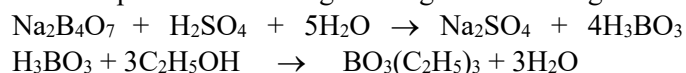$2Cu(BO_2)_2 + C \rightarrow 2CuBO_2 + B_2O_3 + CO$
$2CuBO_2 + C \rightarrow 2Cu + B_2O_3 + CO$
Cuprous Meta borate (colorless)   (red)

Action with caustic soda:
$Na_2B_4O_7 + 2NaOH \rightarrow 4NaBO_2 + H_2O$
Borax   sodium metaborate
Action with H_2SO_4:
$Na_2B_4O_7 + H_2SO_4 \rightarrow Na_2SO_4 + H_2B_4O_7$
$H_2B_4O_7 + 5H_2O \rightarrow 4H_3BO_3$
$Na_2B_4O_7 + H_2SO_4 + 5H_2O \rightarrow Na_2SO_4 + 4H_3BO_3$
Action with ethanol and H_2SO_4: On heating borax with ethanol and conc. H_2SO_4 gives vapour of triethylborate. These vapour burn with a green edged flame on ignition.
$Na_2B_4O_7 + H_2SO_4 + 5H_2O \rightarrow Na_2SO_4 + 4H_3BO_3$
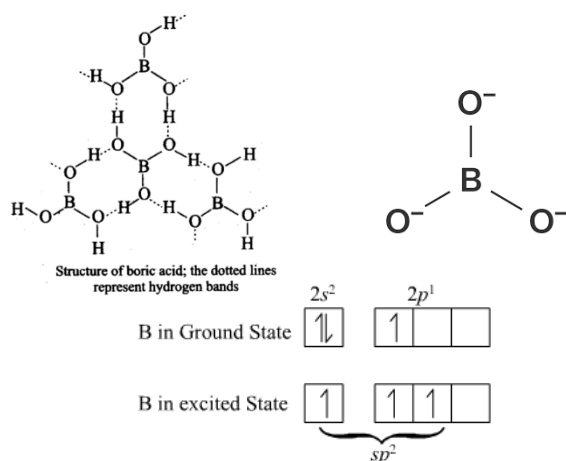$H_3BO_3 + 3C_2H_5OH \rightarrow BO_3(C_2H_5)_3 + 3H_2O$
Uses of borax: Borax is used as (i) a flux in soldering metals. (ii) in making pyrex glass (Borosilicate glass) (iii) in qualitative analysis for borax bead test (iv) in candle industry (v) as cleansing and stiffening agent in laundry (vi) in the manufacture of enamels and glazes for earthen pots (vii) in the manufacture of peroxy borates ($NaBO_2.H_2O_2.3H_2O$) which are important cleansing and bleaching agents present in washing

powders. They also act as brighteners since they absorb UV light and emit visible light (viii) in softening of water (ix) in the preparation of medicinal soaps due to its antiseptic properties.
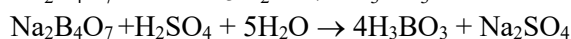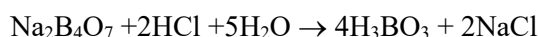
ORTHO BORIC ACID (H$_2$BO$_3$)

Structure of boric acid: Trivial name of Ortho Boric Acid is boric acid. Boric acid has layer type structure in which planar BO_3^{-3} units are linked to one another through H atoms. The H atoms constitute covalent bond with one unit and hydrogen bond with other unit. BO_3^{-3} (borate) ion has trigonal planar structure.
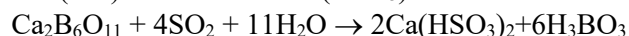

Structure of boric acid; the dotted lines represent hydrogen bands

B in Ground State $2s^2$ ↑↓ $2p^1$ ↑

B in excited State ↑ ↑ ↑ sp^2

Preparation of boric acid:
(i) From borax:

$Na_2B_4O_7 + 2HCl + 5H_2O \rightarrow 4H_3BO_3 + 2NaCl$
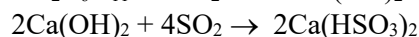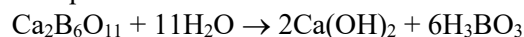
$Na_2B_4O_7 + H_2SO_4 + 5H_2O \rightarrow 4H_3BO_3 + Na_2SO_4$

The resulting solution on concentration and cooling gives crystals of boric acid.

(ii) By hydrolysis of boron compounds: Boric acid is obtained by passing sulphur dioxide through the solution of the mineral colemanite in boiling water. The resulting solution on concentration and cooling gives crystals of boric acid while calcium bisulphite

being highly soluble in water remains in the mother liquor.

$Ca_2B_6O_{11} + 11H_2O \rightarrow 2Ca(OH)_2 + 6H_3BO_3$

$2Ca(OH)_2 + 4SO_2 \rightarrow 2Ca(HSO_3)_2$

$Ca_2B_6O_{11} + 4SO_2 + 11H_2O \rightarrow 2Ca(HSO_3)_2 + 6H_3BO_3$

Properties of boric acid: Boric acid is white crystalline solid with soft soapy touch. It is sparingly soluble in cold water but appreciably soluble in hot water.

Acidic nature: boric acid is a weak monobasic acid ($K_a = 5.6 \times 10^{-10}$). It does not act as a proton donor, i.e protinic acid, but behaves as a lewis acid by accepting a pair of electron from OH⁻ ion of water.

H- OH + B(OH)$_3$ → [B(OH)$_4$]⁻ + H⁺   (pK$_a$ = 9.25)
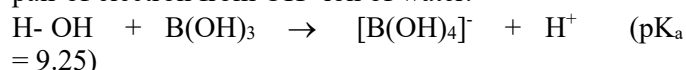
Action of heat: Boric acid, on heating, loses water in three different stages at different temperatures. Ultimately gives boron trioxide.

$H_3BO_3 \xrightarrow{370K} HBO_2 + H_2O$
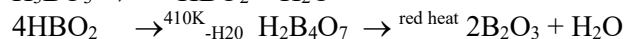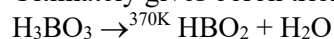
$4HBO_2 \xrightarrow[-H2O]{410K} H_2B_4O_7 \xrightarrow{red\ heat} 2B_2O_3 + H_2O$
Metaboric acid   tetra boric acid   boron trioxide

Reaction with ethyl alcohol: Orthoboric acid reacts with ethyl alcohol in presence of conc. H$_2$SO$_4$ to form triethylborate.

$B(OH)_3 + 3C_2H_5OH \xrightarrow{conc.H2SO4} B(OC_2H_5)_3 + 3H_2O$

The vapors of triethylborate when ignited burn with a green-edged flame. This forms the basis for detecting borates and boric acid in qualitative analysis.

Uses:
(i) Boric acid is used in the manufacturing of heat resistant borosilicate glass
(ii) It is used as a preservative for milk and food stuffs
(iii) It is used in the manufacturing of enamels and glazes in pottery
(iv) The aqueous solution of boric acid is used as a mild antiseptic especially as eye wash under the boric lotion.

Assignment

1. The number of OH-groups directly linked to boron atoms in Na$_2$B$_4$O$_7$.10H$_2$O is ------
   (A) 2   (B) 4   (C) 6   (D) 10

2. Boric acid is polymeric due to -----
   (A) its acidic nature
   (B) the presence of hydrogen bonds
   (C) its monobasic nature
   (D) its geometry.

3. Which of the following is not a protonic acid?
   (A) B(OH)$_3$ (B) PO(OH)$_3$

   (C) SO(OH)$_2$ (D) SO$_2$(OH)$_2$

4. H$_3$BO$_3$ is -------
   (A) monobasic and weak lewis acid
   (B) monobasic and weak bronsted acid
   (C) monobasic and strong lewis acid
   (D) tribasic and weak bronsted acid

5. Which of the following imparts green colour to the burner flame?
   (A) B(OMe)$_3$ (B) NaOMe
   (C) Al(OH)$_3$ (D) Sn(OH)$_2$

6. Borax is used as a cleansing agent because on dissolving in water, it gives ------
    (A) alkaline solution   (B) acidic solution
    (C) bleaching solution   (D) amphoteric solution.

7. Boric acid is used in carom boards for smooth gliding of pawns because -----
    (A) H_3BO_3 molecules are loosely chemically bonded and hence soft
    (B) its low density makes it fluffy.
    (C) it is chemically inert with the plywood.
    (D) H-bonding in H_3BO_3 gives it a layered structure.

8. Boric acid is an acid because its molecule -------
    (A) contains replaceable H^+ ion
    (B) gives up a proton
    (C) accepts OH^- from water releasing proton
    (D) combines with proton from water molecule

9. In borax, the number of B-O-B links and B-OH bonds present are respectively------
    (A) five and four   (B) four and five
    (C) three and four   (D) five and five

10. In order to keep $B(OH)_3 + NaOH \leftrightarrow Na[B(OH)_4]$ reaction in the forward direction, which reagent should be used?
    (A) cis-1,2-diol   (B) trans-1,2-diol
    (C) borax   (D) Na_2HPO_4

11. Which of the following statements about boric acid is false?

(A) it acts as a monobasic acid
(B) it is formed by the hydrolysis of boron halides
(C) it has planar structure
(D) it acts as a tribasic acid.

12. Borax is prepared by treating colemanite with ------
    (A) $NaNO_3$ (B) NaCl
    (C) Na_2CO_3 (D) $NaHCO_3$

13. Orthoboric acid on strong heating to red hot gives ------
    (A) metaboric acid   (B) borax
    (C) boron trioxide   (D) tetraboric acid.

14. An aqueous solution of borax is ------
    (A) bleaching agent   (B) alkaline
    (C) acidic   (D) neutral

15. Identify the compounds A, X and Z in the following reactions:
    $A + 2HCl + 5H_2O \rightarrow 2NaCl + X$
    $X \rightarrow^A_{370K} HBO_2 \rightarrow^A_{>370K} Z$

    (A) $Na_2B_4O_7, H_3BO_3, B_2O_3$
    (B) $B_2O_3, Na_2B_4O_7, H_3BO_3$
    (C) $Na_2B_4O_7, B_2O_3, H_3BO_3$
    (D) $H_3BO_3, B_2O_3, Na_2B_4O_7$

Answers

15. (A)   14. (B)   13. (C)   12. (C)   11. (D)   10. (A)   9. (A)   8. (C)

7. (D)   6. (A)   5. (A)   4. (A)   3. (A)   2. (B)   1. (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

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The value of a college education is not the learning of many facts but the training of mind to think.

- *Albert Einstein*

—00—

We are about to sacrifice our civilization for the opportunity of a very small number of people to continue to make enormous amount of money...

But it is the sufferings of the many which pay for the luxuries if the few...

You say that you love your children above everything else. And yet you are stealing their future.

- *Greta Thumnberg*

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A hundred times 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.

Albert Einstein

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Who cares what am I or I do, as long as I am not either useful or dreadful.

Can I take first step to befriend other by complementing my usefulness,

for the larger good.

—00—

SCIENCE QUIZ : February'2020

Kumud Bala
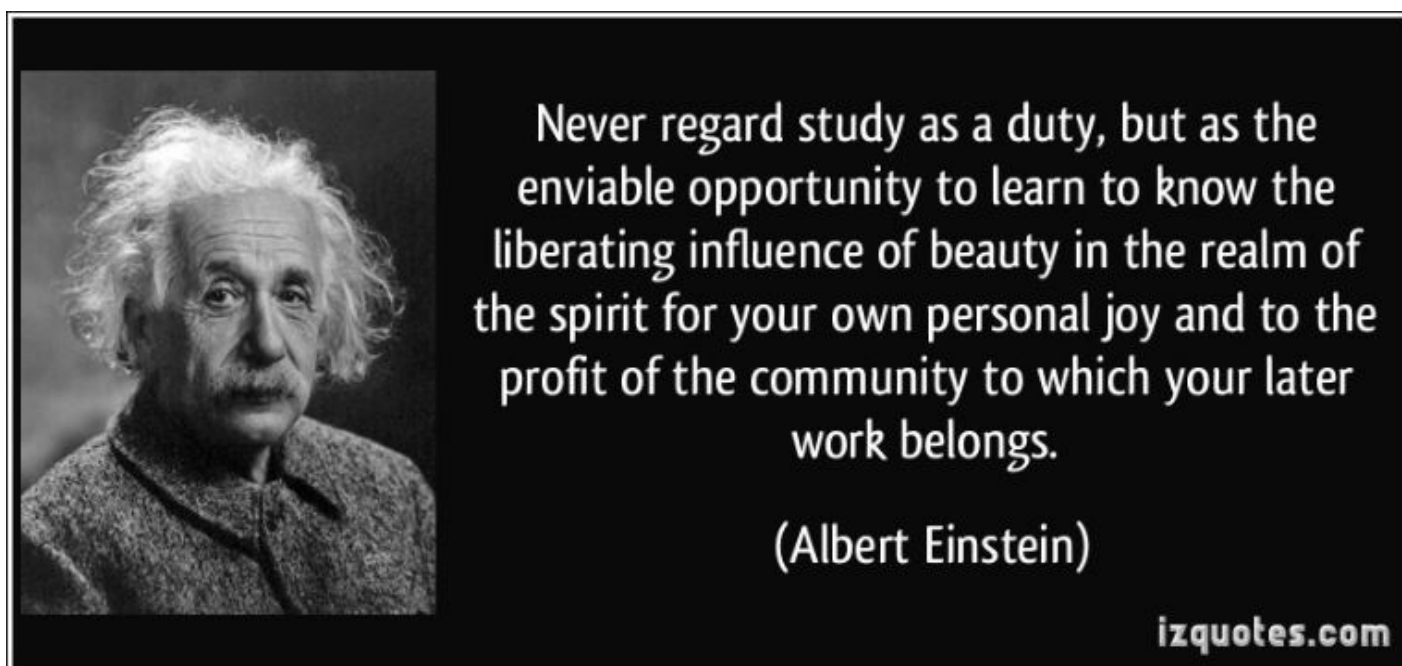
1. A batsman hit a cricket ball which then rolls on the ground. After covering a short distance the ball comes to rest. The ball stops due to -------
   (A) magnetic force   (B) frictional force
   (C) gravitational force   (D) muscular force

2. When two forces applied on an object are equal and opposite, then these forces ------
   (A) may move the object
   (B) may stop the object
   (C) may move the object and also cause a change in its shape
   (D) do not move the object but may cause a change in its shape.

3. When two unbalance forces act on a body, in opposite directions, the net force is equal to -----
   (A) the sum of the individual unbalanced forces
   (B) zero
   (C) difference between the two unbalanced forces and is in the direction of the larger force
   (D) difference between the two unbalanced forces and is in the direction of smaller force.

4. Nails have pointed ends. This results in -----
   (A) a decrease in the force exerted on them
   (B) a decrease in the effect of the force exerted on them
   (C) an increase in the force exerted on them
   (D) an increase in the effect of the force exerted on them

5. During dry weather, rubbing a plastic scale with dry hair attracts small piece of paper. This is due to -----
   (A) gravitational force   (B) electrostatic force
   (C) frictional force   (D) muscular force

6. When we press the bulb of a dropper with its nozzle kept in water, air in the dropper is seen to escape in the form of bubbles. Once we release the pressure on the bulb, water gets filled in the dropper. The rise of water in the dropper is due to ------
   (A) pressure of water   (B) gravity of the earth
   (C) shape of rubber bulb   (D) atmospheric pressure

7. Fruits detached from a tree fall down due to force of gravity. We know that a force arises due to interaction between two objects. Which are the objects interacting in this case?
   (A) earth and fruits   (B) earth and tree
   (C) fruits and tree   (D) none of these

8. Two persons are applying forces on two opposite sides of a moving cart. The cart still moves with the same speed in the same direction. What do you infer about the magnitudes and direction of the forces applied?
   (A) both the forces are of equal magnitudes and applied in the opposite directions.
   (B) both the forces are of not equal magnitudes and applied in the opposite directions.
   (C) magnitudes and direction of the forces are different
   (D) none of these

9. A chapatti maker is a machine which converts balls of dough into chapattis. What effect of force comes into play in this process?
   (A) the force changes the shape of the dough.
   (B) electrostatic force
   (C) the force does not change the shape of the dough.
   (D) none of these

10. Which one of the following forces is a contact force?
    (A) force of gravity   (B) force of friction
    (C) magnetic force   (D) electrostatic force

11. An inflated balloon was pressed against a wall after it has been rubbed with a piece of synthetic cloth. It was found that the balloon sticks to the wall. What force might be responsible for attraction between the balloon and the wall?
    (A) muscular force   (B) electrostatic force
    (C) force of friction   (D) force of gravity.

12. A rocket has been fired upwards to launch a satellite in its orbit. Which are the two forces acting on the rocket immediately after leaving the launching pad?
    (A) frictional force and force of gravity
    (B) electrostatic force and muscular force
    (C) magnetic force and electrostatic force
    (D) force of gravity and atmospheric pressure.

13. An archer stretches her bow while taking aim at the target. She then releases the arrow, which begins to move towards the target, the forces acting on it are due to ----- and that due to ----- of air.
    (A) muscular and frictional forces
    (B) gravity and friction
    (C) contact force and shape
    (D) muscular and gravitational forces.

14. Kicking a ball with our legs is an example of force of -------
    (A) friction   (B) gravitation
    (C) muscular   (D) magnetic

15. The pressure in the bottle filled with water is maximum -------
    (A) in the middle of bottle
    (B) at the top of the bottle
    (C) first at the top then in the middle
    (D) in the bottom of the bottle

16. The pressure on earth will be less when the man is ----
    (A) lying   (B) sitting
    (C) standing by one foot   (D) standing by two feet

17. The wear and tear in the machine part is due to -------
    (A) electrostatic force   (B) muscular force
    (C) frictional force   (D) gravitational force.

18. The pressure exerted by liquid due to increase in depth ------
    (A) reduces   (B) increases
    (C) remains same   (D) depends on the nature of liquid.

19. What happens to the atmospheric pressure if, the humidity in air increases?
    (A) atmospheric pressure decreases
    (B) atmospheric pressure increases
    (C) atmospheric pressure remains same
    (D) none of these

20. What will be the pressure when 30N force is applied on $120cm^2$ area?
    (A) $2.5 \times 10^3 \, N/m^2$ (B) $5.0 \times 10^4 N/m^2$
    (C) $2.5 \times 10^2 N/m^2$ (D) $5.0 \times 10^3 N/m^2$

21. It is difficult to cut vegetables with a blunt knife. The area of the blunt knife is more and therefore ------
    (A) less force has to be applied
    (B) more force has to be applied
    (C) no force has to be applied
    (D) none of these

22. Trucks intended to carry heavy loads have eight tyres instead of four tyres. Why?
    (A) it is due to increase the area of contact with road and less pressure is applied on the road.
    (B) it is due to decrease the area of contact with road and more pressure is applied on the road.
    (C) it is due to increase the area of contact with road and more pressure is applied on the road.
    (D) none of these.

23. The speed of a falling body increases continuously. This is because -----
    (A) no force acts on it
    (B) it is very light
    (C) the air exerts a frictional force on it
    (D) the earth attracts it.

24. Sometimes, car skids in rainy season ------
    (A) water increases the friction between the road and the tyres
    (B) it is not possible to apply brakes on a wet road
    (C) the friction between the brake shoes and wheels is reduced
    (D) water reduces the friction between the road and the tyres.

25. The bottom of dam is made thick due to -------
    (A) the water exerts low pressure on bottom wall
    (B) it is a custom
    (C) it looks beautiful
    (D) the water exerts more pressure on bottom wall

(Answers to this Science Quiz shall be provided inMonthly e-Bulletin)

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A hundred times 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.

Albert Einstein

Never regard study as a duty, but as the enviable opportunity to learn to know the liberating influence of beauty in the realm of the spirit for your own personal joy and to the profit of the community to which your later work belongs.

(Albert Einstein)

izquotes.com

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Nature is a beautiful integration of different entities. Mathematics and science only discover them.

Euler's Identity $0 = 1 + e^{j\pi}$ *is an excellent example of integration. Each of the constituent was discovered independently, by different mathematicians, at different point of time.*

Yet they all complement each other.

Lest it not be there whole nature shall have to rediscovered

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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 MovieDo 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 ofcompassionate 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 होना

हम चले नेक रस्ते पे हम से, भूलकर भी कोई भूल होना ||

दूर अज्ञान के हो अंधेरे, तू हमें ज्ञान की रोशनी दे

हर बुराई से बचते रहें हम, जितनी भी दे भली ज़िन्दगी दे

बैर होना किसी का किसी से, भावना मन में बदले की होना ||

इतनी शक्ति हमें देना दाता, मन का विश्वास कमजोर होना

हम चले नेक रस्ते पे हम से, भूलकर भी कोई भूल होना ||

हमना सोचें हमें क्या मिला है, हम ये सोचे किया क्या है अर्पण

फूल खुशियों के बाँटे सभी को, सबका 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 होना

हम चले नेक रस्ते पे हम से, भूलकर भी कोई भूल होना ||

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 ...