GYAN VIGYAN SARITA:शिक्षा

A non-remunerative, non-commercial and non-political initiative to Democratize Education as a Personal Social Responsibility (PSR)

1st Monthlye-Bulletin dt 1st November'18, Fourth Year of the Publication

HAPPY DEEPAWALI

HAPPY GURUPARV WAL

An abstract creation of a child, just turned 5 years. It is for us to read the minds scare about the

CONTENTS: (Against Each Content Page Number is Indicated for Convenience)

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Aim at the Best, but…

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

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 nodes where internt connectivity is poor- Presently A-VIEW 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:

Screen Sharing From Mentoring Centre To Learning Centre

Mentoring 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

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

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

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

Learning Center (if asked for by Mentor)		Mentoring Center (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	15,000	Projector	-
Web camera	10,000	Web camera	-
Mixer cum amplifier with Speaker and Wireless microphones	15,000	Headset with Microphone	3,000
Wireless Surface Writing device	15,000	Wireless Surface Writing device	15,000
Total	75,000		43,000
Estimated Recurring Cost			
Internet charges, based on estimated monthly data transfer which depends upon choice of cloud platform, and tariffs of ISP		Internet charges, based on estimated monthly data transfer which depends upon choice of cloud platform, and tariffs of ISP	
Cloud platform : a. Subscription whether it annual as in WebEx or One time with AMC like in as in UTP+. b. Cloud platform is a shared resource across Learning Centers benefitting from IOMS. c. The IOMS envisages session for more than one centre together, these charges may be shared across, or one centre bears total cost sequentially. It is purely in mutual agreement between Learning Centers. d. Benefit of sharing of charges of cloud platform can be optimized with offset of schedule of sessions of IOMS.		IOMS is since an initiative driven with Personal Social Responsibility (PSR) operating n Zero-Fund-&-Zero-Asset (ZFZA) basis, the Cloud Platform has to provided by Learning Centers benefitting from IOMS. Gyan Vigyan Sarita will be pleased to connect Learning Centers for collectively complementing the cost of Cloud Platform for arriving at a mutual agreement on financial sharing. So also IT Infrastructure with Dr Joshi has been in use and is working. But, at any stage if upgradation becomes essential, extended hand by learning centers is gratefully welcomed on ZFZA basis. The same is true for any other mentor joining IOMS	

Specification: These were practiced independently, 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 centers and mentoring centers.

These specifications have been updated by deriving motivation from **VIVEKDISHA, Belur Math**, which has been engaged in Online Teaching to about 22 Centers, since last 10 years. The only difference that IOMS has is in extensive use of Whiteboard.

Web Camera: Logitech HD 1080p, with a tripod or wall mounting

Projector: Portronics LED Projector Beam 100", 100 Lumen, 130" Screen size, 800x480px resolution

Mixer-cum-Amplifier: Ahuja Make PA Mixer Amplifier Model DPA-370, 30 W Max/37W Max, with Two Cordless Mikes and Speakers. This device offers echoless input/output communication with base computer and Mikes and Speakers in the Class.

Cloud Platform: A-VIEW (Amrita Virtual E-Learning World) developed by Amrita University in association with IIT Bombay, an MHRD, GOI sponsored project.. Problems with Whiteboard functionality of A-VIEW are being circumvented with OneNote app of MS Office for IOMS. This has many features of minimizing bandwidth requirements.

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

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

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

पर्व और परंपरा का ज्ञान : आज की जरूरत

भारत पर्वों का देश है। पर्व जहां एक ओर हमारी संस्कृति को दर्शाते हैं, वहीं दूसरी ओर समाज को व्यावहारिक ज्ञान भी देते हैं कि लोग आपसी भाई-चारा बढ़ायें, आपस में समरस व्यवहार अपनायें, प्रेम-सद्व्यवहार से रहें, साथ-साथ चलने की प्रवृत्ति उपजायें और एक दूसरे के लिये खड़े होने का अभ्यास करें।

आज के समाज में उन लोगों की संख्या बढ़ रही है जिन्होंने अपने समाज और देश के बारे में जानना बंद कर दिया है। उनके लिये उनकी प्राचीन संस्कृति, सभ्यता, पर्व और परंपरायें गौड़ हो गयी हैं। कारण कई हो सकते हैं-एक कारण पाश्चात्य संस्कृति की ओर झुकाव हो सकता है, और दूसरा कारण उनका व्यस्त जीवन हो सकता है। कारण कोई हों पर कोई कारण इसका विरोध नहीं करता है कि हम अपने पर्वों और परंपराओं का ज्ञान न रखें।

पर्व का अर्थ होता है-उत्सव, महोत्सव, त्यौहार अथवा धार्मिक कृत्य करने का दिन। पर्व एक पवित्र दिन होता है। वह दिन जब हम मन से धर्ममय हो जाते हैं, परोपकार की भावना से भर जाते हैं, अथवा अपने आसपास के लोगों से अपने सुख-दुःख बांटने लगते हैं, वह दिन एक पर्व बन जाता है।

परंपरा का अर्थ होता है-चला आता हुआ क्रम, अटूट सिलसिला, प्रथा, प्रणाली। कुछ विद्वान सामाजिक विरासत को भी परंपरा कहते हैं। वैज्ञानिक भाषा में परंपरा वैसे ही काम करती है, जैसे जैविक वंशानुक्रमण हमारे जीवन में काम करता है। कोई क्रिया जब कड़े और लगातार प्रयोगों से गुजरती है, तभी वह परंपरा बनती है।

पर्व प्राकृतिक, मानवीय, सांस्कृतिक, पर्यावरण, नैतिकता, जैसे कालजयी मूल्यों को संजोये हुये होते हैं, इसीलिये वे चिरस्थायी हैं। हर पर्व में जीवन के मूल्य निहित रहते हैं।

परंपराओं में अगर निरंतर बदलाव नहीं होता रहता है, तब वे रूढ़ि बन जाती हैं और फिर समाज में अपना महत्व खो देती हैं। परंपरा को जीवंत बनाये रखने के लिये आवश्यक है कि उसमें तार्किक प्रवृत्ति से समय के अनुसार नयी चीजें डाली जाती रहें।

आज की आधुनिकता को समझने के लिये परंपरा को जानना उतना ही जरूरी है जितना प्यासे के लिये पानी का ज्ञान होना। परंपरा समाज के संगठन में महत्वपूर्ण भूमिका निभाती है। जिस प्रकार भूतकाल की घटनाओं को समझकर, हम भविष्य का विकास करते हैं, ठीक उसी प्रकार नियमित बदल रही व्यावहारिक अनुभूति को जोड़कर हम परंपरा को सजीव रख सकते हैं।

नवरात्रि में शक्ति-पूजा, और महाराष्ट्र में गणेश उत्सव के पर्व पूर्णतया भक्ति के साथ परंपरा निभाने के सफल उदाहरण हैं। संक्षेप में, रीति-रिवाजों को निभाते जाना ही परंपरा है।

हर पर्व अंतःकरण की कलुषता को मिटाता है और आचरण की निर्मलता को बनाये रखने का काम करता है। भारतीय संस्कृति में प्रातःकाल उठकर भूमि पर पैर रखने से पहले दोनों हाथों को देखना, ईश्वर का उनमें दर्शन करना, धरती पर पैर रखने से पहले, धरती को मां मानकर, उसे प्रणाम करना-एक परंपरा है। प्रकृति मां है, यह

अंधविश्वास नहीं है। मां के प्रति सदा श्रद्धा से भरे रहने की आदत में बंधे रहना एक आदर्श परंपरा है।

हर परंपरा हमें कुछ न कुछ सिखाती है। उदाहरण के तौर पर, श्रद्धा व सम्मान देने के लिये, अपने से बड़ों के पैर छूना एक परंपरा है। हर व्यक्ति का एक आभा-मंडल होता है। जब हम अपने से बड़ों के नजदीक जाकर उनके पैर छूते हैं तब हमें उनके आभा-मंडल से अवश्य कुछ अच्छी चीजें मिल जाया करती हैं। सच कहा गया है-

अभिवादन शीलस्य नित्यं वृद्धोपसेविनः, चत्वारि तस्य वर्धन्ते आयुर्विद्यायशोबलम्। यह श्लोक हमें सिखाता है कि यदि हम अपने से बड़ों का अभिवादन करते रहें तो हमारी चार चीजें हमेशा बढ़ती जाती हैं-आयु, विद्या, यश और बल।

जब हम धर्मपरिवर्तन करते हैं, तब हमारी परंपरा नष्ट हो जाती है। इतिहास और परंपरा भिन्न-भिन्न होती हैं। अमरीका, यूरोप, ऑस्ट्रेलिया आदि का इतिहास है, पर उनके पास परंपरा नहीं है। भारत, इंग्लैंड, इंडोनेशिया आदि के पास परंपरा है, और इतिहास भी है।

परंपरा हमें अपने देश से प्रेम करना, प्रकृति से प्रेम करना, जीव-जंतुओं से प्रेम करना, और नदी-नालों तक में ईश्वर देखना सिखाती हैं। इनका साधारण-सा मतलब होता है कि हम इनकी रक्षा करें और इनका अपनी आवश्यकता भर उपयोग करें।

दीपों का पर्व दीपावली अपने चारों के वातावरण में प्रकाश फैलाने, सफाई और शुद्धता का भाव जगाने का पर्व है। लक्ष्मी-पूजन करना, कर्मठ होकर धन कमाने की ओर संकेत करता है। घर में स्वस्तिक बनाना, मंगलकामना करना है एवं सुख-सौभाग्य के प्रति सदैव सचेत रहना है। पौराणिक कथाओं के अनुसार इस दिन समुद्र-मंथन से लक्ष्मी का उदय हुआ था। समुद्र-मंथन से लक्ष्मी की प्राप्ति, कर्म से धन कमाने की शिक्षा देता है। यह ज्ञान के विस्तार का पर्व है। हम अंधकार से प्रकाश की ओर चलें, इसका पर्व है। हर कोना रोशन हो जाये, कुछ ऐसा दीप जलायें, ऐसा सोचने का पर्व है।

होली हास्य का पर्व है। आनंद-अनुभूति का पर्व है। हंसना एक व्यायाम है। हर पर्व हमें अपने परिचितों से बिगड़े हुये संबंध सुधारने का मौका देता है, दूषित मनोभावों को छोड़ने का मौका देता है, और नकारात्मक सोच से उबरने के लिये कहता है।

श्रीकृष्णजन्माष्टमी का पर्व युगनिर्माता, पथप्रदर्शक, मार्गदर्शक, प्रबंधनगुरू, महामानव बनने की ओर चल पड़ने की शिक्षा देता है। भ्रष्टाचारी शासक, अनीतिकारी प्रशासन और अलाभकारी मनोभावों से कैसे मुक्त हों, यह सीखने की शिक्षा इस पर्व को मनाने से मिलती है।

नवरात्रि में शक्तिपूजा का पर्व यह बताने के लिये आता है कि दुष्ट थोड़े समय के लिये बलवान हो सकते हैं, पर शुभ शक्तियां हमेशा के लिये होती हैं और वे अंत में दुष्टों का नाश अवश्य कर देती हैं।

जाति, धर्म, संप्रदाय, क्षेत्र, भाषा आदि के विवाद में पड़कर हम अपना और अपने समाज का लगातार नुकसान करते जा रहे हैं। इन समस्याओं को हल करने के तरीके हमारे पर्वों की महत्ता और उनके मनाने की विधियों में निहित हैं। पर हम न तो उनके बारे में जान रहे हैं, न सीखने के प्रति जागरूक हैं, बल्कि लापरवाह अधिक हैं। हमें अपने

समाज को अगर आगे बढाना है, खुद सुखी रहना है तो फिर हमें अपनी परंपराओं और पर्वों को जानना होगा, उनके महत्वों को समझना होगा और गहन अध्ययन कर उनमें छिपे रहस्यों का मनन करना होगा। जो अपने पर्वों और परंपराओं को भूल जाता है, धीरे-धीरे वह विनष्ट हो जाता है।

हिंदू समाज में पर्वों की निरंतरता एक पर्व-व्यवस्था के अंतर्गत होती है। पर्व-व्यवस्था में प्रकृति के परिवर्तन का समय, समाज के लोगों के पास व्यस्तता से समय निकालकर खुश रहने की प्रवृत्ति का ध्यान रखा जाता है। सभी त्यौहारों को संयुक्त रूप से मनाये जाने का प्रचलन है। हालांकि प्रारंभिक अवस्था में श्रावणी यानि रक्षाबंधन ब्राह्मणों का, दशहरा क्षत्रियों का, दीपावली वैश्यों का और होली शूद्रों का त्यौहार हुआ करता था। पर आज समय के बदलाव के साथ सभी लोगों ने सभी त्यौहारों को एक मन से, एक आस्था, एक विश्वास और एक परंपरा के साथ अपना लिया है।

राखी का पर्व भाषा और जातीयता की सीमा को लांघकर आजकल भावनात्मक बंधन का पर्व हो गया है। पंडित मदन मोहन मालवीय जी ने काशी नरेश को राखी बांधकर विश्वप्रसिद्ध बनारस हिंदू विश्वविद्यालय की स्थापना के लिये जमीन, उनसे दक्षिणा में मांग ली थी। इतिहास साक्षी रहा है कि कठोर हृदय भी राखी के धागे से द्रवित हो जाते हैं।

हर पर्व कुछ न कुछ सिखाता है। वाकचातुर्य, उर्जावान, विवेकशीलता, नेतृत्व-प्रबंधन, सबको साथ लेकर चलने की कला, छोटी हरकतों को नजरंदाज करने की क्षमता, रणक्षेत्र में नीति-अनीति का उचित समय पर प्रयोग आदि की शिक्षा हमें पर्वों और परंपराओं से मिलती है। बस जरूरत है कि हम इन परंपराओं और पर्वों के बारे में सकारात्मक रूख अपनायें, इनकी उत्पत्ति और अक्षुण्य रहने के पीछे के तथ्यों को पढ़ें, समझें और अपने जीवन में समय के अनुरूप उतारने का प्रयास करें।

आज जरूरत है कि हम अपने व्यस्त जीवन से कुछ समय निकालें, कुछ पुस्तकें पढ़ें, कुछ दूसरों से सीखें, फिर अपने बच्चों को उन अच्छी बातों को बतायें और अपने पर्वों व परंपराओं के बारे में सामूहिक ज्ञान बांटें। ज्ञान विज्ञान सरिता परिवार इसी क्रम को आगे बढ़ने में प्रयास रत है।

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हमारा पंचवर्षीय प्रवास

Start: June-2012
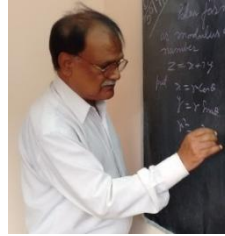
April-2015

June-2016........

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

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

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Coordinator's View

Spirituality and Religion

With the onset of Navratri (नवरात्री) the whole environment in our country gets charged with spirituality, there are festivities centered around religious performances and spiritual discourses on deities in different forms. It is all about a super natural power Shakti (शक्ति) and is full of reverence, devotion and faith in its divinity. These manifestations towards divinity have many facets. One of it is in individual capacity is a self-restraint as long as there is honesty of purpose and selfless; there is a preparedness to make life purposeful for others. The moment one starts putting demand and expectations out of the pursuit it is a commercial deal. It is a belief in religious pursuit that '*God is happy to grant wishes get rid of devotees and get rid off called Mukti* (मुक्ति)*, but HE always follows his devotees who have no demand and is called Bhakti* (भक्ति)'. Despite being an atheist, it is possible to make a sense out of this belief. Godliness is divinity, and divinity is a consequence of co-existence, harmony and wellbeing of all without discrimination; this is what the nature is. A close look on various religious practices reveals that natural powers un-explicable were revered in one or the other form; some personified in Idol Worship while others are abstract and impersonalized. Origin of these natural powers and life is a subject of investigation of spirituality, and is purely scientific. All the religions are manifestation of pursuit of sages who spent their lifetime in exploring nature and experimenting upon themselves various experiences, also called Tapasya (तपस्या). Genesis of basic religions took place in an era when transmission of the findings and/or realization by these sages was oral. It perpetuated down generations, hundreds and thousands, before it could be transcripted in print form. It is with the advent of computer error free reprinting has become possible, else in every reprint possibility of typographical error, despite best care, in voluminous scriptures could not be ruled out. An excellent example in this regard a prose from Sunderkand (सुंदरकांड) of Ramcharit Manas (रामचरित मानस) is "ढोल , गँवार , शूद्र , पशु …" . Its meaning and contentions have been a subject of debated on various platforms. Some go by verbatim meaning of it in Sanskrit or Avadhi, whereas typographical aberration of word तारन is a matter of opinion and cannot be ruled out. The original manuscript and its history has different claims and here aim is not to get into their validation. Nevertheless, picking threads from these premises analysis is being presented.

Genesis of life from unicellular organism Amoeba is a complex bio-chemical process which started with cooling and hardening of earth's crust about 4 billion of years ago. But, the process of creation of conditions for formation the organism called pre-biotic evolution might have started at least a few million years ago. It is purely a matter of speculation. The beauty of science is that it is observable, scalable and replicable and can be correlated with definite laws and mathematical relationship. Endeavour of spirituality and science is to discover these phenomenon so as to regulate course of life which is livable, sustainable and coexists with nature. Use of this knowledge for welfare or destruction is purely a matter of choice of every individual and collective wisdom. Ultimately, all forms of life are manifestation of nature and human life is in its highest form empowered to observe, correlate, simulate, alternate and coexist with the nature, while living and growing happily.

Anthropologists engage themselves in study of human and society's behavior in present and past. It is a very long process of evolution and survival under the vagaries, diversities involving dynamics of construction, destruction and blending of the nature. The nature to reach in its present form has undergone volcanoes, earthquakes storms, floods, draughts, and continental shifts some of them were catastrophic causing painful migration and resettlement inhabitants of the affected areas at a large scale. This lead people to fear power of nature, which is uncontrollable, and they regarded it as a God. Natural calamities were construed by men as annoyance of God, caused by their misdeeds. Thus began the process of various religious practices viz. prayers, worships of natural powers personalized into idols (Sakar- साकार), while some schools of thought symbolized the formless God (Nirakaar निराकार). Accordingly, they pursued their religious reverence and devotional practices at personal level, and collectively at social levels at places were created for this purpose.

Gradually as people got awakened and started understanding environment, its relevance into social life and civilization, the religious pursuit took two different approaches one is of secular which upholds life as a manifestation eternal nature, and religious practices were pursued in a convenient manner, based on socio-economic and geographical conditions and a tradition in which one is groomed. Gradually, spiritual essence of these religious

practices i.e. spirit behind it disappeared and what is left is simply rituals. As an aberration these rituals belonging to specific religion and sect got communal manifestations. These ritual created identity crisis and became cause of conflicts for imposition of believes across religions and across sects of the same religion, and not the reasons and spirit behind it. These impositions got exercised as a matter of self-proclaimed right derived from either believes or supremacy of power, wealth or position. It is a communal approach which is of imperial and anarchic in nature. Whereas, the secular approach is of growth with coexistence with due respect to the spiritual essence of each belief.

Science is secular and its laws and phenomenon lead to same observations and conclusion, without discrimination. It may not be out of context to say that all sages showered their wisdom on people around without discrimination and were democratic in nature. Reverence bestowed upon these sages grew based on experiences of nature and human behavior showered by them on people in their surroundings. Enlightened devotees continued their pursuit of spiritual realization like scientists in their own humble way. This pursuit was selfless and relentless and such devotees were smaller in number, while larger proportion of devotees was unable to reason the school of thoughts of their masters. Thus crept in blind and indiscriminate practices where aim was to garner support, gather power, enlarge sphere of influence, and escape from duties and commitments on such pretexts. This gave rise to communal conflicts, division among people and a kind of mobocracy. This is an aberration of democracy where reason and collective wisdom of masses is dominated by whim and fancies of a few who are influential enough to incite emotions with their rhetoric. In prevalent times, media management plays a crucial role in shaping or re-shaping opinion of the masses.

Spirituality (Adhyatma-अध्यात्म) is concerned with human spirit (soul- आत्मा) in a meta-physical domain. But, backward journey into creation of life and its spirit needs better understanding of science which is yet to come out of speculations and hypotheses. Divine reverence in an individual or belief is based on spiritual experiences and this reverence inculcates devotion and devoted following. A true devotee derives strength from selfless divine faith and its effects are miraculous. It gives rise to a feeling of peace, solace, happiness and a feeling of living under patronage of an omniscient, omnipresent and omnipotent power. This feeling is similar to that of a child who adventures with extraordinary fearlessness in presence of parents. This is the reason that God is considered to be supreme father (Parampita - परमपिता). But, wherever this unconditional and selfless reverence and faith is missing it gets manifested in hypocrisy. Such pursuits never gets one any solace and gains. If at all there is any circumstantial gain in such a pursuit and it breeds a greed like a growing spiral, a vicious trap. Such a person is too late to undertake penance and finally ends up in self destruction. This is the essence of religious scriptures.

There is famous phrase '*no need to reinvent the wheel*' and this is how education of science is designed through simulation of scientific principles. Precisely, progression of spirituality is through master-disciple tradition (Guru-Shishya Parmpara- गुरु-शिष्य परंपरा). But, finding a Master (Guru- गुरु) having spiritual attainment is extremely difficult. Swami Vivekananda could get a master Swami Ramakrishna Paramahansa, who could transcendent into him spiritual experience, but such cases are rare. Reaching a divine Guru is a matter of chance and one is really lucky to have it. This distrust is highly detrimental to spiritual culture of country, and it has become rampant with the unexpected conduct of self-proclaimed divine powers. This is an alarming situation. It has created a criminal environment in this serene space of reverence and devotion. As a result an irresistible temptation among poor, sufferer of their own circumstances, drives them to unscrupulous to derive a solace, and eventually they become the real victims. This criminal exploitation grows exponentially with increase in following. The person being followed is virtually worshiped and followers are deeply influenced into a state of total submission, before they are able to realize the trap.

Spirituality does not require one to be highly learned; Saints like Kabeer, his life and his prose are an excellent depiction of this premise. But, it definitely demands serenity and confession of ignorance with firm determination to explore the truth. Interaction with the surrounding in life is the finest teacher. If pains and pleasure that one experiences in life are treated with same sensitivity to every living or non-living, without discrimination, it is the spirituality and a scientific way of coexistence life, a universal religion. Ultimately no religion is above humanity and every religion in its purest form converges into spirituality, an individual specific experience, and science a common and verifiable experience. Space of scientific knowledge is and has been expanding to discover nature and its origin. Every elite person has a greater degree of personal social responsibility, and can collectively complement towards adherence and furtherance of such a spiritual and religious life, a leading to divinity.

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An Appeal: 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-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, a free 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 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 power engineer by profession, soon after submission of Ph.D. Thesis in April'12, at IIT Roorkee, at the age of 61 years, decided to mentor unprivileged students.*

The endeavour started with Chalk-N-Talk mode of mentoring unprivileged students starting from class 9ᵗʰ upto 12ᵗʰI. n last more than Six years it has gone through many turbulences and is now settled with its IOMS model and looking forward to reach needy students. IOMS has been in operation since July'16. Currently regular sessions of IOMS are held regularly for class 9ᵗʰ and 10ᵗʰ, at Ramkrishna Mission School, Sithanagram, A.P. This is second year of mentoring at the school. We want to add more learning centers

*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 IOMS online.*

Actions Requested: *May please like to ponder upon this initiative.* **Queries** *,if any, are heartily welcome. We would welcome your collective complementing in any of the areas listed at* **Involvement**, *above, to make the mission more purposeful and reachable to target children.*

Contact: Dr. Subhash Kumar Joshi, **Coordinator** –Gyan Vigyan Sarita.
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    (M):+91-9711061199,
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मौन

मधुकर पान्डेय

खामोशी क्या है ?
परिस्थितियों के आगे आत्मसमर्पण
या भीतर क्रोध का धधकता हुआ उबाल

कहते हैं कि शब्द ब्रह्म है
है जिसकी विशेष ध्वनि
होता है झंकृत जिससे सारा संसार
पर मौन तो वह वीणा है
करती है झंकृत जो अंतर्मन के तार

मौन तो हमारा सर्वोत्तम मित्र है
क्योंकि इसकी अपनी एक व्याकरण है
विशेष इसकी अपनी एक सरगम है
इसकी एक अपनी एक भाषा है
इसकी अपनी ही एक परिभाषा है

इसमें तो रंचमात्र भी नहीं है दोष
यह है शांत,, धीर एवं एक विशाल शब्दकोष

मौन तो हमारा शक्तिशाली परम मित्र है
क्योंकि उसकी आधारशिला ही सच्चरित्र है
पर हमें मौन तो कदापि भी नहीं भाता
क्योंकि उसे तो सदा सत्य ही बोलना आता

सच तो यह है कि कडुआ मीठा कुछ भी नहीं
क्योंकि सत्य का कोई विकल्प नहीं
सत्य तो यह है कि मौन ही सर्वोत्तम तप है

पर यहाँ एक विडम्बना भी बड़ी अजब है
कि हम भूखे रह सकते हैं पर मौन नहीं
हम लड़ सकते हैं पर मौन नहीं
हम लुट सकते हैं पर मौन नहीं

क्यों कि मौन ही तो वह दर्पण है जो
हमारा ही वास्तविक चेहरा दिखता है
सुकर्मों और कुकर्मों कि याद दिलाता है

हम लुट भी गए हम पिट भी गए
भूखे भी रहे प्यासे भी रहे
पर झूठे आडम्बर कि इस दुनिया में
निर्विकल्प मौन से दूर रहे

जिस दिन इस दुनिया के मानव को
मौन की भाषा आयेगी
कर्म प्रधान इस सृष्टि में असली क्रांति आयेगी
क्षण भंगुर जीवन के इस आँगन में
सच्चा सुख और शांति आएगी

कवि प्रचार माधयम के क्षेत्र में लगभग चार दशक से कार्यरत हैं तत्कालीन सिनेमा से लेकर नवीनतम तकनीकी पर आधारित सामुहिक प्रचार माध्यमों में कार्यरत रहकर प्रमुख संस्थानों जैसे ज़ी नेटवर्क,हिंदुजा ग्रुप , रिलायंस कम्युनिकेशन में जिम्मेदार पदों पर रहकर अनेक न्यूज़ और धार्मिक चैनल के सीईओ , एडिटर-इन-चीफ रहे हैं | वर्तमान मैं वे सामुहिक प्रचार माध्यमों के सलहाकार हैं | कविता लेखन उनकी रूचि है |

E-mail ID: madhukarpanday@gmail.com

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

- This place is not where they will be taught how to score marks and get higher ranks, but to conceptualize and visualize subject matter in their real life so that it becomes intuitive.

- This place is not to aim at solutions but inculcate competence to analyze a problem and evolve solution.

- This place does not extend selective and personalized attention, rather an opportunity to become a part of which is focused on learning and problem solving ability collectively.

- This place provides an opportunity to find students above and below one's own level of learning. Thus students develop not in isolation but learn from better ones and associate in problem solving to those who need help. This group dynamics while create a team spirit, an essential attribute of personality, while one learns more by teaching others.

- This place has strategically chosen Online Mentoring, so that those who are unprivileged can gather at one point and those who can facilitate learning of such students by creating, necessary IT setup. Aseperate **Mentor's Manual**is being developed to support the cause.

We are implementing this philosophy through **Online Mentoring**

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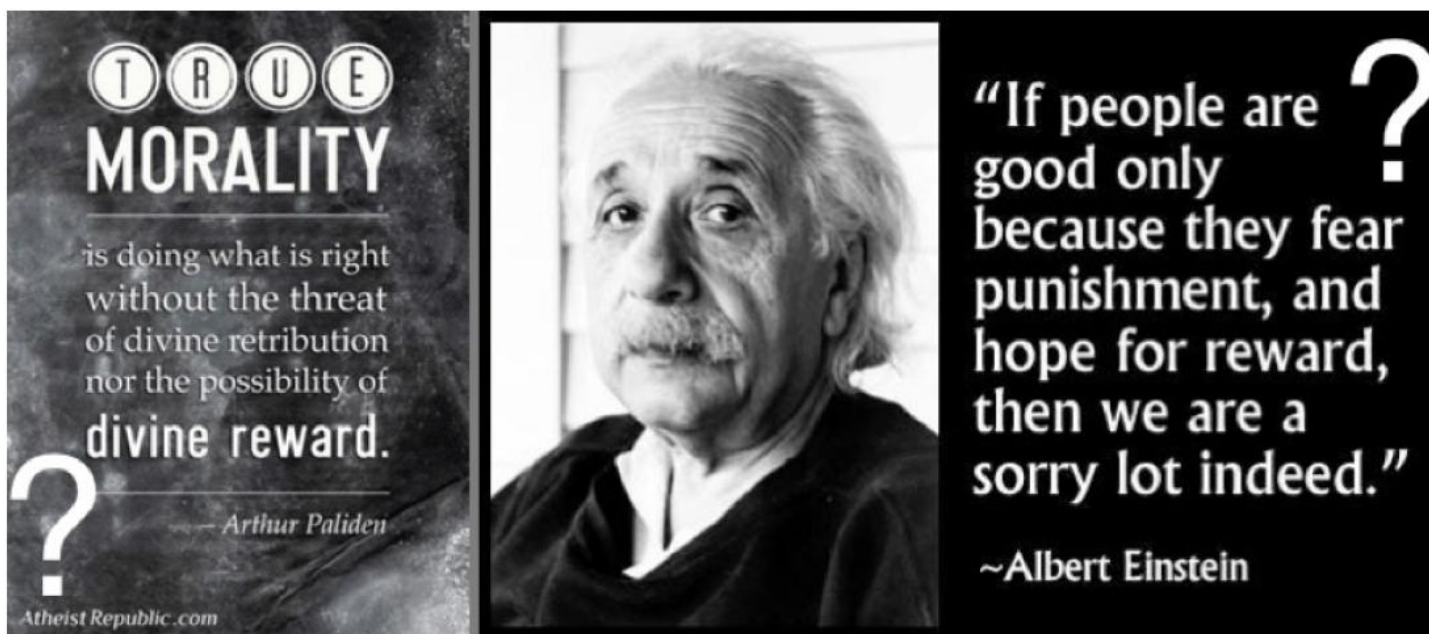
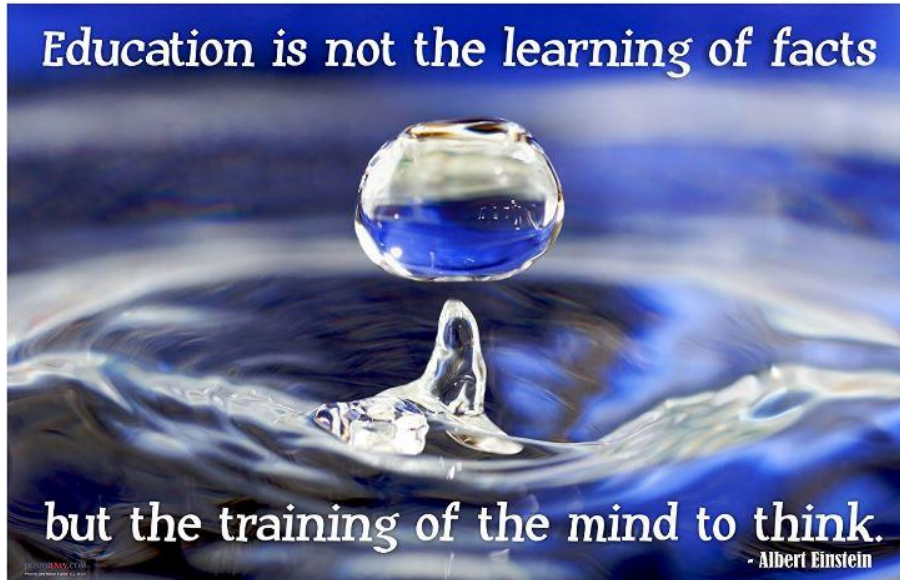

*"**Imagination** is more important than **knowledge**.*

*For **knowledge is limited**, whereas **imagination** embraces the entire world,*

stimulating progress, giving birth to evolution."

- **Albert Einstein**

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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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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 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 its 2nd Monthly e-Bulletin** Gyan-Vigyan Sarita: शिक्षा **.**
  - ➢ **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.**

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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अंदाज ए बयां

बीती ताहि बिसार दे ?

समीर लाल 'समीर'

कहते हैं, मुसीबत कैसी भी हो, जब आनी होती है-आती है और टल जाती है-लेकिन जाते जाते अपने निशान छोड़ जाती है.

इन निशानियों को बचपन से देखता आ रहा हूँ और खास तौर पर तब से-जब से गेस्ट हाऊसेस(विश्राम गृहों)और होटलों में ठहरने लगा. बाथरुम का शीशा हो या ड्रेसिंग टेबल का , उस पर बिन्दी चिपकी जरुर दिख जाती है. क्या वजह हो सकती है? कचरे का डब्बा बाजू में पड़ा है. नाली सामने है. लेकिन नहीं, हर चीज डब्बे मे डाल दी जायेगी या नाली में बहा देंगे पर बिन्दी, वो माथे से उतरी और आईने पर चिपकी. जाने आईने पर चिपका कर उसमें अपना चेहरा देखती हैं कि क्या करती हैं, मेरी समझ से परे रहा. यूँ भी मुझे तो बिन्दी लगानी नहीं है तो मुझे क्या ? मगर एकाध बार बीच आईने पर चिपकी बिन्दी पर अपना माथा सेट करके देखा तो है , जस्ट उत्सुकतावश. देखकर बढ़िया लगा था. फोटो नहीं खींच पाया वरना दिखलाता.

यही तो मानव स्वभाव है कि जिस गली जाना नहीं , उसका भी अता पता जानने की बेताबी.

मुसीबतें भी अलग अलग आकार की होती है , तो वैसे ही यह निशान भी. श्रृंगार, शिल्पा ब्राण्ड की छोटी छोटी बिन्दी से लेकर सुरेखा और सिंदुर ब्राण्ड की बड़ी बिन्दियाँ. सब का अंतिम मुकाम- माथे से उतर कर आईने पर.

कुछ बड़ी साईज़ की मुसीबतें , बतौर निशानी , अक्सर बालों में फंसाने वाली चिमटी भी बिस्तर के साईड टेबल पर या बाथरुम के आईने के सामने वाली प्लेट पर छोड़ दी जाती हैं. इस निशानी की मुझे बहुत तलाश रहती है. नये जमाने की लड़कियाँ तो अब वो चिमटी लगाती नहीं , अब तो प्लास्टिक और प्लेट वाली चुटपुट फैशनेबल हेयरक्लिपस का जमाना आ गया मगर कान खोदने एवं कुरेदने के लिए उससे मुफ़ीद औजार मुझे आज तक दुनिया में कोई नजर नहीं आया. चाहें लाख ईयर बड से सफाई कर लो , मगर एक आँख बंद कर कान कुरेदने का जो नैसर्गिक आनन्द उस चिमटी से है वो इन ईयर बडस में कहाँ ?

औजार के नाम पर एक और औजार जिसे मैं बहुत मिस करता हूँ वो है पुराने स्वरूप वाला टूथब्रश. नये जमाने के कारण बदला टूथब्रश का स्वरुप. आजकल के कोलगेटिया फेशनेबल टूथब्रशों में वो बात कहाँ ? आजकल के टूथब्रश तो मानो बस टूथ ब्रश ही करने आये होंऔर किसी काम के नहीं. स्पेशलाईजेशन और विशेष योग्यताओं के इस जमाने में जो हाल नये कर्मचारियों का है , वो ही इस ब्रश का.हरफनमौलाओं का जमाना तो लगता है बीते समय की बात हो , फिर चाहे फील्ड कोई सा भी क्यूँ न हो.

बचपन में जो टूथब्रश लाते थे , उसके पीछे एक छेद हुआ करता था जिसमें जीभी (टंग क्लीनर) बांध कर रखी जाती थी. ब्रश के संपूर्ण इस्तेमाल के बाद , यानि जब वह दांत साफ करने लायक न रह जाये तो उसके ब्रश वाले हिस्से से पीतल की मूर्तियों की ब्रासो से घिसाई ..फिर इन सारे इस्तेमालों आदि के हो जाने के उपरान्त जहाँ ब्रश के स्थान पर मात्र ठूंठ बचे रह जाते थे , ब्रश वाला हिस्सा तोड़कर उसे पायजामें में नाड़ा डालने के लिए इस्तेमाल किया जाता था. नाड़ा डालने के लिए उससे सटीक और सुविधाजनक औजार भी मैने और कोई नहीं देखा.

जिस भी होटल या गेस्ट हाऊस के बाथरुम के या ड्रेसिंग टेबल के आईने पर मुझे बिन्दी चिपकी नजर आती है , मेरी नजर तुरंत बाथरुम के आईने के सामने की पट्टी पर और बिस्तर के बाजू की टेबल पर या उसके पहले ड्राअर के भीतर जा कर उस चिमटी को जरुर तलाशती है जो कभी किसी महिला के केशों का सहारा थी , उसे हवा के थपेड़ों में भी सजाया संवारा रखती थी. खैर , सहारा देने वालों की , जिन्दगी के थपेड़ों से बचाने वालों की सदा से ही यही दुर्गति होती आई है चाहे वो फिर बूढ़े मां बाप ही क्यूँ न हो. ऐसे में इस चिमटी की क्या बिसात मगर उसके दिखते ही मेरे कानों में एक गुलाबी खुजली सी होने लगती है.

बदलते वक्त के साथ और भी कितने बदलाव यह पीढ़ी अपने दृष्टाभाव से सहेजे साथ लिये चली जायेगी , जिसका आने वाली पीढ़ियों को भान भी न होगा.

अब न तो दाढ़ी बनाने की वो टोपाज़ की ब्लेड आती है जिसे चार दिशाओं से बदल बदल कर इस्तेमाल किया जाता था और फिर दाढ़ी बनाने की क्षमता खो देने के बाद उसी से नाखून काटे जाते थे और पैन्सिल की नोक बनाई जाती थी. आज जिलेट और एक्सेल की ब्लेडस ने जहाँ उन पुरानी ब्लेडों को प्रचलन के बाहर किया , वहीं स्टाईलिश नेलकटर और पेन्सिल शार्पनर का बाजार उनकी याद भी नहीं आने देता है. तब ऐसे में आने वाली पीढ़ी क्यों इन्हें इनके मुख्य उपयोगों और अन्य उपयोगों के लिए याद करे , उसकी जरुरत भी नहीं शेष रह जाती है.

फिर मुझे याद आता है वह समय , जब नारियल की जटाओं और राख से घिस घिस कर बरतन मांजे जाते थे. आज गैस के चूल्हे में न तो खाना पकने के बाद राख बचती है और न ही स्पन्ज, ब्रश के साथ विम और डिश क्लीनिंग लिक्विड के जमाने में उनकी जरुरत. स्वभाविक है उन वस्तुओं को भुला दिया जाना.

सब भूला दिया जाता है. हम खुद ही भूल बैठे हैं कि हमारे पूर्वज बंदर थे जबकि आज भी कितने ही लोगों की हरकतों में उन जीन्स का प्राचुर्य है. तो यह सारे औजार भी भूला ही दिये जायेंगे, इसमें कोई अतिशयोक्ति नहीं.

अंतर बस इतना ही है कि आज अल्प बचत का सिद्धांत पढ़ाना होता है जो कि पहले आदत का हिस्सा होता था.

अल्प बचत मात्र थोड़े थोड़े पैसे जमा करने का नाम नहीं बल्कि छोटे छोटे खर्चे बचाने का नाम भी है.

 लोकप्रिय चिट्ठाकार समीर लाल व्यवसाय से चार्टर्ड एकाउंटैंट हैं। आजकल वे कैनैडा 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 "उड़नतश्तरी" हिन्दी ब्लॉगजगत में एक लोकप्रिय नाम है।

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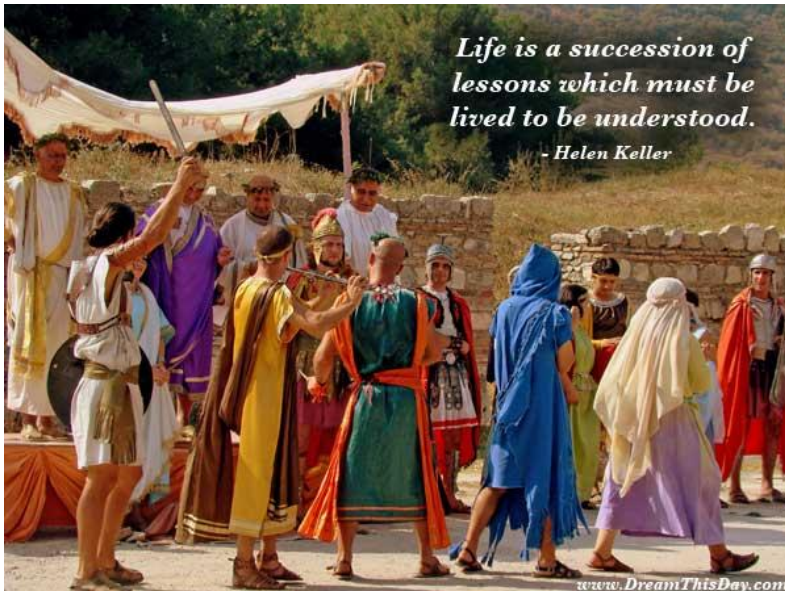*- Arnold Schwarzenegger*

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Education is not job training;
the function of education is to instill an appreciation
of our place in the flow of time and space,
to expand our intellectual and empathetic understanding
of nature and people.

- Jonathan Lockwood Huie

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Life is a succession of lessons which must be lived to be understood.
- Helen Keller
www.DreamThisDay.com

Ayurveda- Health Care

Aahar- Vihar

Dr Sangeeta Pahuja

In My previous articles I have explained about how you would know about your prakriti in this article will explain about which diet and lifestyle is helpful for people of different constitution.

It is essential to first know your Prakriti (Vata, Pitta or Kapha) and keep yourself healthy by balancing the Tridoshas.

Vata Pacifying Food - Sweet-Sour-Salty (Madhur-Amal-Lavan) food items pacify Vata.

This includes wheat, old basmati rice, kulath , mustard, patole, bathua, gourd, chaulai, sahjan carrot, phalsa , sweet mango, pomegranate, walnut, almond, figs,dates etc.

Vata Pacifying Herbs are Saunth, Asafoetida, Ajwain,Methidana, Pippali, Dalchini, Jaiphal, Cardamom, Haritaki, Castor oil, Guggul, Giloy, Ashwagandha,Shatavari, Bhringraj etc.

Unfavorable lifestyle in case of Vata is avoid day-time sleeping, night awakening, suppression of natural urges, fasting for long hours, anxiety,fear.

Vata Pacifying Lifestyle requires regular body massage with Til oil or Almond oil, proper sleep. hot water bath, drink lukewarm water alongwith Yoga, Pranayam and Meditation.

Unfavorable diet and lifestyle for Vata Prakriti is to avoid sali rice, barley, roasted chana, moth,masoor, arhar, excess sugar, cauliflower, peas, french beans, tea, coffee, aAlcohol, drugs.

Pitta Pacifying Food - Sweet-Bitter-Astringent (Madhur-Tikt-Kashay) foods pacify Pittaj.

This includes barley, oats, wheat, white basmati rice, broccoli, cauliflower, cucumber, beans, green capsicum, green vegetables, mushrooms, ladyfinger, tomato, gourd, apple, avocado, orange, guava, pineapple, grapes, mango, figs, tofu, sunflower seeds, jaggery, cardamom, dalchini, coriander, sweet fennel, saffron etc.

Unfavourable diet and lifestyle for Pittaj Prakriti includes oily, spicy food items, sour and salty foods.

Avoid Anxiety,

As regards lifestyle it is to avoid irregular eating habits, ever sleep just after having meals.

Kapha Pacifying Food - pungent, bitter, astringent (Katu-Tikt-Kashay) food pacify Kapha

This includes ginger, garlic, onion, black pepper, neem, bitter gourd, spinach, turmeric, honey, drakshavleh, fennel etc.

Consume moderately potato, rice, excess cereal, radish, ladyfinger, olive, tomato, cucumber, sweet potato, curd, milk, coconut.

Unfavorable diet for kapha Prakriti include - oily, heavy food items. curd, yoghurt, paneer, chocolate, sugary products, refrigerated food, don't drink milk with other food items.

Kapha Pacifying Lifestyle is active life, exercise,

Swimming and running.

Unfavorable lifestyle is sadantary lifestyle, excess sleeping, overeating,

Triphla Churna is Tridoshshamak. Add the required food items in your daily diet to balance the Tridoshas.

Know Ayurveda, Follow Ayurveda and Stay Healthy.
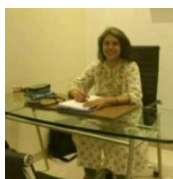
Author is an Ayurvedic Medical Practitioner. She did B.A.M.S. from M.D. University, Rohtak. She has consultation centres at Delhi and Noida. She is keenly interested in spiritual, women and social developmental activities. Contact No.: 9953967901, E-mail - sangeeta.pahuja3@gmail.com

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पथिक की कलम से

धर्माचार

अभ्यानन्द पाठक "पथिक"

यदा–कदा हम सभी आपस में यह चर्चा करते रहते हैं कि धर्म क्या है, धर्माचार किसे कहते हैं आदि आदि। यों तो इस विषय पर अनगिनत आलेख आ चुके हैं तथापि मैं अपने अध्ययन एवं चिन्तन के अनुरूप तथा विभिन्न धर्मग्रंथों से संकलित कुछ विचार एवं बातें आप सभी के समक्ष प्रस्तुत करना चाहुँगा। इस निवेदन के साथ कि इन पर दृष्टिपात करते हुए अनुकुलता के होने पर इसे आत्मसात करने के प्रयास के साथ अन्य जनों को भी अपने विचार से सिंचित करने का प्रयास करें।

धर्म की रक्षा करने से स्वयं की रक्षा होती है। (धर्म रक्षति रक्षत:)

"दिनैकं मासपक्षं वा पक्षार्द्ध वापि वत्सरम्।

कृता येन य च गच्छेन्ममालयम्।। (पद्म पुराण)"

(एक वर्ष, एक मास, एक पक्ष, एक सप्ताह अथवा एक दिन भी जिसने माता–पिता की भक्ति की है, वह परम धाम को प्राप्त होता है।)

यह कहना सर्वथा समयोचित होगा कि हम सभी विश्व के उस भू–भाग पर जन्में हैं जहाँ देवतागण भी जन्म लेने हेतु लालायित रहते हैं।

"गायन्ति देवाः किल गीतकानि,

धन्यास्तु ते भारतभूमि भागे।

स्वर्गा पवर्ग स्मद मार्गमृते,

भवन्ति भूयः पुरूषा सुरत्वात्।।

(अपने इस भू–भाग पर जन्म को सार्थक बनाने के लिए हमें सद्गुण–सदाचार एवं चित्र–निरोध पर विशेष ध्यान देने की आवश्यकता है। सद्गुण से सदाचार की एवं सदाचार से सद्गुणों की वृद्धि होती है।)

"सर्वागमानामाचारः प्रथमं परिकल्पते।

आचार प्रभवो धर्मो धर्मस्य प्रभुरच्युतः।।"

(बीज और वृक्ष की तरह सद्गुण से सदाचार की और सदाचार से सद्गुणों की वृद्धि होती है। शास्त्रानुकुल संपूर्ण विहित कर्मों का नाम सदाचार है।)

"सर्वागमानामचारः प्रथमं परिकल्पते।

आचारप्रभवो धर्मो धर्मस्य प्रभुरच्यृतः।।"

(सब शस्त्रों में सबसे पहले आचार की ही कल्पना की गयी है, आचार से धर्म उत्पन्न होता है और धर्म के प्रभु श्री अच्युत भगवान है।)

आचार के मुख्यतः दो भेद है– शौचाचार और सदाचार। जल और मृत्तिका आदि से शरीर को तथा भोज, वस्त्र, घर और बर्तन आदि को शास्त्रानुकुल स्वच्छ रखना **शौचाचार** है। सबके साथ यथायोग्य व्यवहार एवं शास्त्रोक्त उत्तम कर्मों का आचरण करना **सदाचार** है।

भगवान मनु ने पापकर्म के तीन प्रकार बताये हैं–

(क) **कायिक पाप** – बिना दिया हुआ धन लेना, हिंसा और परस्त्री गमन।

(ख) **वाचिक पाप** – ये मुख्यतः चार हैं: कठोर वचन, मिथ्या वाचन, चुगली करना और बिना सिर–पैर के बात करना।

(ग) **मानसिक पाप** – दूसरे का माल मारने का दाँव सोचना, मन से दूसरे का अनिष्ठ चिंतन करना और "मैं शरीर हूँ"इस प्रकार का झुठा अभिमान करना।

इन विविध पापों का नाश करने के लिए भगवान श्रीकृष्ण ने श्रीमद्भगवतगीता में तीन प्रकार के तप बतलाये हैं– 1) शारीरिक तप, 2) वाङ्मय तप और 3) मानस तप। (देखें अध्याय 17 श्लोक 14 से 16 तक)

कहते हैं सभी जीव को अपने कर्मों के अनुसार फल की प्राप्ती होती है तथा स्वर्ग और नरक प्राप्त होता है।

स्वर्ग और नरक की स्थिति कुछ इस प्रकार से वर्णित की गई है–

"स्वर्गास्थितानाताम् यह जीव लोके,

चत्वारी चिह्लानि निवसन्ति देहे।

दान प्रसंगा, मधुरा च वाणी,

देवार्चनम् ब्रह्माण तपर्णस्थः।।"

"अत्यन्ति कोपः कटुका च वाणी,

दरिद्रता च स्वजनीसु बैरी।

नीच प्रसंगा, कुलहीन सेवा,

चिह्लन्ति देहे नरका स्थितानाम्।।"

सनातन धर्म सर्व हितकारी, कल्याणकारी एवं जीवमात्र के सुख और आनन्द की कामना करता है।

सर्वे भवन्तु सुखिनः, सर्वे सन्तु निरामया।

सर्वे भद्राणि पश्यन्तु, मा कश्चित दुःखभाग्भवेत्।।"

हमारी सोच भी कुछ इस प्रकार होनी होगी।

"न कामये राज्ये न पुनरोभवः।

कामये दुःख तप्तानामः

प्राणी नामार्ति नाशनम्"

यद्यपि मन चंचल और अस्थिर है तथापि अभ्यास और वैराग्य से वह स्थिर हो सकता है। महर्षि पतंजलि का भी यही कथन है–

"अभ्यासवैराग्याभ्यां तन्निरोधः।" (योग 1/12)

(सांख्य के रचयिता भगवान कपिलदेव ने भी अभ्यास और वैराग्य को चित्त–निरोध का साधन बतलाया है। – वैराग्याभ्यासात्)

वैराग्य का लक्षण महर्षि पतंजलि इस प्रकार करते हैं–

"दृष्टानुश्रविक विषयवितृष्णस्य वशीकारसंज्ञा" (वैराग्यम 1/15)

(अर्थात् कंचन कामिनी आदि दृष्ट विषयों में तथा श्रुतियों में कहे हुए स्वर्गादि अदृष्ट विषयों में तृष्णारहित वश में किये हुए चित्त की राग रहित सिथति का नाम ही "वैराग्य" है।)

धर्म शब्द "धृ" धंतु से बनता है, जिसका अर्थ यह है कि जो समस्त ब्रह्माण्ड को धारण करता है वह 'धर्म' है।

धारणाद् धर्ममित्याहुर्धर्मेण विधृताः प्रजाः।

यः स्याद् धरणसंयुक्तः स धर्म इति निश्चयः।। (महा० शान्ति 109/11)

महर्षि कण्णाद धर्म का लक्षण इस प्रकार बताते हैं–

"यतोऽभ्युदयनिः श्रेयससिद्धः सधर्म।"

(जिससे इस लोक में अभ्युदय हो और परम् कल्याणरूप मोक्ष की प्राप्ति हो वही धर्म है।)

वेद, स्मृति, सदाचार और अपनी रूचि के अनुसार परिणाम में हितकर यह चार प्रकार का धर्म का साक्षात लक्षण है। मनु ने भी ऐसा ही कहा है–

"वेदः स्मृतिः सदाचारः स्वस्य च प्रियमात्मनः।

एतच्चतुर्विधं प्राहु साक्षाद्धर्मस्य लक्षणम्।।"

धैर्य, क्षमा, मन का निग्रह चोरी न करना, बाहर–भीतर की शक्ति, इन्द्रियों का संयम, सात्वीक बुद्धि, आध्यात्मविद्या, यथार्थ भाषण और क्रोध न करना, ये धर्म के दस लक्षण हैं।

यम – नियम

"अहिंसासत्यास्तेयब्रह्मचर्यापरिग्रह यमाः।" (योग 2/30)

(अहिंसा, सत्य भाषण, चोरी न करना, ब्रह्मचर्य का पालन और सर्वस्व ईश्वर को अर्पण करना। ये चार प्रकार के नियम हैं।)

"शौचसन्तोषतपः स्वध्यायेश्वर प्राणिधानानि नियमाः।" (योग 2/32)

(बाहर–भीतर की पवित्रता, संतोष, तप, स्वध्याय और सर्वस्व ईश्वर को अर्पण करना ये चार प्रकार के नियम हैं।)

पवित्रता दो प्रकार की होती है– बाहरी और भीतरी।जल, मिट्टी से शरीर की, सर्वार्थ त्याग से व्यवहार और आचरण की तथा न्यायोपार्जित द्रव्य से प्राप्त सात्विक पदार्थों के पवित्रतापूर्वक

सेवने से आहार की, यह बाहरी पवित्रता है। अहंता, ममता, राग, द्वेष, ईर्ष्या, भय और काम–क्रोधादि भीतरी दुर्गुणों के त्याग से भीतरी पवित्रता होती है।

सुख–दुःख, लाभ–हानि, यश–अपयश, सिद्धि–असिद्धि, अनुकुलता–प्रतिकुलता आदि के प्राप्त होने पर सदा–सर्वदा सन्तुष्ट–प्रसन्नचित्त रहने का नाम **संतोष** है।

मन और इंद्रियों के संयमरूप धर्मपालन के लिए कष्ट सहने का और तितिक्षा, व्रत एवं उपवासादिक नाम **तप** है।

कल्याणप्रद शास्त्रों का अध्ययन और इष्टदेव के नाम का जप–तप स्तोत्रादि पठन–पाठन एवं गुणानुवाद करने का नाम **स्वाध्याय** है।

ईश्वर की भक्ति अर्थात् सबकुछ ईश्वर को अर्पण करके ईश्वर के लिए मन–वाणी और शरीर द्वारा ईश्वर के अनुकुल ही चेष्टा करने का नाम **स्वाध्याय** है।

"अहिंसाप्रतिष्ठायां तत्सन्निधौ वैरत्यागः।" (योगदर्शन 2/35)

"सत्यप्रतिष्ठायां क्रियाफलाश्रयत्वम्।" (योगदर्शन 2/36)

"अस्तेयप्रतिष्ठायां सर्वरत्नोपस्थानम्।" (योगदर्शन 2/37)

"ब्रह्मचर्यप्रतिष्ठायां वीर्यलाभः।" (योगदर्शन 2/38)

"अपरिग्रहस्थैर्ये जन्मकथन्तासम्बोधः।" (योगदर्शन 2/39)

"शौचात्स्वांगजुगुप्सा परैःसंसर्गः।" (योगदर्शन 2/40)

"सत्वशुद्धिसौमनस्यैकाग्येन्द्रियजयात्यदर्शनयोग्यत्वानिच।" (योगदर्शन 2/41)

"सन्तोषादनुत्तमसुखलाभः।" (योगदर्शन 2/42)

"कोयेन्द्रियसिद्धिरशुद्धिक्षयात्तपसः।" (योगदर्शन 2/43)

"स्वाध्यायादिष्टदेवतासम्प्रयोगः।" (योगदर्शन 2/44)

"समाधिसिद्धिरीश्वर प्रणिधानात्" (योगदर्शन 2/45)

इन्द्रियों का अपने–अपने विषयों के संयोग से रहित होने पर चित्त स्वरूपों में अवस्थित हो जाना **प्रत्याहार** है।

चित्त को किसी एक देश–विशेष में स्थिर करने का नाम **धारणा** है।

"वित्तं बंधुर्वयः कर्म विद्या भवति पंचमी।

एतानि मानस्थानानि गरीयो यद्दुत्तरम्।।"

(न्याय से अर्जित धन, जाति बंधु {चाचा, मामा आदि}, वेदों के अनुसार कार्य करने वाला आचारशील व्यक्ति, आयु में अपने से बड़ा और विद्या से युक्त पुरुष इन पांचों का स्थान आदर ययोग्य है। इनमें भी धन की तुलना में संबंध का, संबंध की अपेक्षा आचार का, आचार की तुलना में आयु का तथा आयु से विद्वता का अधिक महत्व है।) मनुस्मृति – 139

" नारुन्तुदः स्यादार्त्तोऽपि न परद्रोहकर्मधीः।

यथाऽस्योद्विजते वाचा नालोक्या नामुदीरयेत्।।"

(अपने आप दुःखी होने पर भी किसी दूसरे व्यक्ति को दुःख नहीं दें, दूसरे को हानि पहुँचाने का ख्याल तक नहीं करें तथा जिस बात से कोई दुःखी हो सकता है, ऐसी स्वर्ग पाने में रूकावट डालने वाली बोली नहीं बोलें।) मनुस्मृति – 164

"विषादप्यमृतं ग्राह्यं बालादपि सुभाषिताम्।

अमित्रादपि सद्वृत्तममेध्यादपि कांचनम्।।"

(विवेकशील व्यक्ति विष में से भी अमृत निकाल लेता है, एक बालक से भी कल्याण करने वाला कथन ग्रहण कर लेता है, दुश्मन से भी श्रेष्ठ व्यवहार सीख लेता है और गंदे या अपावन स्थान से भी सोना प्राप्त कर लेता है। कहने का तात्पर्य यह है कि व्यक्ति को गुण तथा वस्तु को महत्व देना चाहिए, न कि व्यक्ति या स्थान को।) मनुस्मृति – 243

"न साम्परायः प्रतिभाति बालं प्रमाद्यन्तं वित्तमोहेन मूढम्।

अयं लोको नास्ति पर इति मानी पुनः पुनर्वशमापद्यतेमे।।"

(कठोपनिषद् – 1/2/6)

(मनुष्य शरीर भगवतप्राप्ति के लिए मिला है, परन्तु इस बात को भूलकर मनुष्य स्त्री–पुत्रादि तथा गृह वैभव आदि भोगपदार्थों में इतना अधिक व्यामुग्ध हो जाता है कि वह अज्ञानावस्था में ही जीवन–यापन करता है। इसके फलस्वरूप उसे परलोक या पुनर्जन्म की बात सूझती ही नहीं, अतैव जो प्रत्यक्ष दिखता है उस लोक के सिवा दूसरा भी लोक है तथा इस शरीर छूटने के बाद दूसरा शरीर धारण करना पड़ता है, ये बात उसके मन में आती ही नहीं। इस कारण वह परवंश होकर जन्म–मरण के चक्र में घुमता रहता है।)

मनुष्य शरीर जीवन निर्वाह के लिए नहीं है। प्रत्येक देहधारी किसी–किसी प्रकार जीवन–निर्वाह कर ही लेता है। अन्य जीव को मनुष्य के अपेक्षा कम ही हाय–हाय करनी पड़ती है। इसका कारण यह है कि देह निर्माण के पूर्व ही उसके जीवन निर्वाह के साधनों का निर्माण हो जाता है। अर्थात् प्रत्येक देहधारी निर्वाह के साथ उत्पन्न होता है। इसे ही **प्रारब्ध** कहते हैं।

जो लोग पुनर्जन्म या परलोक नहीं मानते, तो इसमें उनका कोई दोष नहीं; क्योंकि इनको तत्वज्ञों ने ऐसी ही शिक्षा दी है।

"यच्चित्तस्तन्मयो भवत्येतद् गुह्यं सनातनम्।"   (श्रुति.....)

(अर्थात चित्त के ऊपर जैसा संस्कार पड़ता है मनुष्य उसी स्वभाव का बन जाता है और उसका जीवन–निर्वाह भी उसके स्वभाव के अनुसार ही होता है।)

"सर्वाजीवे सर्वसंस्थे वृहन्ते अस्मिन् हंसो भ्राम्यते ब्रह्मचक्रे।

पृथगात्मानं प्रेरितारं च मत्वा जुष्टस्ततस्तेनामृत्वमेति।।"

(श्वेताश्वर उपनिषद् – 1/6)

"यदेवेह तदमुत्र यदमुत्र तदन्विह।

मृत्योः स मृत्युमाप्नोति य इह नानेव पश्यति।।"

(कठोपनिषद् – 2/1/10)

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लेखक का जन्म बिहार के बक्सर जिले के एक ग्राम में हुआ। वहीं से उन्होंने प्राथमिक एवं हायर सेकेंडरी की शिक्षा उत्तीर्ण की। तदोपरांत संत कोलम्बस महाविद्यालय हजारीबाग से अर्थशास्त्र मे सनातक की परीक्षा पास की तत्पश्चात, जेवियर समाज सेवा संस्थान राँची से कर्मिक व्यवस्था एवं ओधोगिक संबंध में स्नातकोत्तर हुए और उन्होंने कल्याण पदाधिकारी के पद पर, कोल इंडिया लिमिटेड धनबाद में सेवा आरंभ की। सेवाकाल के प्राथमिक वर्षों में रांची विश्वविद्यालय से विधि स्नातक की परीक्षा भी उत्तीर्ण की और विभिन्न पदों पर कार्य करते हुए वे सन 2011 में सेवानिर्मित महाप्रबंधक के पद से भारत कोकिंग कोल इंडिया लिमिटेड धनबाद से लिया। सामाजिक विषयों पर आध्यात्मिक चिंतन एवं लेखन उनकी रूचि है। आपको भारतीय राजभाषा विकास संस्थान देहरादून द्वारा '**भारतेंदु राजभाषा साहित्य शिरोमणि** से , अक्टूबर 2009 में, सम्मानित किया गया। E-mail ID: abhayanand.pathak@gmail.com

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Take care of your thoughts,

For they are formed and moulded by our thoughts.

Those whose minds are shaped by selfless thoughts,

Give jot when they speak or act.

Joy follows them like a shad,

that never leaves them.

- Gautama Buddha

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एक ही दे चिंगारी , महानल !, एक ही दे चिंगारी

क्रांति कनाटे

संतों के साहित्यिक अवदान का यह विषय संपूर्ण भारत भूमि की मिट्टी से जुड़ा हुआ है   तथा अनादिकाल से जुड़ा हुआ है। संतों के स्वरूप में तथा साहित्यिक प्रकार में समय-समय पर अवश्य परिवर्तन हुए हैं परंतु उनका साहित्यिक अवदान तथा महत्त्व यथावत बना रहा है। । हमारे देश ने सैकड़ों वर्षों तक आतताइयों के आक्रमण का सामना किया और फिर सैकड़ों वर्षों की पराधीनता सहन की। तमाम राजनैतिक उथल-पुथल तथा आमूल चूल हुए सामाजिक परिवर्तनों के बीच यदि कोई स्वर शाश्वत रहा है तो वह है हमारे संतों की वाणी का । संतों ने अपने साहित्य के माध्यम से इस देश की शिक्षित-अशिक्षित , निर्धन-सधन जनता में जो सामाजिक जागरण फैलाने का कार्य किया   , सोयों को सचेत किया   , उनमें राष्ट्रप्रेम की अलख जगाने का महत कार्य किया वैसा दूसरा कोई उदाहरण विश्व के इतिहास में भी नहीं है और विश्व साहित्य में भी नहीं है। इस विषय को लेकर एक प्रश्न यह अवश्य उठता है कि संत साहित्य की इस चर्चा में भक्तकवियों का समावेश होता है या नहीं क्योंकि मोटे तौर पर यह माना जाता है कि संत सन्यस्त होता है तथा वह निर्गुण/निराकार ब्रह्म की साधना करता है जबकि भक्त गृहस्थधर्म का पालन करते हुए सगुण/ साकार ईश्वर की उपासना करता है। संत शब्द के साथ तत्काल तुलसी   , सूर, ज्ञानेश्वर का स्मरण हो आता है तो भक्त कहने भर से नरसिंह मेहता , दयाराम और मीराबाई की छबियाँ साकार हो उठती हैं परंतु कबीर तथा रैदास भी तो हैं जो गृहस्थ धर्म का पालन करते हुए निराकार ब्रह्म की उपासना करते हैं तथा संत परंपरा के अंतर्गत आते हैं। भक्ति निर्गुण हो या सगुण, हम उन्हें संत की संज्ञा दें या भक्त की हम उन्हें ऋषि-मुनि-महर्षि जो भी कहकर स्वयं को धन्य कर लें , परम सत्य यह है कि उनका सृजन हमारे साहित्य की बहुमूल्य धरोहर है।

हमारे साहित्य का आविर्भाव ही संत साहित्य से होता है जिसका प्रत्यक्ष प्रमाण हमारे चारों वेद है। वेद से अथश्री हुए श्लोक , हो या स्तोत्र, कोई सूक्ति या कालानुक्रम में वह कोई भजन हो या प्रार्थना , अभंग हो या पद, दोहा हो या साखी; इन सबने हमें निरंतर प्राणवान-ऊर्जावान-गतिमान तथा सहिष्णु बनाए रखा है। इन्होंने हमें जीने का अर्थ दिया है ('बड़े भाग मानुस तन पाया'-तुलसी); कठिन से कठिन परिस्थिति का सामना करना सिखाया ('मेरु तो डगे पण मन नहि डगे'-गंगासती) मानव जीवन के एक   -एक क्षण का महत्त्व समझाया('एकवीस हजार छ: सौ ने काळ खाशे गंगासती अपने एक भजन में कहती है कि एक दिन बीत जाने का अर्थ है 21600 साँसों का व्यर्थ हो जाना),धर्महित प्राण निछावर करने की प्रेरणा दी ('सूरा सो पहचानिए जे लड़े दीन के हेत': कबीर); पाखंड तथा आडंबर से दूर करने का प्रयास किया, इन्होंने हमें मृत्यु के स्वागत का रास्ता भी दिखाया('काळ   आला देहासी खाऊ, आम्ही आनंदे नाचू-गाऊ '-तुकाराम) और इन सबके परे स्वजनों को हमारे मरणोपरांत शोक न करने की बिनती भी की (यथा , 'मारी मृत्युना ओच्छव करजो मारी मृत्यु ना शोक ना होय ',-दयाराम)। संतों ने हमें हमारे लौकिक उत्तरदायित्व का पालन करते हुए एक अलौकिक ध्येय की ओर अग्रसर किया। हमारे इहलोक से परलोक की कड़ी है हमारा यह गौरवास्पद संत साहित्य जिसकी विशेषता यह है कि सामान्य जन तक यह साहित्य वाचिक परंपरा से पहुँचा है और इसीलिए हमारे जीवन में इसकी जड़ें गहराई तक पैठी हुई हैं।

एक दुविधा यह भी है कि संतों के साहित्यिक अवदान का उल्लेख भला कहाँ से किया जाए क्योंकि आसेतु-हिमालय हो अथवा पश्चिमी सिरे पर स्थित राजस्थान की मरुभूमि से लेकर पूर्वांचल में अवस्थित सात भगिनियों के रम्य प्रदेश हों ; इतिहास का कोई भी कालखंड हो; कोई भी भाषा/लोकभाषा हो वहाँ का पूरा वातावरण आपको संतों की वाणी से , उनके साहित्य से सुरभित मिलेगा क्योंकि इस स्वर्णिम संत साहित्य की परंपरा वैदिक युग में हजारों वर्ष पूर्व हमारे ऋषियों-ऋषिकाओं मुनियों द्वारा बीज रूप में डाली गई थी आज यहाँ तक आते-आते उस बीज का प्रस्फुटन-पल्लवन   एक शाश्वत साहित्य के रूप में हमारे सामने है। कहाँ से हो इसकी शुरुआत ? मैत्रयी ने हमें दिए महामंत्र से-   'असतो माँ सदागमयन से..... '। हिमाच्छादित प्रदेश कश्मीर से अपनी यात्रा आरंभ करते हैं तो सबसे प्रथम उल्लेख करना होगा लल्लेश्वरी (१३३५-१४१५) का। निर्गुण परंपरा की उपासक संत लल्लेश्वरी वैराग्य की उस चरम सीमा पर पहुँच गई कि दिगंबरा हो गई। उनके १०६ पदों का संग्रह 'लल्लावाक्यानि(स: डॉ.ग्रियर्सन) में पाया जा सकता है। सिंध प्रदेश की बात करते हैं तो याद आते हैं संत झूलेलाल (जन्म १०६०) और शादाराम साहेब (१७०८-१७९३) जिनकी वाणी ने मुगलों से त्रस्त लोगों को संगठित करने का महत कार्य किया। पंजाब के तो नाम भर से हृदय रोमांचित हो उठता है , कैसी होगी भूमि जहाँ संत गुरु नानकदेव से लेकर गुरु गोविंदसिंह तक दसों गुरुओं ने निराकार भक्ति के साथ राष्ट्रभक्ति- राष्ट्रप्रेम की अनुपम ज्योत जलाई। शस्त्र तथा शास्त्र को समान लेखने वाले खालसापंथ ने   'श्री गुरुग्रंथ साहिब(पृष्ठ संख्या:1430) के रूप में हमें प्रदान किया सबसे बड़ा साहित्यिक अवदान है जिसमें पाँच सिख गुरुओं के अलावा भारतभर के अनेक संतों के पद संग्रहित हैं। नानकदेव की यह अवधारणा ही कितनी आल्हादकारी है कि 'एक नूर ते सब जग उपज्यो.... ' यह सोचकर ही प्रसन्नता की अनुभूति होती है कि हम सबकी उत्पति किसी प्रकाश बिंदु से हुई है। इस विचार भर से एक गौरव   , एक दायित्व का बोध होता है।

हम बढ़ते हैं उत्तर प्रदेश की ओर और गौरवानुभूति होती है। स्वामी रामानंद (1299-1448) की प्रेरणा से जहाँ भक्ति आंदोलन को एक नया मोड़ मिलता है क्योंकि अब संत-भक्त अपनी रचनाएँ हिंदी में अथवा लोकभाषा में करना आरंभ करते हैं। अब संत साहित्य जनमानस तक पहुँचकर अपनी सार्थकता को प्राप्त करता है , इस क्रम में आते हैं कबीर , रैदास, धन्ना, पीपा, मलूकदास कोई वर्णभेद नहीं, कोई वर्गभेद नहीं संतों की वाणी सबको अंधकार से प्रकाश की ओर ले जाती है। यहाँ वल्लभाचार्य के शिष्यों के रूप में हमें अष्टछाप कवि प्राप्त होते हैं जिनमें प्रमुख हैं- कुंभनदास , सूरदास, कृष्णदास तथा परमानंद दास। इन कवियों के रचे कृष्णलीला के पदों से ब्रज भाषा का साहित्य समृद्ध होता हैं। संत तुलसीदास के साहित्यिक अवदान की चर्चा भला क्या किसी शब्दसीमा में संभव है। तुलसी साहित्य लोकमानस में गहरी पैठ लगाए हुए है और

विश्वविद्यालय के शोधार्थियों में भी एक प्रचलित विषय। हम सभी इस तथ्य से परिचित हैं कि ब्रिटिश राज में उत्तरप्रदेश तथा बिहार से मारिशस गए हज़ारों गिरमिटियों के जीवन में सांत्वना देने वाला यदि कोई तत्व था तो वह था रामचरितमानस का गुटका संस्करण। आधुनिक युग में दलित विमर्श के नाम पर यह भ्रांति फैला दी गई है कि दलित साहित्य तो वही है जो दलित लेखकों ने लिखा है। हमारे उच्चवर्णीय संतों ने भी सदा समता और बंधुत्व का संदेश दिया है। इस क्रम में बंगाल के चैतन्य महाप्रभु (१४८५-१५५३) का नाम हम अत्यंत श्रद्धा से लेते हैं जिन्होंने कहा- 'जेइ भजे सेइ बड़ो अभक्त हीं छार/ कृष्ण भजने नहिं जाति कुल विचार '। भावपक्ष के साथ कलापक्ष की भी एक उत्कृष्ट कृति है'कृत्तिवास रामायण। बांग्ला के आदिकवि कृत्तिवास (पंद्रहवीं शताब्दी) की इस रचना को बंगाल में वही स्थान तथा सम्मान प्राप्त है जो हिंदी प्रदेशों में 'रामचरितमानस को। भारत का एकमात्र प्रदेश बंगाल जिसके माथे पर उधर हिमशिखर हैं तो इधर चरण पखारता समुद्र भी। ऐसे ही प्रदेश में हो सकते हैं 'मनेर मानुष'के उपासक बावरे 'बाउल संत। असम में नव वैष्णव धर्म के प्रवर्तक शंकरदेव(1449-1568) तथा उनके शिष्य माधवदेव (1489-1596) के शास्त्रीय रागों पर आधारित प्रार्थनापरक बरगीतों ने असामिया साहित्य को एक नया आयाम दिया तथा जनमानस को भक्ति की ओर प्रेरित किया इन्हींके समकालीन संत हरिदेव (1426-1566) तथा भट्टदेव (1558-1638) को उनके ईश्वरभक्तिपूर्ण गद्य साहित्य हेतु जाना जाता है।

महाराष्ट्र में जैसे संत 'पंचायतन' (ज्ञानदेव , नामदेव , एकनाथ , तुकाराम, समर्थ रामदास) हैं वैसे ही ओड़िशा में हैं 'पंचसखा बलरामदास, अतिबड़ि जगन्नाथदास, अच्युतानंददास, अनंतदास एवं यशोवंतदास और है जयदेव जो हमारे लिए गीत गोविंद 'के पर्याय हैं।'पंचसखा भक्तों ने उस काल में अपने जाति सूचक विशेषण हटाकर एक साहसिक निर्णय लिया था। भक्ति साहित्य में तमिल का योगदान विशिष्ट माना जाता है क्योंकि यहाँ छठी शताब्दी से ही लोकभाषा में भक्ति की धारा प्रवाहित होने लगी थी। नायंमार कहाए जाने वाले शैवसंत तथा आलवार कहाए जाने वाले वैष्णव संतों के साहित्य से यह पवित्रभूमि समृद्ध हुई है। 'श्री संप्रदाय 'के प्रणेता श्री रामानुजाचार्य (1017-1137) के 'श्री भाष्य, वेदांत सार' 'वेदांत दीप' आदि ग्रंथ हमारी साहित्यिक धरोहर हैं। कर्नाटक में संत पुरंदरदास तथा (१४८४- १५६४) तथा कनकदास की वाणी गूँजती है तो केरल में हैं चौदहवीं तथा पंद्रहवीं सदी के निरमण और चेरूशेरी नंबूतिरि। महाराष्ट्र के समर्थ रामदास राष्ट्रीय संत कहलाए और गुरूनानक से १००-१५० वर्ष पूर्व नामदेव(जिनके 60 पद गुरु ग्रंथसाहिब ' में

सुशोभित हैं) ने ज्ञानेश्वर के अनुरोध पर पंजाब में लगभग बीस वर्ष तक अपने पदों के माध्यम से धार्मिक जागरण का कार्य कर आने वाले समय के लिए एक पूर्वपीठिका तैयार की। गुजरात में कृष्ण भक्ति की धारा में बहे नरसिंह मेहता से लेकर दयाराम तक सबने गुजराती साहित्य को समृद्ध किया। मध्यप्रदेश की बात करते हैं तो संत सिंगाजी के भजन और संत घासीदास के सतनाम का स्मरण हो उठता है। राजस्थान हमारे लिए मीरा , दादूदयाल, संत पीपा और धन्ना के भजनों का पर्याय है। इस भक्तिधारा में सूफ़ी संतों , मुसलमान रामभक्तों और कृष्णभक्तों की एक उल्लेखनीय श्रृंखला है जिसके अंतर्गत अमीर खुसरो , रसखान, शेख महम्मद , बाबा फरीद, ताज बीबी और मलिक मुहम्मद जायसी आदि हैं जिन्होंने भारतीय संत साहित्य को समृद्ध किया हम भी उनके प्रति अपना सम्मान भारतेन्दु हरिश्चंद्र के शब्दों में प्रकट करते हैं, 'ऐसे मुसलमान हरिजन पर कोटिन हिंदू वारिए '। इसमें बौद्ध भिक्षुक-भिक्षुकाओं द्वारा प्रणीत थेर तथा थेरी गाथाएँ भी हैं और हैं जैन मुनियों-साध्वियों रचित विपुल साहित्य जो हमें प्रगति तथा अपरिग्रह की ओर ले जाता है।संतों के साहित्यिक अवदान की यह चर्चा अधूरी होगी यदि इसमें 1980 में शॉकन बुक्स, न्यूयार्क द्वारा प्रकाशित अलिकि तथा विलिस बार्नस्टोन द्वारा संपादित पुस्तक ' बुक ऑफ विमिन पोएट्स ' फ़्राम एंटिक्विटी टू नाऊ' का उल्लेख न किया जाए जिसमें लगभग 52 देशों में बोली जाने वाली 60 भाषाओं की 274 कवयित्रियों के संक्षिप्त परिचय के साथ उनकी कुछ रचनाओं के अंग्रेजी अनुवाद प्रकाशित किए गए हैं। हमारे लिए गौरव का विषय है कि इस संग्रह में संस्कृत, तमिल, तेलुगू, कन्नड ,कश्मीरी, पालि, हिंदी, मराठी की कुलजमा 16 भारतीय कवयित्रिओं का समावेश है जिनमें हैं संतकवियात्रियाँ - आंडाल, महादेवी, मुक्ताबाई, जनाबाई, मीराबाई तथा लल्लेश्वरी।

वेदों से शुभारंभित नाथपंथ के मार्ग से होता हुआ आदि शंकराचार्य से लेकर स्वामी विवेकानंद तक का हमारा संपूर्ण संत साहित्य स्वर्णिम साहित्य है जो किसी एक समय या भाषा या क्षेत्र तक सीमित नहीं है परंतु हमारी सीमा में उस पर समग्र रूप से चर्चा संभव नहीं है। हम अपने सभी संतों के सामने , उनके साहित्यिक अवदान के सामने, साहित्य के माध्यम से उन्होंने हमें जो वैभव दिया उसके सामने नतमस्तक हैं। हर कवि संत नहीं होता परंतु हर कवि कहीं न कहीं भक्त तो होता ही है। हम अपने लिए गुजराती कवि हरिहर भट्ट (1885-1978) के शब्दों में इतना भर माँगते हैं- 'एकज दे चिंगारी महानल ! एकज दे चिंगारी ....!'

लेखिका म.प्र. में जन्मी **तथा** एम.ए.(अँग्रेजी साहित्य) में शिक्षा प्राप्त कर थोड़े समय तक म.प्र. के शासकीय महाविद्यालयों में व्याख्याता के रूप में कार्यरत रहीं, तत्पश्चात बड़ौदा में स्थायी. आपको मराठी, हिंदी, अँग्रेजी, उर्दू तथा गुजराती का **भाषा ज्ञान है**.आपने 'अपनी-अपनी धूप(काव्य संग्रह) तथा 'पक्षी उड़ आयेंगे (महेंद्रसिंह जाडेजा के गुजराती काव्य संग्रह का हिंदी अनुवाद), 'जेता' (कर्ण के अंतिम समय पर आधारित काव्य नाटक तथा 'एमिली डिकिंसन की कविताएँ (अनुवाद संग्रह) प्रकाशित किये हैं . हिन्दी की लगभग सभी प्रतिष्ठित पत्रिकाओं में लेख, समीक्षाएँ व कविताएँ प्रकाशित हैं । आप साहित्य परिक्रमा' (अखिल भारतीय साहित्य परिषद न्यास की ग्वालियर से प्रकाशित त्रैमासिक पत्रिका) की **संपादक** एवं हिंदी सलाहकार समिति, इस्पात मंत्रालय की **सदस्य हैं, तथा** पूर्व में हिंदी सलाहकार समिति, रेलवे मंत्रालय की**सदस्य रहीं हैं**.
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Plasma Gasification: Fast Emerging and Pioneering Technology in Waste Management

Aarti Sharma

We all know that environmental responsibility is vital to protecting our planet's future .Energy from waste has been in recent years the focus of many developing nations that are serious about tackling mounds of trash while simultaneously solving energy crisis by creating energy from waste which would otherwise be sent to landfill . But just why is waste to energy important? There's so much more to it than just satisfying environmental objectives and energy goals.

What is waste to energy?: Waste to energy is the process of creating energy (that can be used as heat or electricity) from waste materials, more commonly called municipal solid waste (MSW). This treatment is a form of energy recovery, and the process actually helps to minimise waste too. What cannot be used in energy recovery will be sent to landfill thereby minimising load on saturated landfill sites .

Technology that is in Sync with UNDP Sustainable Goal No 7 – ensure environment sustainability

Need for widespread promotion of waste to energy technology also arises as it helps in achievement of UNDP Goal 7 for sustainable development which stresses the importance of clean , reliable , affordable and sustainable technology .
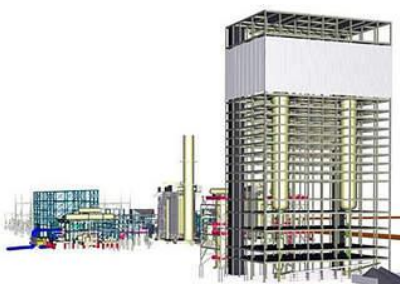
Plasma Gasification Technology: Plasma gasification is a fast developing Waste to Energy Technology and perfect way to divert MSW from landfill and produce valuable by-products. This emerging technology can process landfill waste to extract commodity recyclables and convert carbon-based materials into fuels. It can form an integral component in a system to achieve zero-waste and produce renewable fuels, whilst caring for the environment.

Utilizing this technology to convert municipal solid waste (MSW) to energy is still in nascent stage , but it has great potential to operate more efficiently than other combustion systems due to its high temperature, heat density, and nearly complete conversion of carbon-based materials to syngas, and non-organics to slag.

Working ofPlasma gasification process: Gasification has a long history in industry where it has been used to refine coal and biomass into a variety of liquid fuels, gases and chemicals.

Plasma gasification is a multi-stage process which starts with feed inputs ranging from waste to coal to plant matter, and can include hazardous wastes. The first step is to process the feed stock to make it uniform and dry, and have the valuable recyclables sorted out. The second step is gasification, where extreme heat from the plasma torches is applied inside a sealed, air-controlled reactor. During gasification, carbon-based materials break down into gases and the inorganic materials melt into liquid slag which is poured off and cooled. The heat causes hazards and poisons to be completely destroyed. The third stage is gas clean-up and heat recovery, where the gases are scrubbed of impurities to form clean fuel, and heat exchangers recycle the heat back into the. The final stage is fuel production the output can system as steam range from electricity to a variety of fuels as well as chemicals, hydrogen and polymers.

Economics Behind Plasma Gasification : The economics of MSW plasma gasification are encouraging. Waste gasification facilities get paid for their intake of waste. The system then earns revenues from the sale of power produced. Electricity is the primary product today, but liquid

fuels, hydrogen, and synthetic natural gas are all possibilities for the future.

Sorting the MSW to capture commodity recyclables, such as metals and high-value plastics, presents a third revenue stream. Minor revenue sourcesinclude the sales of slag and sulphur. Slag has the potential to be used for a number of construction products, and sulphur has some commodity value as fertilizer.

Additional costs are avoided by diverting waste from landfills and minimizing transportation of waste. Government subsidies for renewable energy or carbon credits may be substantial in the future, but are difficult to project.

Advantages of Plasma Gasification

1. **Improved Waste Management:** Gasification is superior to landfilling MSW in many ways . Landfills are toxic to the environment due to the production of toxic liquid leachate and methane gases. Plasma gasification can divert waste from landfills and create beneficial uses for the material, by maximizing recycling and cleanly using the rest for fuel.

2. **Superior to Incineration :**Incinerators are high-temperature burners that use the heat generated from the fire to run a boiler and steam turbine in order to produce electricity. During combustion, complex chemical reactions take place that bind oxygen to molecules and form pollutants, such as nitrous oxides and dioxins. These pollutants pass through the smokestack unless exhaust scrubbers are put in place to clean the gases.Gasification by contrast is superior to incineration a low-oxygen process, and fewer oxides are formed. For combustion systems, the smokestack scrubbers offer no operational benefit and are put in place primarily to meet legal requirements. Plasma gasification systems employing proper scrubbers have extremely low emissions and no trouble meeting and beating the most stringent emissions targets.

3. **Electricity production is superior to that from incinerator combustion :** Incinerators typically use the heat from combustion to power a steam turbine to produce power. Gasification systems can use gas turbines that are far more efficient, particularly when configured in integrated gasification combined cycle mode (IGCC). Just as IGCC is the state-of-the-art in producing power from coal, the same is true when using MSW as the fuel source.

4. **Carbon impact :** The carbon impact of plasma gasification is significantly lower than other waste treatment methods. It is rated to have a negative carbon impact, especially when compared to allowing methane to form in landfills. Gasification is also an important enabling technology for carbon separation. It is primarily a carbon processing technology; it transforms solid carbon into gas form.

Conclusion : Plasma gasification of MSW is a fairly new application that combines well-established sub-systems into one new system. The sub-systems are waste processing and sorting, plasma treatment, gas cleaning and energy production. The integration of these systems is rapidly maturing, but has still not been built in large industrial systems. Demonstration and pilot-scale systems are running successfully in Japan and Canada with more starting in the US and Europe.

Plasma gasification of waste can be part of the solution to both problems. Using toxic waste materials, as feed stocks for producing renewable fuels, transforms liabilities into assets.

As a municipal or publicly funded operation, a waste gasification plant can help balance budgets and provide a hedge against future increases in energy prices. The complexity and expense make plasma gasification a challenge for private investors and for municipalities.

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मानवीय मूल्यों से समन्वित अध्यापक शिक्षा की आवश्यकता

सीमा फाटक

साविद्या या विुक्तये शिक्षा वही है जो मुक्ति प्रदान करें। इस तरह शिक्षक मुक्ति मार्ग का पथ प्रदर्शक होता है, शिक्षक देश के भावी कर्णधारों अर्थात् युग निर्माता की भूमिका अदा करता है बीज जितना पुष्ट होगा पौधा भी उतना ही पुष्पित व पल्लवित होगा विद्यार्थियों में ज्ञान के बीज का अंकुरण शिक्षक ही करता है। चाहे वह माता की भूमिका में हो या शिक्षण संस्थानों में कार्यरत अध्यापकों के रूप में हो शिक्षा के अंग में उभरते नए आयोजन और मानवीय मूल्यों की महत्ता को दृष्टिगत रखते हुए आज शिक्षकों के प्रशिक्षण में गुणात्मक उन्नयन की आवश्यकता को महसूस किया जा रहा है ताकि शिक्षक शिक्षण अधिगम प्रक्रिया में अन्तर्निहित मूल्यो की महत्ता को आत्मसत् करते हुए व्यवसायिक सोच के समुचित दायरे से बाहर निकलकर देश के एक जिम्मेदार नागरिक की भूमिका का निर्वहन कर सके। सूचना एवं प्रौद्योगिकी के भौतिकतावादी युग में दुतगामी से होने वाले आधुनिक औद्योगिक विकास, विभिन्न संसार माध्यमों के 46 वें आकर्षण एवं प्रभाव तथा जनसंख्या विस्फोट एवं नगरीकरण के कारण न केवल मानव की जीवन शैली प्रभावित हुई है, बल्कि मानव मूल्यों के संकट की स्थिति भी चुनौती के रूप में दस्तक दे रही है। सामाजिक जीवन में समस्तता के स्थान पर विषय की स्थिति जन्म ले रही है जिसके कारण निर्धनों व निर्षलों का शोषण वर्चस्ववाले लोगों के द्वारा निरन्तर बढ़ता जा रहा है। बढ़ती स्वार्थ परता के कारण व्यक्ति अवसरवादी। आत्मा केन्द्रिय, चाटुकार तथा कर्तव्य बोध से विमुख ठोकर मानवीकरणयता से दूर होता नज़र आ रहा है। उसका प्रमुख कारण उसमें मूल्य चेतना का अभाव। यह स्थिति आज जीवन के विविध आयामों के रूप में चहुँओर व्याप्त है। भारतीय चिंतकों एक शिक्षा विदों के द्वारा व्यक्तित्व विकास के महत्वपूर्ण आयाम के रूप में स्थापित शिक्षा भी आज इसके प्रभाव से नहीं बच पाई है। भारतीय संस्कृति के संवाहक एवं राष्ट्रनिर्माता में प्रतिष्ठित शिक्षक की संकल्पना के समय आज मूल्यों के संकट की स्थिति अति विचित्र और सोचनीय रूप में दिखाई देती है। अपने ज्ञान के प्रकाश से विद्यार्थियों के व्यक्तित्व का निर्माण करने वाली शिक्षकों की प्रतिबद्धता अब स्थानांतरित होकर मध्याह भोजन की व्यवस्था और उसके वितरण तथा सरकारी प्रक्रियाओं की कागजी आपूर्ति तक सिमट कर रह गई है। अब बाल केन्द्रित शिक्षा का उद्देश्य उनके सामने मौन है। शासन द्वारा आबंटित किए गए कार्यों की कागजी प्रक्रिया को पूर्ण करना उनका प्राथमिक उद्देश्य बन गया है, क्योंकि वही उनके व्यवसायिक उन्नयन का माप दण्ड है। शिक्षण में नवसंचार गुणात्मक और मूल्य शिक्षा जैसे शब्द सिर्फ शैक्षिक सरकारी योजनाओं और पुस्तकों में ही दिखाई देते है। उपयुक्त शैक्षिक प्रबंधन के अभाव और शिक्षकों की शिक्षण और कार्यों में बढ़ती संलग्नता के कारण न केवल शिक्षण अधिगम का गुणात्मक सार

प्रभावित हुआ है। बल्कि शिक्षा का मूल उद्देश्य बालक के व्यक्तित्व का सर्वांगीण विकास करना। केवल सपना बनकर रह गया है। इसके साथ ही शिक्षकों की शिक्षकीय अभिवृद्धि और मूल्यो पर भी इसका प्रभाव पड़ा है। आज उनमें सृजनात्मक चिंतन की कमी तो होती जा रही है। साथ ही साथ शिक्षक बनने का आत्म सम्मान भी पा्रप्त हो रहा है। शिक्षकों से बात करने पर अक्सर यही सुनने को मिलता है। कि नौकरी करना ताकि हर महीने वेतन मिलता जाए। इसी सिमित सोच के साथ अधिकांश लोग शिक्षक बन रहे है। सामान्यतः देखा जाए तो शिक्षा के हर स्तर पर अधिकांश रूप में शिक्षकों की यही धारणा देखने को मिलती है। अपने दायित्व बोध के स्थान पर वह नौकरी की सुरक्षा और प्रतिमाह मिलने वाले वेतन के प्रति ज्यादा सजग दिखाई देते है। प्रतिमाह मिलने वाले वेतन के अतिरिक्त वह अपने शिक्षकीय कौशलो के अनुप्रयोग और वाकपदुम से कितना अधिक धनोपार्जन कर सकते हैं, इस पर अन्य सतत् चिंतन चलता है।

शिक्षकों के द्वारा दिए जाने वाले हर विषय का ट्यूशन और कोचिंग संस्थानों की सतत् अभिवृद्धि इस बात का प्रमाण है कि भौतिक ग्रस्त बाजारू संस्कृति के प्रभाव ने शिक्षकों के अंदर भी धन कमाने की पिपासा को जन्म दिया है। स्वार्थग्रस्त शिक्षकों पर टिप्पणी करते हुए रविन्द्रनाथ टैगोर ने कहा है कि आज के शिक्षक दुकानदार हैं, विद्यादान उनका व्यवसाय हो गया है। इसलिए वे खरीदार की खोज में फिरते रहते हैं। व्यवसायियों से लोग चीजें खरीद सकते हैं, पर उनके यहाँ बिक्रि की चीजों की सूची में स्नेह, श्रद्धा, निष्ठा आदि हार्दिक गुण भी रहेंगे ऐसी आशा कोई नहीं कर सकता। इस आशा के अनुसार ही शिक्षक लोग वेतन लेते है। और विद्या वस्तु बेचते है। यहीं पर विद्यार्थियों के साथ उनका सारा संपर्क समाज हो जाता है। ऐसी प्रतिकूल परिस्थिति में अनेक शिक्षक जो लेन-देन के संबंध से उपर उठ पाते है। वे केवल अपनी निजी विशेषता के फलस्वरूप गुरूदेव के उपर्युक्त विचारों से स्पष्ट है कि आज शिक्षा में जो मूल्यों के संकट की स्थिति दिखाई दे रही है। उसके तमाम कारणों में से एक प्रमुख कारण यह भी है कि समाज का पथप्रदर्शक गुरू अपने कर्तव्य और सामाजिक दायित्व से भटक गया है। अब सिर्फ नौकरी के लिए लालयित पेशेवर शिक्षक शेष रह गये है। शिक्षकों का निर्माण करने वाली शिक्षक प्रशिक्षण संख्याएँ भी आज अपने मूल उद्देश्यों से भटक गई है। अधिकांशतः स्ववित्तपोषित शिक्षक प्रशिक्षण माहविद्यालयों की स्थापना के उद्देश्यों के पिदे वहाँ के संचालकों की अधिक से अधिक धन कामाने की व्यावसायिक दृष्टि दिखाई देती है। शिक्षकों के गुणवत्तायुक्त कार्यक्रम की योजना सिर्फ कागज़ों में ही पिरलक्षित होती है। भावी शिक्षकों में समय के प्रति प्रतिबद्धता, अध्ययापन के प्रति अभिरूचि और निष्ठा, कर्तव्य बौध,

नौतिक, आचार-विचार, श्रमशीलता, ईमानदारी, संवेदनशीलता, चारित्रिक व्यवहार और श्रेष्ठ चिंतन जैसे मूल्यों के विकास के प्रति ये संस्थाएँ न तो सजग है और न ही संकल्पित दिखाई देती है। प्रवेशार्थियों से एक मोटी रकम लेकर उन्हें डिग्री प्रदान करना ही उद्देश्य बन चुका है। परिणामतः शिक्षक प्रशिक्षण संस्थानों में स्वयं ही नैतिक मूल्यों की कमी है। स्वयमेव उनसे अच्छे शिक्षक निर्माता की उम्मीद कैसे की जा सकती है? अतः यह स्थिति आज संपूर्ण शिक्षा सत्र के लिए स्वयं ही एक प्रश्नचिन्ह बनकर रह गई है।

शिक्षक प्रशिक्षण माहविद्यालयों में मान्यता प्रदान करने वाली राष्ट्रीय अध्यापक शिक्षा परिषद को भी इस दिशा में पुनर्विचार और चिंतन की आवश्यकता है। इसके अतिरिक्त शिक्षाविदों, शिक्षक प्रशिक्षण महाविद्यालयों। संस्थाओं से जुड़े शिक्षक प्रशिक्षकों ;ज्मंबीमतए म्कनबंजवते तथा सुंमद्ध प्रशासकों को भी इस दिशा में सकारात्मक चिंतन के साथ सार्थक प्रयास करने होंगे तभी अध्यापक शिक्षा के समक्ष उत्पन्न मूल्यों के संकट की स्थिति को दूर किया जा सकता है।

लेखिका हैं एवं पिछले वर्षों से शिक्षक के रूप में कार्यरत हैं. प्रकृति, कला एवं शिल्पकारी उनकी रूचि है
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आज के शिक्षक व विद्यार्थी भारतीय संस्कृति ;सदाचार एवं नैतिक मूल्यद्ध को आत्मसात् करने के बजाएँ भौतिकता के आकर्षण के पिदे भागते दिखाई देते हैं। अतः आवश्यकता इस बात की है कि प्रारंभ से बालकों में अच्छी आदतों, संस्कारों एवं मानवीय मूल्यों को समावेशित करने का प्रयास किया जाए। शायद इसी आवश्यकता के महसूस करते हुए महान शैक्षिक विचारक जे. कृष्णमूर्ति एक ऐसी शिक्षा व्यवस्था की आधार शिला रखने को कृत संकल्पित हुए जो विद्यार्थी को वास्तविकता का बोध कराते हुए। प्रेम, करूणा, प्रज्ञा, संवेदनशीलता व अंतः इस आदिगुणों से युक्त बनाए।

मानवीय मूल्यों से समन्वित शिक्षा की परिकल्पना के द्वारा वह बालकों का व्यक्तित्व निर्माण करना चाहते थे। बालकों के व्यक्तित्व निर्माण में नैतिकता का संकट अस्तित्व का भी संकट है। यदि मानव अपने को नैतिक बना सकेगा तो उसका अस्तित्व कायम रहेगा। नैतकता का कोई स्त्रोत बनाना है यानि उसे ढूँढना नहीं है। उसे बनाना है।

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Real Role Of Teacher?

D.V.S.Durga Prasad

I have really fed up with the present system of teaching being happened in the class rooms. I can't digest why the teacher is ignoring the student's role in the learning process in the class room. Here I want to recall a good saying by Gauthama Buddha.

"Do not believe what your teacher tells you merely out of respect for your teacher."

I am more worried about the teacher's role in the teaching-learning system. The teacher should act as a guide, mentor or facilitator to the student. He / she should provide a chance to the student to learn a new thing by experimenting or exploring. Students should question teachers about existing norms now and then. The teacher need to make his /her children independent thinkers. A child will be able to respond in real-life situations - that are bound to come in their future life. The teachers' role in this contemporary world is to act as a mediator. Areas like literacy and numeracy, cognitive skills, social emotional skills can only be taught using an active learning process.

In this high-paced world, the most important skill that needs to be imparted among children is critical thinking and problem-solving. Encouraging the children to question is the right way to go about it. Teacher is neither the judge in the court nor a police man. They are to motivate them to approach self-learning. He /she should make the child ambitious in life. Like a potter, it's the duty of the teacher to give a definite shape to a child's mind and enhance his /her curiosity quotient. This is possible if we encourage them to question, rather than become just listeners because the respected teacher is speaking. It's quite against to the saying of Buddha which I quoted above.

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दीप जलाओ ज्ञान का ...

मृणालिनी घुळे

दीप जलाओ ज्ञान का, दया करो हे नाथ

अंधियार का नाश हो, सदा उजाला साथ।

तारे सारे गगन के,हैं धरती पर आज

धरा और आकाश में है प्रकाश का राज।

सदा सर्वदा ही रहे,शैशव मुख पर हास

ऐसे दीप जलाइये,कोई न हो उदास।

दीपक छोटा ही सही,साहस बड़ा अपार

वही अकेला हर सके,तम का पारावार।

दीप जलाओ तो मिटें,आपस का कटु भाव

प्रेम भाव से मिट सकें,मन के सारे घाव।।

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 |
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विज्ञान -

डॉ. संगीता पाहुजा

विज्ञान देता हर विषय का विस्तृत ज्ञान
हर विषय को आगे बढ़ाता विज्ञान।

अन्धविश्वास को दूर भगाता विज्ञान ।
यथार्थ के धरातल का प्रतिबिंब है विज्ञान।

सब तथ्यों को तर्कसंगत बनाता विज्ञान।
हर क्यों का उत्तर है विज्ञान।
बुद्धि के अन्धकार को मिटाए विज्ञान।
सत्य से परिचित करवाए विज्ञान।

हर दुविधा की सुविधा में बदले विज्ञान
जल,थल नभ के रहस्यों को अनावृत करे विज्ञान।
यथार्थ के धरातल का प्रतिबिंब है विज्ञान ।

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,
E-mail: sangeeta.pahuja3@gmail.com

—00—

"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

Students' Section

Collection of Atharv Ghule,, a student of Classs 5, Choithram School Indore. His keenness to creative drawing and using junk, anything around him, surfaced at the age of 10.
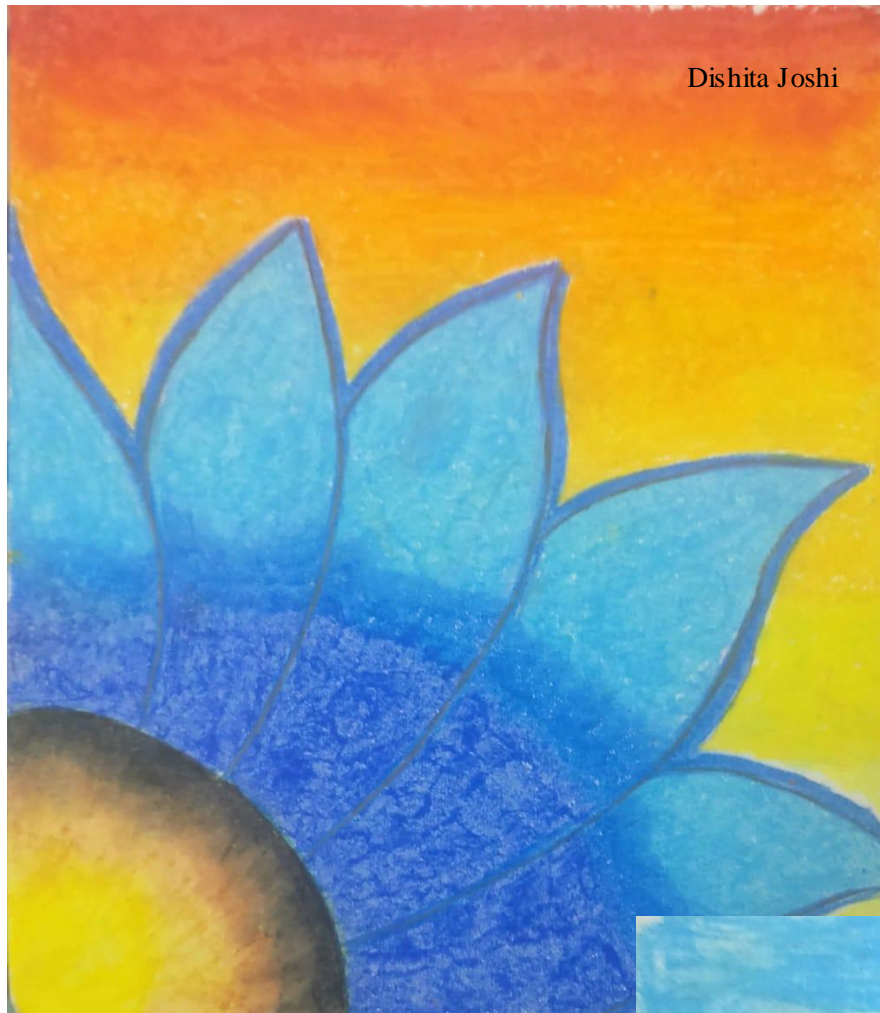
His favourite pass time is to design planes and crafts

His diversified interests

A project on "SAVE MOTHER EARTH"

PUSH A PEDAL TO SAVE EARTH

Dishita Joshi

Anura Joshi

Anura and Dishita Joshi are studying in Upper KG and class Viith respectively in The Khaitan School, NOIDA

Magic of Words

K. S. S. Vishnu Priya

Once upon a time there lived a man. One day he was going home through the forest. He got tired and he sat under a big tree. Suddenly he heard some sounds like 'cut them, kill them, eat them' . He f\became fearful. These words were said by a parrot. It was living with a hunter and so he learned bad words from him. The man ran away. After some time he heard a voice like 'sir please take rest in our ashramam, our ashramam is near to this forest, sir please come in.' These words are from another parrot. He went to the ashramam and took rest. There were a few swamijis in the ashramam. The man shared his experience till now what happened in the forest with one swamiji. After hearing the words the swamiji said that the parrot had been living with a bad person so it had learned bad words from him. The two parrots are brothers. They were separated in their childhood. The big parrot learned bad words and the small parrot learned good words. It depends on the environment in which we live.

Moral : Bad or good it will depend on the persons along with us.

The presenter is a students of Class 9ᵗʰ, at Ramakrishna Mission School, Sithanagram, AP. She is attending IOMS sessions hosted by the school.

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Hearing vs listening

Dishita Joshi

Have you ever thought if hearing is different from listening? They might appear similar or synonyms, but they are altogether different. Hearing is the faculty of perceiving sounds, whereas, listening is paying attention to a sound. We hear everything that is going around us based on the human hearing abilities – irrespective of whether we want to hear that or not. Hearing is not selective, and every sound that falls on our eardrum gets perceived by our brain.

On the other hand, listening is the specific activity of paying attention to a specific sound. Our mind takes a conscious decision to selectively focus on some sounds and process them. It could be listening to a song to get the mind relaxed or listening to instructions from our teachers or parents and focus on what has been told.

For example, when we visit a zoo, we hear all the sounds of animals without paying any specific attention. However, when our mother or teacher is talking to us, we are not just hearing but listening to them, understanding what has been told, and memorizing their instructions for future.

So, as students, we must make sure that we listen to right things among the various sounds in our surroundings so that we gain the right knowledge while growing up. However, we should also learn to avoid listening to negative thoughts around us and should filter everything that we hear. Apart from this, we should also learn to make a judgement to choose the people we should listen to. For example, there may be strangers whom you may choose not to listen and on the other hand, listen to your well-wishers.

She is a student of class VII in The Khiatan School, Noida, Her hobiies are vocal music, drawing and painting and playing lawn tennis

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—00—

Cleanliness

G.V.S. MEGHANA

Cleanliness is a most important and good quality. It is must to be followed by every human being to be healthy and happy all through the life. People with dirty habits always become unhappy and suffer many infectious diseases. However people with cleanliness habit become happy and healthy in their life. We need to maintain the habit of cleanliness accordingly with the progress of civilization. We need to keep our body, mind and spirit clean every time to remain away of the problems. The habit of cleanliness can be practiced better at home in the guidance of our parents and at school in the guidance of our teachers.

Cleanliness is very essential for our life as it benefits us in many ways.It is necessary for maintaining self-respect, getting confidence and getting respect from others. People who live in dirt never get confidence and self respect. Cleanliness helps people get lots of respect and popularity. It helps people living closer to the divinity and has fear from the God. It indicates the standard and character of a man. In order to follow cleanliness all across the life, one needs to acquire clean habits from childhood onwards. It not only keeps us healthy but also improves our confidence level in various fields. Just keeping our bodies and limbs clean, we can be free of many kinds of diseases. We should take care of the cleanliness

while making food, eating food, taking bath, cleaning dishes, cleaning home and other surrounding areas. Cleaning our bodies regularly make our complexion brighter which enhances our confidence level. We feel happy, fit and smart if we wear clean clothes. It gives us a peaceful and cheerful mind which brings us closer to the divinity. We should maintain cleanliness everywhere whether at home, office, school or other places. We should always take part in the activities related to the cleaning habit for better understanding. There are various ways we can keep ourselves neat and clean properly in daily life. We should teach our neighbors and other illiterate people to be neat and clean. We should keep our kitchens and toilets very clean as they are the source of various infectious diseases. Cleanliness is the matter of fact without which no one can be happy and healthy.

Cleanliness is Next to Godliness

Author is a student of Class 10th at Ramkrishna Mission High School, Sitanagram, Distt. Guntur, AP. She is a regular student of IOMS being held at the school. Shehas been attending IOMS at school since class 9th.

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—00—

Answers to Science Quiz : Oct'18

Kumud Bala

1. (b)	2. (d)	3. (c)	4. (a)	5. (d)	6. (c)	7. (c)	8. (a)	9. (c)	10. (c)
11. (c)	12. (c)	13. (d)	14. (b)	15. (a)	16. (c)	17. (c)	18. (a)	19. (b)	20. (d)
21. (d)	22. (a)	23. (a)	-	-	-	-	-	-	-

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BE HONEST….

N. Kamalesh

Honesty is the best policy is the phrase that signifies the value and importance of being a truthful person. It is one of the universally recognized and accepted sayings. Honesty is the most admirable and appreciated characteristics that a person can have. It is the virtue that is embedded in us by parents and teachers from our childhood.

We learn to be honest as we grow by watching parents, teachers and other people around us. Dishonesty is the sign of cowardliness and will gain you money and power but it will last for a short time. Honesty is the sign of strength and gives you long term benefits. An honest person is the one who will act as he says and thus is more trustworthy and reliable.

There will be more confusions and chaos in our society if everyone keeps lying and cheating each other. It is important to be honest in relationships to avoid creating misunderstandings and soreness in future. Being dishonest in a relationship is only going to make you happy for short term. For example, if everyone scores great marks by cheating in exams rather than studying hard, there will be no importance of having knowledge. Or if we fake degrees and mark sheets and get jobs then there will be no importance of hard work and it would lead to inefficient work performance that might result in several adverse consequences.

We all know lying whether to parents, teachers or anyone else is wrong and at the end of the day the consequences of lying may adversely affect not only those we lie to but also to our self. So, it is always vital to be truthful in life and never lie or cheat anyone.

So in any aspect of life, it is important to be honest or it may seriously harm not only us but others as well. An honest person can lead a more confident and respectable life. The fruits of honesty can be enjoyed for long term and be cherished for life time

Author is a student of class X[th] at Ramkrishna Mission High School, Sitanagaram, Ditt. Guntur Andhra Pradesh. He is in Group Varahmihira, formed in Online Mentoring Sessions being held at the school. He has been attending IOMS at school since last One year.

Mail ID: varahamihirarkmsvja@gmail.com

—oo—

ANSWER: CROSSWORD PUZZLE Oct'18: Gyan Vigyan Sarita

Prof. S.B. Dhar

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GROWING WITH CONCEPTS - Mathematics

LET'S DO SOME PROBLEMS IN MATHEMATICS-III

Prof. SB Dhar

This article deals with problems from the section ***Theory of Equations***. Theory of equations is a very important segment for the competitive examinations. These questions contain concepts from all the branches of Mathematics. It may be assumed that these problems will be useful for the students who are either studying in 10+2 (Intermediate) Classes or aspiring for the prestigious Entrance Examination - JEE (Main) or IIT-Advanced.

1. **If α, β are the distinct roots of the equation $x^2-x+1=0$, then $\alpha^{101}+ \beta^{107}$ is equal to**
   (a) 0   (b) 1   (c) 2   (d) -1

   Solution:
   The discriminant is negative, hence $\alpha = -\omega$, and $\beta = -\omega^2$ i.e. $\alpha^{101}+ \beta^{107} = (-\omega)^{101}+(-\omega^2)^{107}$
   $-(\omega^2+\omega)=1$ as $1+\omega+\omega^2=0$ and $\omega^3=1$
   Option (b) is correct.

2. **The solution set of $S=\{x \in R : x \geq 0, 2|\sqrt{x} - 3| + \sqrt{x}(\sqrt{x} - 6) + 6 = 0\}$**
   (a) **contains exactly one element**

   (b) **contains exactly two elements**
   (c) **contains exactly four elements**
   (d) **is an empty set**

   Solution:
   Case I: assume $x \in [0,9)$
   $2|\sqrt{x} - 3| + \sqrt{x}(\sqrt{x} - 6) + 6 = 0\}$
   $\Rightarrow -2(\sqrt{x} - 3) + \sqrt{x}(\sqrt{x} - 6) + 6 = 0\}$
   x=16 or 4 but x lies between 0 and 9 hence x=4.
   Case II: assume $x \in [9,\infty)$
   $2|\sqrt{x} - 3| + \sqrt{x}(\sqrt{x} - 6) + 6 = 0\}$
   $\Rightarrow 2(\sqrt{x} - 3) + \sqrt{x}(\sqrt{x} - 6) + 6 = 0\}$
   x=16 or 0 but x lies between 9 and ∞, hence x=16.
   The values of x are 4 and 16.
   Option (b) is correct.

3. **If $f(x) + 2y\left(\frac{1}{x}\right) = 3x, x \neq 0$, then $f'(x)$ at x=1 is**
   (a) -1   (b) 0   (c) 1   (d) -3

   Solution:
   Rewrite the given equation as
   $f(x) + 2f\left(\frac{1}{x}\right) = 3x$....(i)
   replace x by $\frac{1}{x}$ and rewrite it as

$f\left(\frac{1}{x}\right) + 2f(x) = 3\frac{1}{x}$....(ii)
on eliminating $f\left(\frac{1}{x}\right)$
we get $f(x) = \frac{2}{x} - x$
on differentiation and putting value of x=1, the required answer can be found.
Option (d) is correct.

4. **The sum of all real values of x that satisfy the equation $(x^2 - 5x + 5)^{(x^2+4x-60)} = 1$ is**
   (a) 3   (b) -4   (c) 6   (d) 5

   Solution:
   Case I: $a^x=a^y \Rightarrow$ x=y if $a \neq -1,1,0$
   $\Rightarrow x^2+4x-60=0 \Rightarrow$ x=-10, 6
   Case II: if base is 1 i.e. $x^2-5x+5=0 \Rightarrow$ x=4,1
   Case III: if base is -1 then x=2,3 but x=3 does not satisfy the equation, hence x=2. So only 3 values are possible. Option (a) is correct.

5. **Let α and β be the roots of equation $x^2-6x-2=0$. If $a_n=\alpha^n- \beta^n$, for $n\geq 1$, then the value of $\frac{a_{10}-2a_8}{2a_9}$ is equal to**
   (a) 6   (b) -6   (c) 3   (d) -3

   Solution:
   Rewrite the given equation
   $x^2-6x-2=0$ as $x^{10}-6 x^9-2 x^8=0$ by multiplying both sides by x^8.
   α, β are the roots so,
   $x^{10}-6 x^9-2 x^8=0$ becomes
   $\alpha^{10}-6 \alpha^9-2 \alpha^8=0$ ...(i)
   $\beta^{10}-6 \beta^9-2 \beta^8=0$ ...(ii)
   From (i)-(ii)
   $(\alpha^{10}-\beta^{10})-6 (\alpha^9-\beta^9)-2(\alpha^8-\beta^8)=0$
   $\Rightarrow a_{10}-6a_9-2a_8=0$
   Simplify to get the correct option (c)

6. **If $a \in R$ and the equation $-3(x-[x])^2+2(x-[x])+a^2=0$ where [x] denotes the greatest integer $\leq x$ then all possible values of a lie in the interval**
   (a) $(-1,0) \cup (0,1)$
   (b) $(1,2)$
   (c) $(-2,-1)$
   (d) $(-\infty,-2) \cup (2,\infty)$

Solution:
Since, x-[x]={x}, fractional part
Rewrite the given equation as
$-3\{x\}^2+2\{x\}+a^2=0$
$\Rightarrow \{x\} = \frac{-2 \pm \sqrt{4+12a^2}}{-6} = \frac{-1 \mp \sqrt{1+3a^2}}{3}$
Apply 0≤{x}<1 and get $a \in (-1,1)$
a=0 gives integral solution hence a≠0
the correct option is (a)

7. **Let α and β be the roots of the equation $px^2+qx+r=0$, p 0. If p,q,r are in AP, and $\frac{1}{\alpha}+\frac{1}{\beta} = 4$, then the value of $|\alpha - \beta|$ is**
   (a) $\frac{\sqrt{61}}{9}$ (b) $\frac{2\sqrt{17}}{9}$

   (c) $\frac{\sqrt{34}}{9}$ (d) $\frac{2\sqrt{13}}{9}$

Solution:
$\alpha + \beta = -\frac{q}{p}$ and
$\alpha\beta = \frac{r}{p}$
Also p,q,r are in AP hence 2q=p+r ...(i)
From $\frac{1}{\alpha}+\frac{1}{\beta} = 4$
$\alpha + \beta = 4\alpha\beta \Rightarrow -\frac{q}{p} = \frac{4r}{p} \Rightarrow$4r=-q
$|\alpha - \beta| = \sqrt{(\alpha + \beta)^2 - 4\alpha\beta} = \frac{2\sqrt{13}}{9}$
The correct option is (d)

8. **The real number k for which the equation $2x^3+3x+k=0$ has two distinct real roots in [0,1]**
   (a) **lies between 1 and 2**
   (b) **lies between 2 and 3**
   (c) **lies between -1 and 0**
   (d) **does not exist**

Solution:
Let f(x)=2x³+3x+k
$\Rightarrow$ f'(x)=6x²+3$\Rightarrow x^2 = -\frac{1}{2}$ which is impossible for a real number.
The correct option is (d)

9. **If the equation $x^2+2x+3=0$ and $ax^2+bx+c=0$, $a,b,c \in R$ have a common root, then a:b:c is**
   (a) **1:2:3** (b) **3:2:1**
   (e) **1:3:2** (d) **3:1:2**

Solution:
The discriminant of the given first equation is negative. It means the roots are imaginary. So both the roots are common.
i.e.$\frac{a}{1} = \frac{b}{2} = \frac{c}{3}$
So the correct option is (a)

10. **If $f(x)=x^3-6x^2+11x-6$, then the value of $\frac{1}{x-1}+\frac{1}{x-2}+\frac{1}{x-3}$ is**
    (a) $\frac{f'(x)}{f(x)}$ (b) 0
    (c) f'(1) (d) None of these

Solution: f(0)=0 has roots 1,2,3 then the value of the given expression=f'(x)/f(x). The correct option is (a)

11. **The values of x for which the expression $6x^2-5x-4$ is negative is/are**
    (a) 1 (b) 2
    (c) 3 (d) None of these

Solution:
Rewrite the given expression as: (3x-4)(2x+1)
Obviously this will be negative for many values between -1/2 and 4/3.
The correct option is (d)

12. **The least positive integral value of a, if the equation $3x^4+4x^3-12x^2+5a=0$ has no real solution is**
    (a)5 (b) 6 (c) 7 (d) 8

Solution:
Assume
f(x)= 3x⁴+4x³-12x²
f'(x)= 12x³+12x²-24x
f'(x)=0$\Rightarrow$x=0,1,-2.
$\Rightarrow$f(0)=0, f(1)=-5,f(-2)=-32
Since f(x)+5a=0 has no real solution, hence

5a>32⟹a > 32/5=6
The correct option is (b)

13. **The total number of integral values of "a" for $x^2 + ax + a + 1 = 0$ to have integral roots is**
   (a)0   (b)1   (c) 2   (d) 3

Solution:
The discriminant:
$a^2-4(a+1)=(a-2)^2-8=k^2$ (say)
i.e. (a-2-k)(a-2+k)=8 (an even number)
the factors may be (1,8),(-1,-8),(2,4)(-2,-4).
Both factors on the left hand side may take each value and on simplification
"a" will have only 2 values -1 and 5.
The correct option is (c)

14. **The number of real solutions of $2^{x/2}+(\sqrt{2}+1)^x=(5+2\sqrt{2})^{x/2}$ is**
   (a)0   (b)1   (c) 2   (d) None of these

Solution:
Rewrite the given equation as
$(\sqrt{2})^x+(\sqrt{2}+1)^x=\{\sqrt{(5+2\sqrt{2})}\}^x$

$$\Rightarrow \left(\frac{\sqrt{2}}{\sqrt{5+2\sqrt{2}}}\right)^x + \left(\frac{\sqrt{2}+1}{\sqrt{5+2\sqrt{2}}}\right)^x = 1$$

$\Rightarrow (\cos\alpha)^x + (\sin\alpha)^x = 1$ which is true for x=2 and hence the number of solution=1.
The correct option is (b).

Dr S.B. Dhar, is **Editor of this Quartrerly e-Bulletin**. He is an eminent mentor, analyst and connoisseur of Mathematics from IIT for preparing aspirants of Competitive Examinations for Services & Admissions to different streams of study at Undergraduate and Graduate levels using formal methods of teaching shared with technological aids to keep learning at par with escalating standards of scholars and learners. He has authored numerous books of excellence.
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Education is a social process.
Education is growth.
Education is not a preparation for life;
education is life itself.

- John Dewey

www.DreamThisDay.com

CROSSWORD PUZZLE November'18: Festivals of India

Prof. SB Dhar
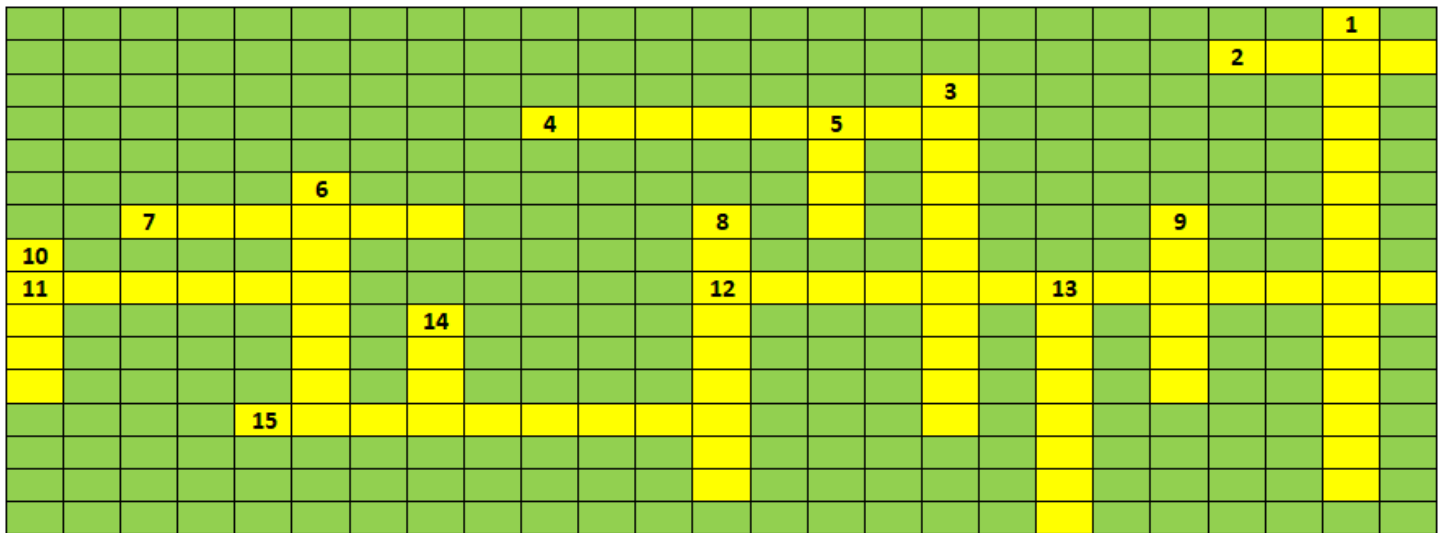
ACROSS

2 Welcoming the mighty Mahabali in Kerala

4 Witnessing of triumph of Good over Evil

7 Grand festival of light

11 Resurrection of Jesus Christ

12 Strengthening the bond of Kinship

15 Festival after the end of Ramdan

DOWN

1 Festival relating to Lord Ganesha

3 Birth of Lord Krishna

5 Vibrant festival of colours

6 Nine days of fasting

8 Birth day of First Sikh Guru

9 Harvest festival dedicated to Sun in Tamil Nadu

10 Celebration of the birth anniversary of Padmasambhava, in Ladakh

13 Harvest festival of Punjab

14 Dance, Music and laughter festival of Assamese

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Growing with Concepts : Physics   *Code: Phy/MRB-1/S/003*

Solving Subjective Problems – Mechanics of Rigid Bodies
(Center of Mass and Rotational Motion)

This set of subjective questions is in series with objective question on Mechanics of Rigid Bodies brought out in two preceding sets. This time subjective questions on Gravitation and Rotational Motion have been drawn from a compendium of questions that appeared in IIT-EE during 2013-1979 brought out by DC Pandey. Illustrations of the solutions of each question are based on our experience that students and mentors who might use it are remotely placed and may not be able to connect for any clarification that may be necessary. Accordingly, illustrations might be found getting too much into basics and at times tending to be from First-Principle. Readers at higher pedestal of conceptual clarity may like to bear with over elaborations, foster the benefits of deprived readers, and support the endeavour by extracting their needs and skipping steps considered to be redundant. This being a totally selfless initiative, need of deprived users has been overweighed. Moreover, series of question banks would be integrated on Mentors' Manual, posted on our website, as a free web-resource. This series of subjective questions on Mechanics of Rigid Bodies will follow with additional 1-2 sets, in successive bulletins.

It is reiterated that as study of mechanics progresses, higher degree of integration of concepts gets involved. These concepts would get more integrated as the journey enters into other topics of physics including electricity and magnetism. These subjective questions are for a drill to train mind of students to think out-of-box in an integrated manner and not a closed views as that with a blinder.

Subjective questions are generally framed beyond the complexity of objective questions. But, necessarily they are not always complex. They are however designed to test minute observation of student , clarity of concepts and ability to integrate different phenomenon. Accordingly, time and marks for questions are proportioned in examination. Therefore, during practice students are advised to refrain from adopting short-cuts and using direct formulae, and practice with basic steps. In process, they would reinforce their conceptual clarity, speed and accuracy. These attributes are a necessity for success in examination and growth in analytical intuition. It would give them higher speed of solving questions correctly.

We have benefit of response of students through their difficulties, doubts and question during Interactive Online Mentoring Sessions (IOMS) for students at remote and rural areas. This experience has been used to simplify and illustrate steps while evolving solutions. Footnote to the illustrations, wherever considered essential, has been brought out for clarity.

Another, important method of developing high intuitive skill is *group dynamics*, where students discuss, problems and solutions attempted individually, in groups and try to clarify concepts. Only in case of disagreement they consult their mentor. It not only enhances collective wisdom but also helps to evolve individual ability and group synergy; both the traits are important attribute of a good personality. This group dynamics is being integrated in learning and mentoring methodology of IOMS.

Possibility of inadvertent typographical errors is not ruled out. We would gratefully welcome suggestions for value addition and corrections, if needed.

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*Code: **Phy/MRB-I/S/003***

Mechanics of Rigid Bodies : Subjective Questions (Typical)
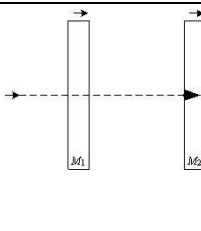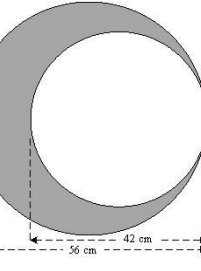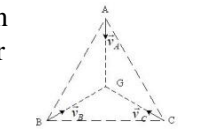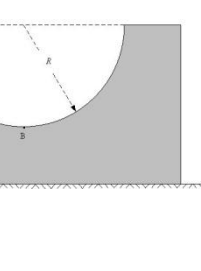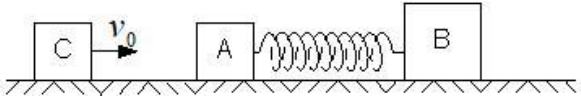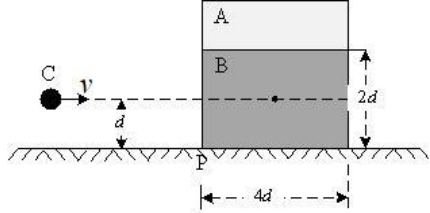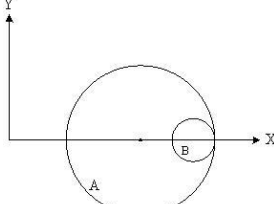
No of Questions: 35   **Time Allotted: 10 Hours**
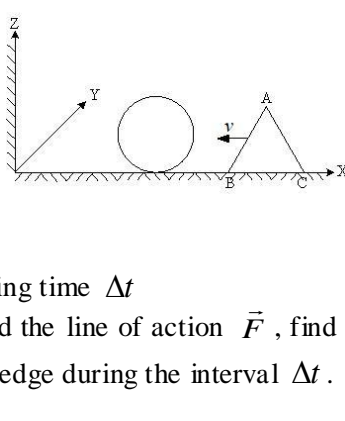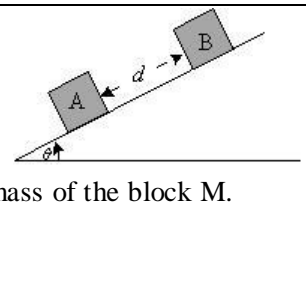
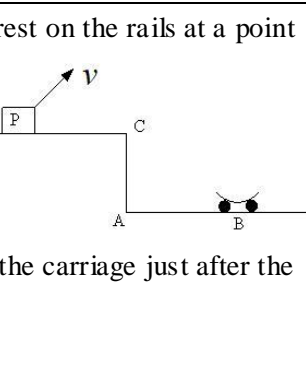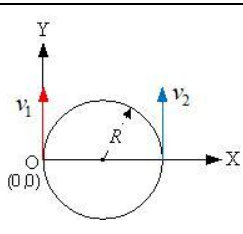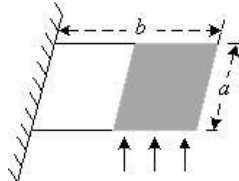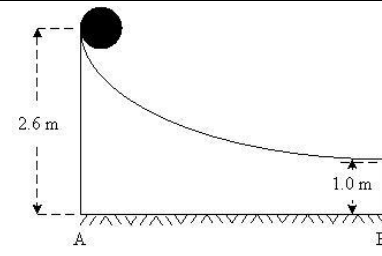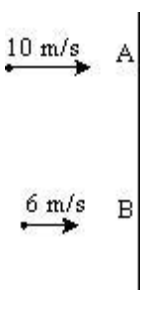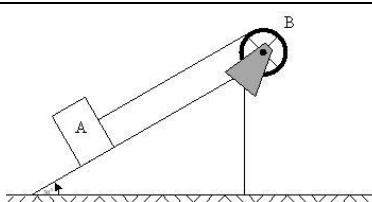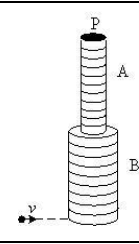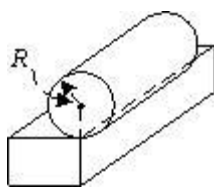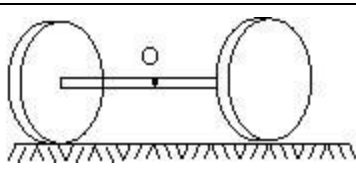**Don't Attempt All Questions in One Go, Split Them in Three Parts 10+10+15**

All questions are compulsory
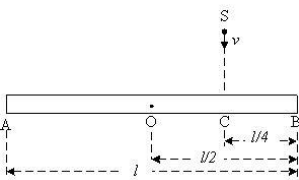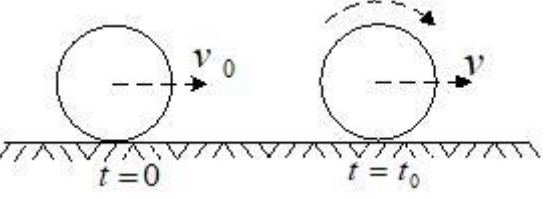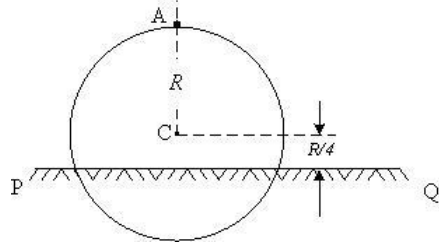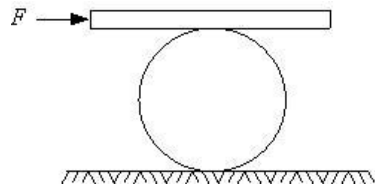
[Note: Figures are conceptual only and not to the scale]

Q-1	A body A of mass m moving with a velocity v in $x-$ direction collides with another body B of mass M moving in $y-$ direction with velocity V. They coalesce into one body during collision. Find- (a) The direction and magnitude of the momentum of the composite body. (b) The fraction of initial kinetic energy transformed into heat during collision
Q-2	When a ball is thrown up, the magntude of its momentum initially decreases and then increases. Does this violate the principle of conservation of momentum?
Q-3	A bullet of mass 20g pierces through a plate of mass $M_1 = 1\text{kg}$ and then comes to rest inside a second plate of mass $M_2 = 2.98\text{kg}$ as shown in the figure. It is found thst the two plates initially at rest now move with equal velocities. Find the percentage loss in the intital velocity of the bullet when it is between M_1 and M_2. Neglect any loss of matrial due to action of the bullet. Both plates are lying on smooth table.
Q-4	A circular plate of uniform thickness has a diameter of 56 cm. A circuar portion of diameter 42 cm is removed from one edge of the plate as shown in figure. Find position of the centre of the mass of the remaining portion.
Q-5	A body of mass 1 kg initially at rest, explodes and breaks into three fragments of masses 1:1:3. The two pieces of equal masses fly-off perpendicular to each other with a speed of 30 m/s each. What is the velocity of the heavier fragment?
Q-6	Three particles A, B and C of equal masses move with equal speed v along the median of an equvilateral traingle as shown in the figure. They collide at the centroid G of the triangle. After collision A comes to rest, B retraces its path with speed v. What is the velocity of C?
Q-7	A block of mass M with a semicircular track of radius R rests on a horizontal frictionless surface. A uniform cylinder of radius r and mass m is released from rest at the top point A, as shown in the figure. The cylinder slips on the semicircular frictionless track. Then – a. How far has the block moved when the cylinder reaches bottom (point B) othe track? b. How fast is the block moving when the cylinder eaches the bottom of the track?
Q-8	Two bidies A and B of masses m and $2m$ respectively are plaved on a smooth floor. They are connected by a spring. A third body C of mass m moves with a velocity v_0 along the line joining A and B and collides

elastically with A as shown in the figure. At certain instant of time t_0 after the collision, it is found that instantaneous velocities of A and B are the same. Further, at this instant the compression of the spring is found to be x_0. Determine – (a) Common velocities of A and B at time t_0, (b) The spring constant.

Q-9	A ball of mass 100 g is projected vertically upwards from the ground with a velocity of 49 m/s. At the same time another identical ball is dropped from a height of 98 m to fall freely salong the same path as followed by the first ball. After some time the two balls collide and stick together and finally fall to the ground. Find the time of flight. [Take $g = 9.8\,\text{m/s}^2$]
Q-10	A simple pendulum is suspended from a peg on a vertical wall. The pendulum is pulled away from the wall to a horizontal position. The ball hits the wall, the coefficient of restituition being $\dfrac{2}{\sqrt{5}}$. What is the minimum number of collisions after which amplitude becomes less than 60 degrees ? [Take vale of $g = 10\,\text{m/s}^2$]
Q-11	An object of mass 5 kg is projected with a velocity of 20 m/s at an angle of 60^0 to the horizontal. At the highest point of its path the projectile explodes and breaks up into two fragments of masses m_1 and m_2 equal to 1 kg and 4 kg, respectively. The fragments separate horizontally after collision. The explosion releases internal energy such that kinetic energy of the system at its highest point is doubled. Calculate the separation between the two fragments when they reach the ground. [Take $g = 10\,\text{m/s}$]
Q-12	A block A of mass $2m$ is placed on another block B of mass $4m$ which in turn is placed on a fixed table. The two blocks have same length $4d$ as shown in the figure. The coefficient of friction (both static and kinetic) between block B and table is μ. There is no friction between two blocks. Another object of mass m moving with a horizontal velocity v, along a line passing through COM of block B and perpendicular to its face collides elastically with it at a height d above the table. Find – (a) Minimum value of $v = v_0$ which will topple the block A, (b) If $v = 2v_0$, find distance of from the point P, at which the mass m falls on the table after collision. [Ignore friction during the collision]
Q-13	A uniform thin rod of mass M and length L is standing vertically along Y-axis on a smooth horizontal surface with its lower end at origin (0,0). A slight disturbance at $t = 0$ causes lower end to slip on the smooth surface along the positive X-axis, and the rod starts falling. Find – (a) Path followed by the centre of mass of the rod during its fall? (b) Equation of trajectory of a point on the rod located at a distance r from the lower end? (c) What is the shape of the point at (b)?
Q-14	A small sphere of radius R is held against the inner surface of a thin hollow sphere of radius $6R$. Masses of larger and smaller spheres are $4M$ and M respectively. This arrangement is placed on a horizontal table. There is no friction between any surfaces of contact. The smaller sphere is now released. Find the coordinates of the center of the larger sphere when smaller sphere reaches the other extreme position.

Q-15	A wedge of mass m and traingular cross-section (AB=BC=CA=$2R$) is moving with a constant velocity $-v\hat{i}$ towards a sphere of radius R fixed on a smooth horizontal table as shown in the figure. The wedge makes an elastic collision with fixed sphere and returns along the same path without any rotation. Neglect all friction and assume that the wedge remains in contact with the sphere for a very short time Δt during which the sphere exerts a constant force $\vec{F}$ on the wedge.
	(a) Find the force $\vec{F}$ and also the normal force $\vec{N}$ by the table on the wedge during time Δt
	(b) Let h denote the perpendicular distance between the COM of the wedge and the line of action $\vec{F}$, find the magnitude of the torque due to normal force $\vec{N}$ about the centre of the wedge during the interval Δt.
Q-16	A cylindrical solid of mass 10^{-2} kg and cross-sectional area 10^{-4} m^2 is moving parallel to its axis (X-axis) with a unform speed 10^3 m/s in the positive direction. At t=0, its front face passes the plane $x=0$. The region to the right of this plane is filled with stationary dust particles of uniform density 10^{-3} kg/m^3. When a dust particle collides with the face of the cylinder, it sticks to the surface. Assuming that the dimensions of the cylinder remains practically unchanged and that the dust encountered by the cylinder during travel sticks only to its front crss-sectional surface, find X-cordinate of the front of the cylinder at $t=150$ s.
Q-17	Two blocks A and B of mass 2 kg and M are at rest on an inclined plane and are seperated by a distance 6.0 m as shown. The coefficient of friction between each block and the inclined plane is 0.25. The 2 kg block is given a velocity of 10.0 m/s up the inclined plane. It collides with B, comes back and has a velocity 1.0 m/s when it reaches its initial position. The other block B after collision moves 0.5 m up and comes to rest. Calculate – (i) the corfficient of restituition between the blocks and (ii) mass of the block M. [Given $\sin\theta = \tan\theta = 0.05$ and $g = 10$ m/s^2]
Q-18	A car P is moving with a uniform speed of $5\sqrt{3}$ m/s towards a carriage of mass 9 kg at rest on the rails at a point B as shown in the figure. The height AC is 120 m. Cannon balls of 1 kg are fired from the car with an initial velocity 100 m/s at an angle 30^0 with the horizontal. The first cannon ball hits the stationary carriage after a time t_0 and sticks to it. Determine t_0 [part (i)]
	At t_0, the second cannon ball is fired. Assume that resistive force between rail and carriage is constant and ignore the vertical motion of the carriage throughout. If the second ball also hits and sticks to the carriage, what will be the horizontal velocity of the carriage just after the second impact? [part (ii)]
Q-19	A particle of mass m, moving in a circular path of radius R with a constant speed v_2 is located at oint ($2R,0$) at time $t=0$ and a man starts moving with a velocity v_1 along the positiv Y-axis from the origin at time $t=0$. Calculate the linear momentum of the particle w.r.t. man as a function of time.
Q-20	Two point masses m_1 and m_2 are connected by a spring of natural length l_0. The spring is compressed such that the two point masses touch each other and then they are fastened by a string. Then the system is moved with a velocity v_0 along positive X-axis. When the system reaches the origin, the spring breaks at $t=0$. The position of the point mass m_1 is given by $x_1 = v_0 t - A(1-\cos\omega t)$ where A and ω are constant.
	(a) Find the position of the second mass as a function of time.
	(b) Relation between A and l_0

Q-21	There is a rectangular plate of mass M kg of dimension $(a \times b)$ as shown in the figure. The plate is held in horizontal position by striking n small balls uniformly per unit area per unit time. Ecah ball is of mass m These are striking in gray half region of the plate. The balls are colliding elasticall with velocity v. What is v? [Given that $n = 100$, $M = 3$ kg, $m = 0.01$ kg; $a = 1$ m, $b = 2$ m; $g = 10 \, \text{m/s}^2$]
Q-22	Three objects A, B and C of mass $m, 2m$ and m respectively are kept in a straight line on a frictionless horizontal surface. The object A moves towards B with a speed 9 m/s and makes an elastic collision with it. Thereafter B makes completely inelastic collision with C. All motions occur on the same straight line. Find the final speed of object C in m/s.
Q-23	A binary start consists of two stars A and B of masses $2.2 M_s$ and $1.1 M_s$, where M_s is the mass of the sun. They are separated by a distance d and are rotating about their center of mass, which is stationary. Find ratio of total angular momentum of the binary star to the angular momentum of the star B, about the center of mass.
Q-24	A particle of mass m is projected at time $t = 0$ from point P on the ground with a speed v_0 at an angle of 45^0 to the horizontal. Find the magnitude and direction of angular momentum of the particle about P at time $t = \dfrac{v_0}{g}$.

Q-25	A small sphere rolls down without slipping from top of a track in a vertical plane. The reack has an elevated section and a horizontal part. The horizontal part is 1.0 m above the ground level and the top of the track is 2.6 m above the ground.
	    (a) Find distance on the ground with respect to the point B (which is vertically below the end of the track as shown in the figure) where the sphere lands.
	    (b) During its flight as a projectile, does the sphere continue to rotate about its centre of mass? Explain
	 [Take value of $g = 10 \, \text{m/s}^2$]

Q-26	A thin uniform bar lies on a frictionless horizontal surface and is free to move in any way on the surface. Its mass is 0.16 kg and length $\sqrt{3}$ m. Two particles, each of mass 0.08 kg are moving on the same surface and towards the bar in a direction perpendcular to the bar one with a velocity 10 m/s and the other with 6 m/s, as shown in the figure. The first particle strikes the bar at point A and the other at point B. points A and B are at a distance 0.5 m from the centre of the bar. The particles strike the bar at the same instant of time and stick to the bar on collision. Calculate the loss of kinetic energy of the system in the above collision process.
Q-27	A carpet of mass M made of inextensible material is rolled along its length in the form of of a cylinder of radius R and is kept on a rough floor. The carpet starts unrolling without sliding on the foor when a negligibly small push is given to it. Calculate the horizontal velocity of the axis of the cylindrical part of the carpet when it radius reduces to $\dfrac{R}{2}$.

Q-28	A homogeneous rod AB length $l = 1.8$ m and mass M is piboted at the centre O in such a way that it can rotate freely in the vertical plane as shown in the figure. The rod is initially in the horozontal position. An insect S of mass M falls vertically with speed v on the point C, midway between point O and B. Immediately after falling, the insect moves towards the end B such that rod rotates with a constant angular velocity ω.
	    (a) Determine the angular velocity ω interms of v and l
	    (b) If insect reaches the end B when rod has tuned through an angle of 90^0, determine v
	[Given that $g = 10$ m/s^2]

Q-29	A block A of mass 0.5 kg is held by a long massles string on a frictionless plane inclined at 30^0 to the horizontal. The string is wound on a uniform solid cylindrical drum B of mass 2 kg and of radius 0.2 m as shown in the figure. The drum is given an initial angular velocity such that the block A starts moving up the plane.
	    (a) Find the tension in the string during the motion
	    (b) At a certain instant of time the magnitude of the angular velocity of B is 10 rad/s. Calculate the distance travelled by A from the instant of time until it come to rest.

Q-30	Two uniform rods A and B of length 0.6 m each and masses 0.01 and 0.02 kg respectively are rigidly joined end to end. The combination is pivoted at the lighter end P, as shown in the figure, such that it can freely rotate about P, in vertical plane. A small object C of mass 0.05 kg moving horizontally, hits lower end of the combination and stick to it. What would be the velocity of the object so that the system could just be raised to the horizontal position.

Q-31	A rectangualr rigid fixed block has a long horizontal edge. A solid homogeneous cylinder of radius R is laced horizontally at rest with its length parallel to the edge such that the axis of the cylinder and the edge of the block are in same vertical plane as shown in the figure. There is sufficient friction present at the edge, so that a very small displacment causes the cylinder to roll off the edge without slipping. Determine –
	    (a) The angle θ_c through which the cylinder rotates before it leaves contact with the edge,
	    (b) The speed of the centre of the mass of the cylinder before leaving contact with the edge,
	    (c) The ratio of the translational to rotational kinetic energyies of the cylinder when its COM is in horizontal line with the edge.

Q-32	Two thin circular discs of mass 2 kg and radius 10 cm each are joined by a rigid massless rod of lengh w0 cm. The axis of the rod is along perpendicular to the planes of the disc through centers. This object is kept on a truck in such a way that the axis of the object is horizontal and perpendicular to the direction of motion of the truck. Its friction with the floor of the truck is large enough, so that the object can roll on the truck without slipping. Take X-axis as the direction of motion of the truck, and Z-axis as the vertically upward direction. If the truck has an acceleration 9m/s^2, calculate –
	    (a) The force of friction on each disc, and
	    (b) The magnitude and direction of the frictional torque acting on each disc about te centre of mass O of the object. Express torque in the vector form in terms of unit vectors $\hat{i}$, $\hat{j}$ and $\hat{k}$ in x, y and z directions.

Q-33	A uniform disc of mass m and radius R is projected horizontally with velocity v_0 on a rough horizotal floor, so that it starts off with a purely sliding motion at $t = 0$. After time t_0 seconds, it acquires a purely rolling motion as shown in the figure.

	(a) Calculate the velocity of the center of mass of the disc at t_0 (b) Assuming the coefficient of friction to be μ, calculate t_0. (c) Calculate work done by frictional force as a function of time and the total work done by it over a time t much latger than t_0.	
Q-34	A uniform circular disc has radius R and mass m. A particle of mass m is at a point A on the edge of the disc. As shown in the figure. The disc can freely rotate about a horizontal chord PQ at a distance $\dfrac{R}{4}$ from the centre C of the disk. Line AC is perpendicular to PQ. Initially disc is held vertical with the point A at its highest position. It is then allowed to fall so that it starts rotation about PQ. Find the linear speed of the particle as it reaches its lowest position.	
Q-35	A man pushes a plank of mass m_1 placed on the cylinder of of mass m_2 as shown in the figure. There is no slipping at any contact.The horizontal component of force applied by the man is F. Find – (a) Acceleration of the plank and the centre of mass of the cylinder, and (b) Magnitude and direction of frictional force at the contact points.	

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Science in general and Physics in particular is not a subject to learn, but an area of observation and exploration by correlation, integration and analysis of repetitive nature, and then conclusion.

It is a real thrill, full of fun.
But, it can't be done in dicrete manner, it has to be done patiently, like climbing stair far a faster and purposeful journey.
This is where role of education come in; it is to streamline the process.

—00—

"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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Mechanics of Rigid Bodies : <u>Answers</u> To Subjective Questions (Typical)

[Note: Figures are conceptual only and not to the scale]

A-1	(a) $\sqrt{(m^2v^2 + M^2V^2)}\angle\left(\tan^{-1}\dfrac{MV}{mv}\right)$ (b) $\dfrac{Mm(V^2 + v^2)}{(M+m)(mv^2 + MV^2)}$
A-2	NO
A-3	25%
A-4	37 Cms from P or 9 cm left of centre of bigger circle i.e. A.
A-5	$10\sqrt{2}$ m/s along mirror image of bisector of the line of motion of the two equal masses.
A-6	Velocity of particle C after collision is equal and opposite to the vlocity of particle B after collision.
A-7	(a) $\dfrac{(R-r)m}{M+m}$ (b) $m\sqrt{\dfrac{2g(R-r)}{M(M+m)}}$
A-8	(a) $\dfrac{v_0}{3}$ (b) $\dfrac{2m}{3}\left(\dfrac{v_0}{x_0}\right)^2$
A-9	6.5 sec
A-10	4
A-11	$25\sqrt{3}$ m
A-12	(a) $\dfrac{5}{2}\sqrt{6\mu d}$ (b) $6d\sqrt{3\mu}$
A-13	(a) Vertical line oassing through CG when rod is erect. (b) $\dfrac{x^2}{\left(r-\dfrac{L}{2}\right)^2} + \dfrac{y^2}{r^2} = 1$ (b) Second quadrant of an ellipse with its variant, depending on value of *r* such that – (i) If $r > \dfrac{L}{4}$, major axis is along Y axis, (ii) If $r = \dfrac{L}{4}$, circle, (iii) If $r < \dfrac{L}{4}$, major axis along X-axis
A-14	$((L+2R),0)$
A-15	(a) $m\left(\dfrac{2mv}{\sqrt{3}\Delta t} + g\right)$ (b) $\left(\dfrac{4mv}{\sqrt{3}\Delta t}\right)h$
A-16	10^5 m
A-17	(i) 0.84 , (ii) 15.12 kg
A-18	(i) 12 s, (ii) 15.75 m/s
A-19	$m\left(-v_2\cos\left(\dfrac{v_2}{R}t\right)\hat{i} + \left(v_2\cos\left(\dfrac{v_2}{R}t\right)\theta - v_1\right)\hat{j}\right)$

A-20	(a) $v_0 t + A\dfrac{m_1}{m_2}\left(1-\cos\omega t\right)$ (b) $l_0 = A\left(\dfrac{m_1}{m_2}+1\right)$
A-21	10 m/s
A-22	4 m/s
A-23	6
A-24	Magnitude is $\dfrac{m}{2\sqrt{2}}$ and direction is $\left(-\hat{k}\right)$ i.e. perpendicular to the paper and towards entering it.
A-25	$x = \left(4\sqrt{\dfrac{10}{7}}\right)\left(\dfrac{1}{\sqrt{5}}\right) = \left(4\sqrt{\dfrac{2}{7}}\right)$, yes.
A-26	2.72 J
A-27	$\sqrt{\dfrac{14gR}{3}}$ m/s
A-28	(a) $\dfrac{12v}{7X}$ rad/s in clockwise direction. (b) 4.23 m/s
A-29	(a) 1.66 N (b) 1.2 m
A-30	6.4 m/s
A-31	(a) $\cos^{-1}\left(\dfrac{4}{7}\right)$ (b) $\sqrt{\dfrac{4}{7}gR}$ m/s (c) 6
A-32	(a) 6 N (b) 0.85 N-m on Y-Z plane along ling bisector of Y-Z axes in opposite directions
A-33	(a) $\dfrac{2}{3}v_0$ (b) $\dfrac{2}{3}v_0$ (c) $\dfrac{m\mu gt}{2}\left(2v_0 - 3\mu gt\right)$, $\dfrac{mv_0^{\,2}}{6}$
A-34	$4\sqrt{\dfrac{3R}{13}}$
A-35	(a) $a_1 = \dfrac{4F}{8m_1 + 3m_2}$, $a_2 = \dfrac{4F}{8m_1 + 3m_2}$ (b) is $f_1 = \dfrac{3m_2 F}{8m_1 + 3m_2}$, $f_2 = \dfrac{m_2 F}{8m_1 + 3m_1}$

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Growing with Concepts: Chemistry

GAS LAWS (Contd.)

Kumud Bala

Charles's Law (Volume Temperature relationship):-In 1787, a French scientist, Jacques Charles studied the effect of temperature on the volume of gases at constant pressure. The following generalization was observed which is known as Charles's Law: 'Pressure remaining constant, the volume of a given mass of a gas increases or decreases by 1/273 of its volume at 0 °C for every one degree centigrade rise or fall in temperature.' Let V_o be the volume of a given mass of a gas at 0°C and V_t is its volume at any temperature t°C, then the volume, V_t may be written in terms of Charles Law (at constant pressure) as: For 1 degree rise in temperature, volume increases= $V_o \times \frac{1}{273}$. For t
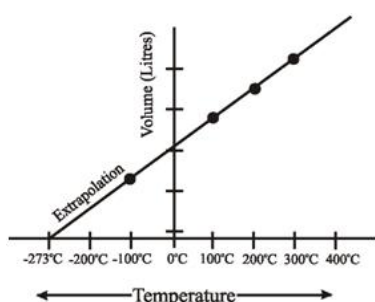
degree rise in temperature, volume increases = $V_o \times \frac{1}{273} \times t$. ∴ Volume at t°C, V_t = initial volume + increases in volume = $V_o + V_o \times \frac{1}{273} \times t$ = $V_o [1+\frac{t}{273}]$ = $V_o [\frac{273+t}{273}]$.
The volume of a certain mass of a gas at any temperature can be calculated by the application of the above relation. Thus as:

Volume at 10°C = $V_o + \frac{10\,V_0}{273}$

Volume at 1°C   = $V_o + \frac{V_0}{273}$

Volume at –1°C = $V_o - \frac{V_0}{273}$

Volume at –20°C = $V_o - \frac{20\,V_0}{273}$

Volume at – 273°C = $V_o - \frac{273\,V_0}{273}$ = 0.

This implies that a gas at -273°C will have zero or no volume, i.e., it will cease to exit. Below this temperature, the volume will be negative which is meaningless. In fact, no one has traced the rate of contraction in volume of any gas up to -273°C at constant pressure. In actual practice, gases liquefy before this temperature is reached. The same conclusion can also be reached graphically by plotting the volume of a certain mass of a gas (along Y-axis) against temperature (along X- axis) at constant pressure. We get a graph consisting of a straight line as shown in figure.

If we extrapolate this straight line, it will meet temperature axis at -273°C. Thus, at -273°C, gas occupies zero or no volume. Charles knew that zero and negative values of volumes are not possible physically. Therefore, he proposed that -273°C is the lowest possible temperature. It may be noted that this value, --273°C does not depend upon the nature of gas or the pressure at which experiment is performed.   At t = -273°C; the volume V = V_o [1-273/273] = 0, this lowest temperature is called absolute zero. "The lowest possible hypothetical or theoretical temperature of -273°C at which a gas is supposed to have zero volume is called absolute zero." A British scientist, Lord Kelvin has suggested a new scale of temperature staring with –273°C as its zero. This scale of temperature is known as Kelvin scale or absolute scale. On this scale, the freezing point of water, i.e., 0°C is 273°A (absolute) or 273K (Kelvin). Thus, any temperature on the centigrade scale can be converted to that on the Kelvin scale by just adding 273 to its value on the centigrade scale. Hence, the two scales are connected by the relation: Kelvin temperature= centigrade temperature + 273 or T K = t°C + 273 thus, –273.15°C = 0 K, 0°C = 273.15K (exact value), 0°C = 273K (for simplicity). Similarly, 1°C = (273 +1) = 274K, 100°C = (273 +100) K = 373 K. Temperature on Kelvin scale is indicated simply by writing the letter K. By convention, the degree sign (°) is not used while expressing the temperature on the Kelvin scale. The advantage of Kelvin scale lies in the fact that the volume of a gas and its temperature on the Kelvin scale are directly proportional to each other. According to Charles's law, V_t = $V_o [\frac{273+t}{273}]$, putting 273 +t = T, the corresponding temperature on the Kelvin scale, we get V_t = $V_o \frac{T}{273}$. As V_o and 273 are constant, hence $V_t \alpha$ T or $V \alpha$ T or above relation gives another definition of Charles's law as follows: "pressure remaining constant the volume of a given mass of a gas is directly proportion to its temperature in Kelvin." $V \alpha$ T implies that V/T = constant at constant pressure. Thus, if V_1 is the volume of a certain mass of a gas at temperature T_1 and V_2 is the volume of the same mass of the same gas at temperature T_2 at constant pressure, then according to Charles's law , $\frac{V_1}{T_1}$= $\frac{V_2}{T_2}$ (mass and pressure constant). Thus, a plot of V vs T at constant pressure will be a straight line passing through the origin.
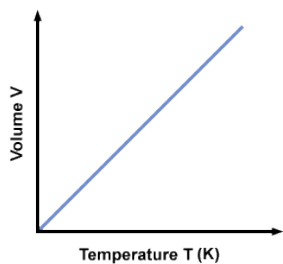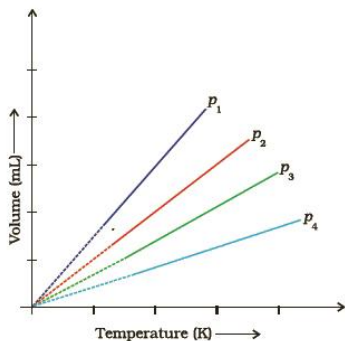
It is interesting to note that at constant pressure, the straight line V vs T plots obtained for different amounts of the same gas or for same amount of the different gases are different but each of them intersects the temperature axis at −273°C corresponding to zero volume. The curves showing the volume – temperature behavior plotted at different fixed pressure are called isobars. Higher the pressure less is the slope of the line (e.g., line 4 corresponds to higher pressure).
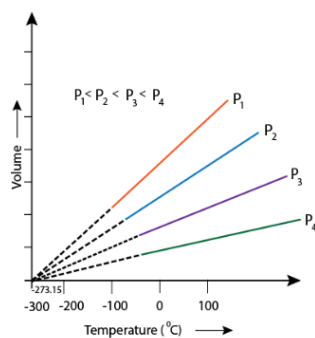
Practical significance of Charles' law: Air expands on heating and hence its density decreases. Thus, hot air is lighter than the atmospheric air. This fact is made use of filling hot air in the balloons which rise up for meteorological observations.

Numerical 1: A sample of helium has volume of 520ml at 100°C. Calculate the temperature at which the volume will become 260ml. Assume that pressure is constant.

Solution: V_1 = 520ml, T1 = 100+ 273 = 373K, V_2 = 260ml, T_2 =?

 By applying Charles's law: $\frac{V1}{T1} = \frac{V2}{T2}$ or $T_2 = \frac{V2 \times T1}{V1}$ or $\frac{260ml \times 373K}{520ml}$ = 186.5K or t = 186.5−273 = −86.5°C.

2. On a ship sailing in a pacific ocean where temperature is 23.4°C, a balloon is filled with 2L air. What will be the volume of the balloon when the ship reaches Indian Ocean, where temperature is 26.1°C? Solution: According to Charles's law, $\frac{V1}{T1} = \frac{V2}{T2}$ or $V_2 = \frac{V1 \times T2}{T1}$, V_1 = 2L, V_2 =? , T_1 = 273+23.4 = 296.4K, T_2 = 273 + 26.1 = 299.1K , $V_2 = \frac{2L \times 299.1K}{296.4K}$ = 2.018L

Gay-Lussac's Law (pressure- temperature relationship): The relationship between pressure and temperature was given by Joseph Gay-Lussac

and is known as Gay-Lussac's law. It state that at constant volume, pressure of a fixed amount of gas varies directly with temperature. Mathematically, it may be expressed as PαT or $\frac{P}{T}$ = constant = k or $\frac{P1}{T1} = \frac{P2}{T2}$

Graphically representation of the law: this law can be illustrated by pressure-temperature graph. At constant molar volume, when a graph is plotted between pressure and absolute temperature,
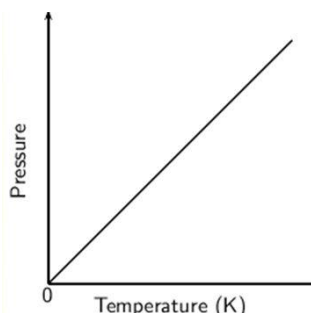
straight line is obtained.

The curves showing the pressure-temperature behavior plotted at fixed volumes are called isochores.
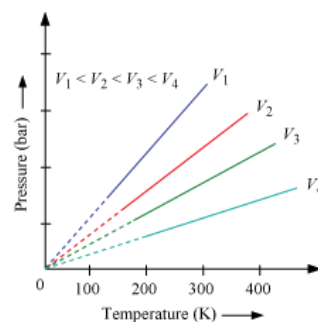
Physical significance of Gay-Lussac's law: Pressure in a well inflated tyres of automobiles is almost constant. But on hot summer day this increases considerably and tyre may burst, if pressure is not adjusted properly. Similarly, during winters, on a cold morning we find the pressure in the tyres of a vehicle decreased considerably.

Numerical: A chamber of constant volume contains hydrogen gas. When the chamber is immersed in a bath of melting ice (0°C), the pressure of the gas is 1.07x10²kPa. What pressure will be indicated when the chamber is brought to 100°C?

Solution: T_1 = 273 +0°C = 273K , P_1 = 1.07x 10²kPa = 107 kPa , T_2 = 273+100°C = 373K , P_2 = ? Since volume remains constant, therefore, according to Gay-Lussac's law: $\frac{P1}{T1} = \frac{P2}{T2}$ or $P_2 = \frac{P1 \times T2}{T1} = \frac{107kPa \times 373K}{273K}$ = 1.462x 10²kPa

Avogadro's law (Volume – Amount relationship): Amadeo Avogadro in 1811, put forward a relationship between volume of a gas to the number of molecules at constant temperature and pressure. This has now been accepted as a law and is known as Avogadro law. The law states that, at a given temperature and pressure, the volume of a gas is directly proportional to the amount of gas. Mathematically, Avogadro's law may be expressed as: Vαn (P and T constant) or V=kn, where 'n' is the amount of substance (moles). The number of

molecules in one mole of gas has been determined to be 6.022×10^{23} and is known as Avogadro's number or constant. Avogadro generalized the above observation by the following statement: "all gases contaning equal amount of substance occupy the same volume at the same temperature and pressure". This means that one mole of each gas at standard tempreature will have same volume. This is known as molar volume,V_m. Molar volume of the gas under standard temperature and pressure are taken at 0°C and 1 atmosphere pressure = 22400ml or 22.4L

When STP conditions taken are 0°C (273.15K) and 1 bar pressure (1bar < 1 atm =.987atm), molar volume is slight higher and equal to 22700ml or 22.7L.

When SATP (standard ambient temperature and pressure) conditions are taken 25°C(298.15K) and 1bar pressure, molar volume of the gas = 22800ml or 22.8L.

Now, number of moles of a gas can be calculated as: $n = \frac{mass\ of\ gas}{molar\ mass} = \frac{m}{M}$, thus, $V = k\frac{m}{M}$, $M = k\frac{m}{V} = kd$ (d=m/V) , where 'd' is density of the gas. Thus, we can say that the density of a gas is directly proportional to its molar mass.

Numerical : What is the density of sulphur dioxide (SO_2) at STP.

Solution : The gram molecules weight of SO_2 = 64g/mole. Since 1 mole of SO_2 occupies a volume of 22.4L at STP. Density of $SO_2 = \frac{m}{V} = \frac{64}{22.4}$ = 2.86g/L

Assignment

1. At constant temperature, in a given mass of an ideal gas-
   (a) the raito of pressure and volume always remains constant
   (b) volume always remains constant
   (c) pressure always remains constant
   (d) the product of pressure and volume always remains constant.

2. Three flasks of equal volumes contain CH_4, CO_2 and Cl_2 gases respectively. They will contain equal number of molecules if :
   (a) the mass of all the gases is same
   (b) the moles of all the gases is same but temperature is different
   (c) temperature and pressure of all the flasks are same
   (d) temperature, pressure and masses are same in the flasks.

3. A certain mass of a gas occupies a volume of 2L at STP. Keeping the pressure constant at what temperature would be gas occopy a volume of 4 litres.
   (a) 546°C   (b) 273°C
   (c) 100°C   (d) 50°C

4. At 100°a gas has 1atm pressure and 10L volume.Its volume at NTP would be------
   (a) 10L   (b) less than 10L
   (c) more than 10L   (d) none of these.

5. Two flasks A and B of 500ml each are respectively filled with O_2 and SO_2 at 300K and 1atm pressure. The flsaks will contain-------

   (a) the same number of atoms
   (b) the same number of molecules
   (c) more number of moles in flask A as compared to flask B
   (d) the same amount of gases.

6. A gas at 10°C occupies a volume of 283ml. If it is heated to 20°C keeping the pressure constant the new volume will be-----
   (a) 293ml   (b) 283ml   (c) 560ml   (d) 586ml.

7. The molar volume of methan (CH_4) at 819°C and 760mm pressure is:
   (a) 22.4L   (b) 44.8L   (c) 89.6L   (d) 5.6L.

8. The temperature of a gas in a closed container is 27^0C. If the temperature is raised to $327\ ^0$C the pressure exerted is:
   (a) reduced to half
   (b) doubled
   (c) reduced to one-third
   (d) cannot be calculated from the given information.

9. An open vessel at 37°C is heated until 3/5 of the air in it has been expelled. Assuming that the volume of the vessel remains constant, the temperature to which the vessel is heated:
   (a) 502°C   (b) 502K
   (c) 243.67°C   (d) 92.5°C.

10. 100ml of O_2 and H_2 are kept at same temperature and pressure. What is true about their number of molecules?
    (a) $O_2 > H_2$ (b) $O_2 < H_2$
    (c) $O_2 = H_2$ (d) $O_2 + H_2$ = 1mole .

Answers

1. (d),   2. (c),   (3) (b),   (4) (b),   (5) (b)

6. (a), [Hint : V_1=283ml, T_1 =273+10 =283K, T_2 =273+20 = 293K , V_2= ? P= constant, V_2 = $\frac{V_1 \times T_2}{T_1}$ = $\frac{283 \times 293}{283}$ = 293ml]

7. (c) [Hint: V_1=22.4L, P_1= 760mm Hg, T_1 = 273K, V_2=?, P_2= 760mm Hg, T_2= 819 + 273 = 1092K, V_2 = 1092ml

[$\frac{V_1 \times T_2}{T_1}$ = $\frac{22.4 \times 1092}{273}$ = 89.6L]

8. (b) [Hint: $\frac{P_1}{T_1} = \frac{P_2}{T_2}$, ∴ P_2 = $\frac{600P_1}{300}$, $\frac{300}{600}$ = $2P_1$ (pressure becomes duble)

9. (a) [Hint: T_1 = 273+37=310K, initial moles of air = n mol, moles of air left = n-3/5 = 2/5n,

final temp. = $\frac{310 \times 5}{2}$ = 775K or 775-273 = 502°C]

10. (c).

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

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GROWING WITH CONCEPTS

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

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

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

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

This e-Bulletin covers – a) 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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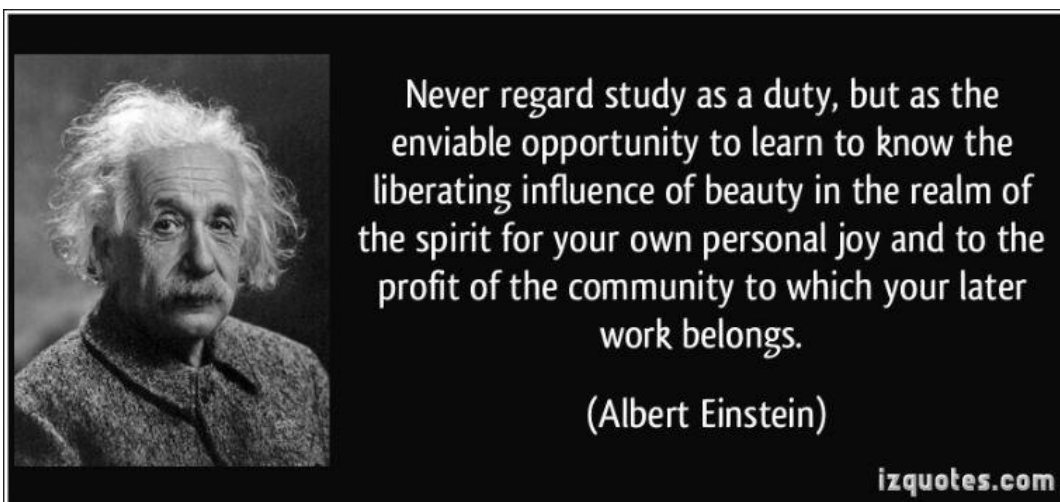# SCIENCE QUIZ November-2018

Kumud Bala

1. Tomatoes in green house grow faster if the CO_2 concentration is increased. This shows that:
   (a) temperature must have been a limiting factor
   (b) CO_2 concentration must have been a limiting factor
   (c) light intensity must have been a limiting factor.

2. Why do plants need nitrate ions?
   (a) to make proteins
   (b) to make fatty acid
   (c) to make starch for storage.

3. What is the name of gas which is used in cigarette lighters?
   (a) methane   (b) butane
   (c) propane   (d) none of these.

4. What is the name of instrument which is generally used to measure altitudes in aircrafts?
   (a) fathometer   (b) wattmeter
   (c) barometer   (d) altimeter

5. Which synthetic fiber is known as artificial silk?
   (a) nylon   (b) rayon
   (c) cotton   (d) terylene

6. Which of the following carbon compounds is used as a fire-extinguisher?
   (a) carbon disulphide
   (b) chloroform
   (c) carbon tetrachloride
   (d) methylene chloride.

7. The gas used for artificial ripening of green fruits is
   (a) ethylene
   (b) ethane
   (c) carbon dioxide
   (d) acetylene

8. The acceleration given to a body by a force applied to it is directly proportional to……
   (a) force
   (b) mass
   (c) acceleration
   (d) momentum

9. A body of mass 4kg when a force of 200N acts on it produces an acceleration of------
   (a) 30m/sec^2
   (b) 40m/sec^2
   (c) 50m/sec^2
   (d) 100m/sec^2

10. Mitosis occurs in--------
    (a) vegetative cell
    (b) epidermal cell
    (c) reproduction cell
    (d) dead cell

11. Which of the following is made use of to open the tightened lid of a bottle?
    (a) superficial expansion
    (b) linear expansion
    (c) thermal expansion
    (d) cubical expansion.

12. A batsman hits a cricket ball which then rolls on a level ground. After covering a short distance, the ball comes to rest. The ball slows to a stop because:
    (a) the batsman did not hit the ball enough
    (b) velocity is proportional to the force exerted on the ball
    (c) there is a force on the ball opposing the motion
    (d) there is no unbalanced force on the ball , so the ball would want to come to rest.

13. Which law explains swimming?
    (a) Newton's first law
    (b) Newton's second law
    (c) Newton's third law
    (d) all of these.

14. The weight of an object is :
    (a) greater on earth and lesser on moon
    (b) greater on moon and lesser on earth
    (c) equal on both earth and moon
    (d) none of these

15. Ozone hole refers to:
    (a) increase in the ozone layer in stratosphere
    (b) decrease in the ozone layer in troposphere
    (c) decrease in thickness of ozone layer in stratosphere
    (d) increase in the thickness of ozone layer in troposphere

16. Pollination is best defined as:
    (a) transfer of pollen from anther to stigma
    (b) germination of pollen grains
    (c) growth of pollen tube in ovule
    (d) visiting flowers by insects

17. The important sugar in honey is-------
    (a) lactose   (b) fructose
    (c) maltose   (d) sucrose

18. The absorption of ink by blotting paper involves-------
    (a) viscosity of ink
    (b) capillary action phenomenon
    (c) diffusion of ink through the blotting
    (d) siphon action

19. The alloy of aluminium used for making magnet is ----
    (a) duralumin
    (b) y- alloy
    (c) alnico
    (d) aluminium bronze

20. If we decrease the time period of a wave, its frequency will -----
    (a) decrease
    (b) increase
    (c) remains same
    (d) none of these

21. Your image in a bathroom mirror results from ------
    (a) diffuse reflection
    (b) specular refraction
    (c) specular reflection
    (d) diffuse refraction

22. A substance consisting of a coil of wire with an iron core and is only magnetized when an electric current flows through it is called--------
    (a) magnet   (b) electromagnet
    (c) battery   (d) coil

23. A rock which attracted iron materials was found by :
    (a) Greeks   (b) Trojans
    (c) Egyptians   (d) Italians

24. Excessive release of the pollutant carbon monoxide (CO) into the air may produce a condition in which oxygen supply in the human body decreases. What causes this condition?
    (a) when inhaled into the human body, CO is converted into CO_2
    (b) the inhaled CO has much higher affinity for hemoglobin as compared to oxygen
    (c) the inhaled CO destroys the chemical structure of hemoglobin
    (d) the inhaled CO adversely affects the respiratory centre in brain.

25. Which type of star is Sun?
    (a) supernova   (b) red giant
    (c) red supergiant   (d) none of these

26. In which ocean does the Mariana Trench is located?
    (a) Indian ocean   (b) Atlantic ocean
    (c) Pacific ocean   (d) Arctic ocean

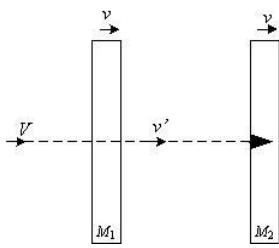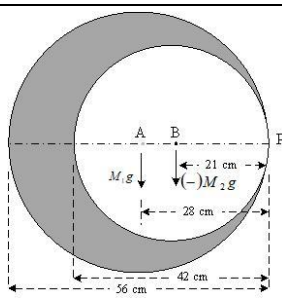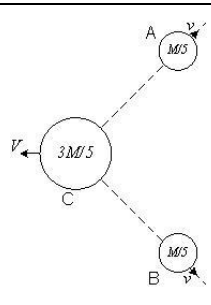*(Answers to this Science Quiz Nov'18 shall be provided in Monthly e-Bulletin dt. 1st Dec'18)*

—00—

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

Mechanics of Rigid Bodies :Illustrations Of Subjective Questions (Typical)

[Note: Figures are conceptual only and not to the scale]

I-1	(a) Momentum of body A is $\vec{P}_A = mv\hat{i}$ and of body B is $\vec{P}_B = MV\hat{j}$. The body after collision coalesce into one therefore is per principle of conservation of momentum, this combined body will have momentum as $$\vec{P} = mv\hat{i} + MV\hat{j} \rightarrow \sqrt{(m^2v^2 + M^2V^2)} \angle \left(\tan^{-1}\frac{MV}{mv}\right)$$ and magnitude of velocity to be used in part (b) is $\frac{\sqrt{(m^2v^2 + M^2V^2)}}{M+m}$.

(b) Kinetic energy of the individual bodies before collision shall be $KE_A = \frac{1}{2}mv^2$ and $KE_B = \frac{1}{2}MV^2$. And that of coalesced body would be - $$KE = \frac{1}{2}(M+m)\left(\sqrt{(m^2v^2 + M^2V^2)}\right)^2 = \frac{1}{2}(M+m)\left(\frac{m^2v^2 + M^2V^2}{(M+m)^2}\right) = \frac{1}{2}\left(\frac{m^2v^2 + M^2V^2}{M+m}\right).$$ Therefore fraction of initial kinetic energy that is lost into heat is – $$k = 1 - \frac{KE}{KE_A + KE_B} = \frac{KE_A + KE_B - KE}{KE_A + KE_B} = \frac{\frac{1}{2}\left(mv^2 + MV^2 - \frac{m^2v^2 + M^2V^2}{M+m}\right)}{\frac{1}{2}(mv^2 + MV^2)} = \frac{Mm(V^2 + v^2)}{(M+m)(mv^2 + MV^2)}$$

N.B.: It is to be noted that in part (a) magnitude of momentum and velocity are different, what is asked is momentum vector.
But in part (b) energy transformed into heat, during collision, is asked as a fraction of initial kinetic energy. Accordingly, equation for k is formulated. |
| I-2 | Principle of consrvation of momentum applies when no external force is acting on the system. But, in the event of an external force principle of impulse $I = \int_{t=0}^{t} p\,dt = \int_{t=0}^{t} mv\,dt = m\int_{t=0}^{t} v\,dt = m\int_{t=0}^{t}(u - gt)dt$ would apply where accelelartion due to gravity g comes into play while the ball ascends as well as descends. This g together with mass of the ball constitutes external force and hence principle of conservation of momentum would not apply. |
| I-3 | Given that initial velocities of the two masses M_1 and M_2 are $u_1 = 0$ and $u_2 = 0$, and their final velocities are $v_1 = v_2 = v$. Let initial velocity of bullet of mass m is V.

With the given data velocites of the bullet can be analyzed in three stages – (a) before piercing mass M_1, (b) after piercing mass M_1 and (c) it gets embedded in mass M_2. As per principle conservation of mementum at stage (b), equation is $mV = M_1v + mv'$ And balance of momentum at stage (c) is $mv' = (M+m)v$. Combining the two equations $mV = M_1v + (M+m)v \rightarrow V = \frac{(M_1 + M_2 + m)v}{m} = \frac{(1 + 2.98 + 0.02)}{0.02}v = \frac{4}{0.02}v = 200v \rightarrow v = \frac{V}{200}$.
Accordingly, velocity of the bullet at stage (b) would be |

$$v' = \frac{mV - M_1 v}{m} = \frac{0.02V - 1 \times \dfrac{V}{200}}{0.02} = \left(1 - \frac{50}{200}\right)V = \frac{3}{4}V \ .$$

Thus, percentage loss of velocity in stage (b) is $\dfrac{V - \dfrac{3}{4}V}{V} \times 100 = 25\%$

N.B.: It is to be carefully noted that what is asked is percentage loss of velocity of bullet when is between M_1 and M_2. Accordingly equations have to be formulated.

I-4	The given figure is so placed that a horizontal diameter passes though a common point P on the edges of the Two circular shapes. The disc of diameter $d_1 = 56$ cm is taken to be of uniform mass density ρ per unit area having its centre of mass $M_1 = \dfrac{\pi d_1^{\ 2}}{4}\rho$, by symmetry of the shape would be at its centre A at a distance $r_1 = \dfrac{d_1}{2} = 28\,cm$ from P. A circular portion of diameter $d_2 = 42$ cm, as shown in the figure, is removed and it can be mathematically taken to be of mass $(-\rho)$per unit area indicating zero mass density; its COM of mass $M_2 = -\dfrac{\pi d_2^{\ 2}}{4}\rho$ shall lie at B, at a distance $r_2 = \dfrac{d_2}{2} = 21$ cms from P, Accordingly, taking moments of the constituents masses about the point P the center of mass shall be at $x = \dfrac{M_1 r_1 + M_2 r_2}{M_1 + M_2} = \dfrac{\pi\rho\left(d_1^{\ 2}\dfrac{d_1}{2} - d_2^{\ 2}\dfrac{d_2}{2}\right)}{\pi\rho\left(d_1^{\ 2} - d_2^{\ 2}\right)} = \dfrac{1}{2}\dfrac{d_1^{\ 3} - d_2^{\ 3}}{d_1^{\ 2} - d_2^{\ 2}} = \dfrac{1}{2}\dfrac{d_1^{\ 2} + d_2^{\ 2} + d_1 d_2}{d_1 + d_2} = \dfrac{1}{2}\left(\dfrac{3136 + 1764 + 2352}{56 + 42}\right)$, it leads to $x = 37\,cm$. It leads to $37 - 28 = 9\,cm$ left of A, i.e. centre of the bigger circle.
I-5	Given that a mass of 1 Kg, at rest, splits in three fragments A, B and C of masses $\dfrac{1}{5}, \dfrac{1}{5}$ and $\dfrac{3}{5}$ kg respectively, as shown in the figure. It is so oriented that $\vec{V}_A = \dfrac{30}{\sqrt{2}}(\hat{i} + \hat{j})$ and $\vec{V}_B = \dfrac{30}{\sqrt{2}}(\hat{i} - \hat{j})$ as given. Let velocity of mass C be $\vec{V} = V_x\hat{i} + V_y\hat{j}$. As per principle of conservation of momentum $M \times 0 = M_A\vec{V}_A + M_B\vec{V}_B + M_C\vec{V}_C = \dfrac{1}{5}\cdot\dfrac{30}{\sqrt{2}}(\hat{i} + \hat{j}) + \dfrac{1}{5}\cdot\dfrac{30}{\sqrt{2}}(\hat{i} - \hat{j}) + \dfrac{3}{5}\cdot(V_x\hat{i} + V_y\hat{j})$. This requires equation satisfies for components of moment along $\hat{i}$ and $\hat{j}$ directions. Accordingly, straight way V_y along $\hat{j}$ direction is zero and along direction $\hat{i}$ is $\dfrac{30}{5\sqrt{2}} + \dfrac{30}{5\sqrt{2}} + \dfrac{3}{5}V_x = 0 \rightarrow \dfrac{3}{5}V_x = -\left(3\sqrt{2} + 3\sqrt{2}\right) \rightarrow V_x = -10\sqrt{2}$ m/s.
I-6	It is given that the particles of mass m at the vertices of an equilateral traingle are moving along median with constant speed v and accordingly, $\vec{v}_A = v(0\hat{i} - \hat{j})$, $\vec{v}_B = v\left(\dfrac{\sqrt{3}}{2}\hat{i} + \dfrac{1}{2}\hat{j}\right)$ and $\vec{v}_C = v\left(-\dfrac{\sqrt{3}}{2}\hat{i} + \dfrac{1}{2}\hat{j}\right)$.

After collision at G, it is given that velocities of the particles $\vec{v}'_A = 0$, $\vec{v}'_B = -v\left(\dfrac{\sqrt{3}}{2}\hat{i} + \dfrac{1}{2}\hat{j}\right)$ and velocity $\vec{v}'c$

of particle C is to be determined. As per principle of conservation of momentum, in absence of external force, momentum during collision $\Delta\vec{p} = 0$. Accordingly, $\Delta\vec{p} = (m\vec{v}_A + m\vec{v}_B + m\vec{v}_C) - (m\vec{v}'_A + m\vec{v}'_B + m\vec{v}'_C)$. It leads to

$$\Delta\vec{p} = m\left((\vec{v}_A - \vec{v}'_A) + (\vec{v}_B - \vec{v}'_B) + (\vec{v}_C - \vec{v}'_C)\right) = mv\left((-j) + 0 + \left(\left(\dfrac{\sqrt{3}}{2}\hat{i} + \dfrac{1}{2}\hat{j}\right) - \vec{v}'_c\right)\right) = 0.$$ Thus, algebtically

$\vec{v}'_C = v\left(\dfrac{\sqrt{3}}{2}\hat{i} + \dfrac{1}{2}\hat{j}\right)$ and $\vec{v}'_c = -\vec{v}'_B$, i.e, velocity of particle C after collision is equal and opposite to that of

particle B after collision.

N.B.: It would be seen that subjetive questions necessarily need not be complex and are good enough to be a part of objective questions to be solved with analytical intuition. Nevertheless, these questions are framed in this category to evaluate analytical illustration capability of student, and hence they are assesded subjectively, despite the answer being correct. Moreover, marks allotted to such questions are appropriately proportioned for time and effort is the solution.

| I-7 | The cylinder of mass m and radius r rolls down from point A to point B along the smicircular track, it behaves like a system. During the rolling horizontal its position of its COM shall remain unchanged, since block is placed on a firm frictionless. COM of the system, w.r.t point A, in initial condition is $x = \dfrac{MR + mr}{M + m}$, or w.r.t. point B is $x' = R - x = \dfrac{(R - r)m}{M + m}$. Since, $R > r$, therefore $R - r > 0$ and hence COM in intitail position shall be right of point B. |

(a) But, when particle reaches at B, by symmetry of the system along vertical line passing through point B, it shall be at the point. Since COM of the system in absence of any external force remains unchanged and hence the whole block would shift to right of initial position of point B by a distance $x' = \dfrac{(R - r)m}{M + m}$.
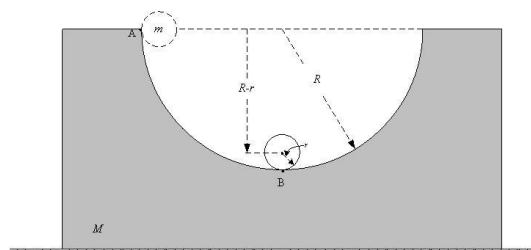
(b) This part of the problem involves two variables, velocity of the roller and the block. Therefore, it needs to be solved with Two equations one based on conservation of mementum (COM) and other based on conservation of energy (COE). It is to be noted that velocity of the roller at every point on the track is tangential to it. Therefore, at point B, $\vec{v}_r = v_r\hat{i}$, while that of the block shall be $\vec{v}_b = v_b\hat{i}$. Since momentum is a vector, and therfore as per COM momentum along $\hat{i}$ and $\hat{j}$ shall be conserved independently. Moreover the system is initially, when roller is at A is at rest, therefore, $m\vec{v}_r + M\vec{v}_b = 0$. It leads to v_b

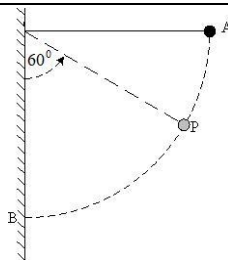$$m v_r\hat{i} + M v_b\hat{i} = 0 \rightarrow v_r = -\dfrac{M}{m}v_b.$$

Since, there change in vertical position of the cylinder, which has descended through a height, $(R - r)$ while both the roller and the block have horizontal velocities, therefore, as per COE, $\Delta PE = \Delta KE$. Accordingly,
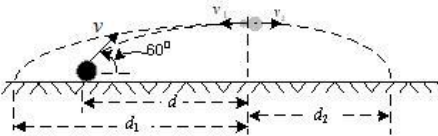
$$mg(R - r) = \dfrac{1}{2}(mv_r^2 + Mv_b^2) = \dfrac{1}{2}\left(m\left(\dfrac{M}{m}v_b\right)^2 + Mv_b^2\right) = \dfrac{1}{2}\left(\dfrac{M(M + m)}{m}\right)v_b^2.$$ It leads to

$$v_b = m\sqrt{\dfrac{2g(R - r)}{M(M + m)}}.$$

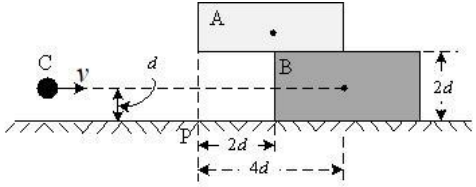N.B.: Here care needs to be taken that cylinder descends through a height $(R - r)$ and nor R since r is

significant and specified.

I-8	Initial momentum of mass C is $P_c = mv_0$ and kinetic energy $K_c = \frac{1}{2}mv_0^2$, while all other masses are at rest. After time t_0 all the masses move with velocity v and spring is compressed by x_0. Since collision of masses A and C is elastic, they will exchange velocities, and hence C will come to rest and A will acquire velocity v_0. Taking system of masses A, B abd C, as per principle on conservation of momentum $mv_0 = (m + 2m)v \rightarrow v = \frac{v_0}{3}$, here v is the common velocity of masses A and B. At t_0 this instant for the system as per principle of conservation of energy, it is- $$K_c = E_f \rightarrow \frac{1}{2}mv_0^2 = \frac{1}{2}(m+2m)v^2 + \frac{1}{2}k\,x_0^2 \rightarrow kx_0^2 = m\left(v_0^2 - 3\left(\frac{v_0}{3}\right)^2\right) = \frac{2}{3}mv_0^2 \rightarrow k = \frac{2m}{3}\left(\frac{v_0}{x_0}\right)^2.$$ N.B.: In this problem, information on duration t_0 after collision for two masses A and C to acquire niform velocity is redundant. It is a non-linear equation and a problem outside scope of the instant curriculum.
I-9	The two ball when start moving their COM is at height $h = \frac{0 + 98}{2} = 49$ m. Since acceleration acting on both masses is g m/s^2, therefore, acceleration of COM shall also be g, while initial velocity of COM shall be $u = \frac{0 + 49}{2} = 24.5$ m/s. Therefore, time of flight of COM shall be $-h = ut - \frac{1}{2}gt^2 \rightarrow -49 = 24.5t - \frac{1}{2}9.8t^2$. It can be simplified to $-4.9 \times 10 = 2.45 \times 10t - 4.9t^2 \rightarrow 2t^2 - 10t - 20 = 0 \rightarrow t^2 - 5t - 10 = 0$. Solving the quadratic equation $t = \frac{5 \pm \sqrt{25 + 4 \times 10}}{2}$ Since, discriminant $\sqrt{25 + 4 \times 10} > 5$ and hence the only (+)ve value of t is $t = \frac{5 + \sqrt{65}}{2} \approx \frac{5 + 8}{2} \approx 6.5$ sec.
I-10	Coefficient of restituition $e = \frac{v}{u} = \frac{2}{\sqrt{5}}$. Let l be the length of pendulum, in that case velocity of pendulum when it collides with the wall can be determined with the principle conservation of energy (COE) such that $\frac{1}{2}mu^2 = mgl \rightarrow u = \sqrt{2gl}$ and velocity of pendulum post collision using value of e shall be $v = \frac{2}{\sqrt{5}}\sqrt{2gl} = \frac{2}{\sqrt{5}}\sqrt{2 \times 10l} = 4\sqrt{l}$. Therefore, after collision the height to which pendulum would rise, as per COE $mgh = \frac{1}{2}m\left(4\sqrt{l}\right)^2 \rightarrow h = \frac{8l}{g} = \frac{4}{5}l$. Therefore after n collisions maximum height to which the bob shall be able to rise is $\left(\frac{4}{5}\right)^n l$. For the bob of the pendulum to have minumum collisions where amplitude is less than 60^0, in that case the height of rise after collision shall be $h' < l - l\cos 60^0 \rightarrow h < \frac{l}{2} \rightarrow (0.8)^n < 0.5l$. At , $n = 3 \rightarrow h = (0.8)^3 = 0.512 > 0.5$, at $n = 4 \rightarrow (0.8)^4 = 0.4096 < 0.5$. Hence, minimum number of collisions is 4.

I-11	The object when projected shall have horizontal velocity $v_h = v\cos 60^0 = 20 \times \dfrac{1}{2} = 10$ m/s. Time taken by it to reach highest point from First Eqn of Motion $0 = v\sin 60^0 - gt \rightarrow t = \dfrac{20 \times \dfrac{\sqrt{3}}{2}}{10} = \sqrt{3}$ s.

During this time the object will travel a horizontal distance $d = v_h t = 10\sqrt{3}$ m.

Kinetic energy og the object at highest point is $K = \dfrac{1}{2}mv_h^2 = \dfrac{1}{2} \times 5 \times 10^2 = 250$ Nm. After explosion combined energy of the split masses is given to be $K_1 + K_2 = \dfrac{1}{2}m_1 v_1^2 + \dfrac{1}{2}m_2 v_2^2 = 2K \rightarrow \dfrac{1}{2}1 \times v_1^2 + \dfrac{1}{2}4 \times v_2^2 = 2 \times 250$.

It leads to $v_1^2 + 4v_2^2 = 1000$. But, there is no external force, and it will comply conserve momentum. Accordingly, $mv\cos 60^0 = m_1 v_1 + m_2 v_2 \rightarrow 5 \times 10 = 4 \times v_2 + 1 \times v_1 \rightarrow 4v_2 + v_1 = 50 \rightarrow v_2 = \dfrac{50 - v_1}{4}$.

Accordingly, combining energy and momentum equations $v_1^2 = 1000 - 4\left(\dfrac{50 - v_1}{4}\right)^2$. It resolves into $4v_1^2 = 4000 - (2500 - 100v_1 + v_1^2) \rightarrow 5v_1^2 - 100v_1 - 1500 = 0 \rightarrow v_1^2 - 20v_1 - 300 = 0$. It is a quadratic equation which gives $v_1 = \dfrac{20 \pm \sqrt{400 - 4 \times 1 \times (-300)}}{2} = \dfrac{20 \pm \sqrt{1600}}{2} = \dfrac{20 \pm 40}{2} = 30$ or -10 m/s.

Splintering, caused by explosion result in separation of particles, in opposite directions and hence $v_1 = -10$ m/s shall be taken. Accordingly, velocity of of mass m_2 shall be, $v_2 = \dfrac{50 - (-10)}{4} = 15$ m/s.. Thus, horizontal velocity of seperation, or the relative velocity of m_2 of w.r.t. m_1 ,the two split masses is $V = v_2 - v_1 = 15 - (-10) = 25$ m/s. From this highest point time talen by the two masses to reach the ground, under gravity, shall be same as that to reach the highest point i.e. $t = \sqrt{3}$ sec. Therefore, sepeartion between two fragments, when the touch the ground, will be $D = Vt = 25\sqrt{3}$ m.

N.B.: In case value of g is not given in that case answer will change based on its value chosen.Therefore, values assumed should be categorically specifiedin the solution.

I-12	Net frictional force exerted by the ground on block B, as long as Block A is on it, would be $f = \mu(2mg + 4mg) = 6mg\mu$. But, there would be no frictional force on A by block B. Therefore, when block B moves under influence of impact of C, the block A would simply slide on block B it will have an retardation $a = \dfrac{f}{4m} = \dfrac{6mg\mu}{4m} = \dfrac{3}{2}\mu g$. This value of a would decide distance moved by block B, before it comes to rest, and in turn would lead to answer (a).

Given that, collision of B and C is elastic, it will help to find velocity of B post collision. Once, accordingly as per principle of COM, $mv = mv_C + 4mv_B \rightarrow v = v_C + 4v_B$ and as per principle of COE it leads to $\dfrac{1}{2}mv^2 = \dfrac{1}{2} \times mv_C^2 + \dfrac{1}{2} \times 4mv_B^2 \rightarrow v^2 = v_C^2 + 4v_B^2$. Accordingly, $v^2 = (v - 4v_B)^2 + 4v_B^2$. It leads to $v^2 = (v^2 - 8vv_B + 16v_B^2) + 4v_B^2 \rightarrow 20v_B^2 - 8vv_B = 0 \rightarrow v_B = \dfrac{2}{5}v$. And, $v_C = v - 4v_B = v - 4 \times \dfrac{2}{5}v = -\dfrac{3}{5}v$.

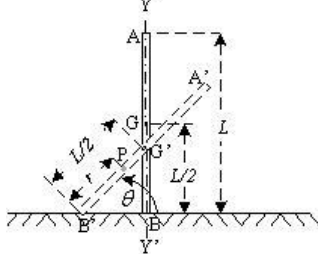|	
	Block B is required to cover a distance , common width of blocks A and B $4d$, before block A topples, Therefore, using Third equation of motion, with final velocity of the block B to be Zero, when it just covers a distance, because the face on which C collides, will have crossed COM of block A, a condition good enough for it topple down. Accordingly, it leads to $$0 = v_B{}^2 - 2a \times 2d \to v_B = \sqrt{4 \times \left(\frac{3}{2}\mu g\right)d} = \sqrt{6\mu\, g\, d}\;.$$ Therefore, for block B to acquire this velocity, minimum velocity of the block C shall have to be $v_0 = \frac{5}{2}v_B = \frac{5}{2}\sqrt{6\mu\, gd}$. This forms part (a) of the answer. If C collides with velocity $v = 2v_0$, then its velocity of rebounce shall be $$v_C' = \frac{3}{5}v = \frac{3}{5}(2v_0) = \frac{3}{5}\left(2\left(\frac{5}{2}\right)\sqrt{6\mu gd}\right) = 3\sqrt{6\mu gd}\;.$$ Object C with initial horizontal velocity, post rebounce from a vertcial surface shall rebounce horizontally. Therefore disance covered by C from point P shall be $x = v_C' t$. Here, t is time taken by an object, during a free fall from a height d above the ground, to touch the ground and it shall be, using Second equation of motion shall be $d = 0 \times t + \frac{1}{2}gt^2 \to t = \sqrt{\frac{2d}{g}}$. Therefore, $$x = \left(3\sqrt{6\mu gd}\right)\left(\sqrt{\frac{2d}{g}}\right) = 6d\sqrt{3\mu}\;.$$
I-13	The vertical rod is stated to be thin, it amounts to taking its diameter negligible w.r.t. its length. The rid starts slipping on smotth surface under gravity, and no other exterbal force is acting on it. Therefore, CG of the rod would descend along the vertical line YY' passing through it as per second equation of motion as $h = \frac{L}{2} - \frac{1}{2}gt^2 = \frac{1}{2}\left(L - gt^2\right)$. Accordingly, answer path of the CG would be vertical , **answer (a).** Coordinates of point P at a distance r from lower end would be $x = -\left(\frac{L}{2}\cos\theta - r\cos\theta\right) = \left(r - \frac{L}{2}\right)\cos\theta \to \cos\theta = \frac{x}{\left(r - \frac{L}{2}\right)}$. Likewise, $y = r\sin\theta \to \sin\theta = \frac{y}{r}$. Since, $$\sin^2\theta + \cos^2\theta = 1 \to \frac{x^2}{\left(r - \frac{L}{2}\right)^2} + \frac{y^2}{r^2} = 1 \to \frac{x^2}{\left(\frac{L}{2} - r\right)^2} + \frac{y^2}{r^2} = 1\;;$$ **answer (b).** The equation of locus of point P is primarilly an ellipse in Second quadrant, with its center at B. But its shape depends on value of r such that – i. When $r > \frac{L}{4}$ its major axis is parallel to Y-axis, with semi major axis equal to r , ii. When $r = \frac{L}{4}$ a circle with its centre at $\left(-r, \frac{L}{2}\right)$, iii. When $r < \frac{L}{4}$ its major axis is parallel to X-axis, , with semi major axis equal to $\frac{L}{2} - r$. N.B.: The trajectory is not asked as a function of time, that simplifies the solution.
I-14	Given that coordinates of larger sphere A of mass $4M$ and radius $6R$ be $(L,0)$. When small sphere B of mass

M and radius R is at extreme right its coordinates are at $((L+6R-R),0)$. The centre of the mass of the system shall be at $x_1 = \dfrac{4M \times L + M(L+5R)}{4M+M} = \dfrac{5ML + 5MR}{5M} = L + R$.

Wnen small sphere is on extreme left, it will be diametrically opposite at same height, since tall syrfaces are frictionless. Let, coordinates of COM of the sphere A be at $(x,0)$, therefore, COM of the system in this new position be

$x_2 = \dfrac{4M \times x + M(x-5R)}{4M+M} = \dfrac{5Mx - 5MR}{5M} = x - R$.

Since, there is no external force acting on the system, therefore COM of system shall remain at the same position i.e. $x_1 = x_2 \rightarrow L + R = x - R \rightarrow x = L + 2R$. Since, the system is on a horizontal table and hence its y, with COM of both the sphere in both the positions lying on X-cordinate and coordinates of sphere A would be $((L+2R),0)$ would remain

I-15	When wedge collides it experiences a force F of collision perpendicular to the surface at the point of collision. This force F will have two components, F_h and F_v. Since, there is no vertical displacement, and hence impact of collision is $\vec{F}_h \Delta t = m(v\hat{i} - (-v\hat{i})) = \dfrac{2mv\hat{i}}{\Delta t} \rightarrow F_h = \dfrac{2mv}{\Delta t}$, or $F = \dfrac{F_h}{\sin 60^0} = \dfrac{\frac{2mv}{\Delta t}}{\frac{\sqrt{3}}{2}} = \dfrac{4mv}{\sqrt{3}\Delta t}$. Accordingly, normal reaction N by the table would be $N = F_v + mg = F\cos 60^0 + mg = \dfrac{4mv}{\sqrt{3}\Delta t} \times \dfrac{1}{2} + mg$. This leades to $N = m\left(\dfrac{2mv}{\sqrt{3}\Delta t} + g\right)$ constitutes answer (a).

It is given that h is the distance of COM of the wedge from line of action of the force $\vec{F}$, and in part (b) of the question it is asked to magnitde of the torque due to internal force $\vec{N}$.

It is further stated in the question that the wedge returns after collision without rotation. It implies that at G, the COM of the wedge net torque is zero i.e.

$\vec{\tau}_N + \vec{\tau}_F = 0 \rightarrow \vec{\tau}_N = -\vec{\tau}_F = \vec{h} \times \vec{F} = -h\dfrac{4mv}{\sqrt{3}\Delta t}\sin 90^0 \hat{k} \rightarrow \tau_N = \left(\dfrac{4mv}{\sqrt{3}\Delta t}\right)h$. This answer (b).

N.B.: Apparently, the solution requires geometrical determination of h and l. But, l is an integeral of τ_N, and h is stipulated in the problem, therefore, fetermination of these two variables is simple, yet it is redundant and and hence skipped.

I-16	Let A be the cross-sectional area of the cylinder. Since no external force is causing motion of the cylinder and hence $\Delta p = p - p_0 = 0 \rightarrow p = p_0 = (m + m_d)v = mv_0$, here mass of dust sticking to the cross-sectional area A of the cylinder be $m_d = Ax\rho$ kg. Therefore, with the given data,

$(m + A\rho x)\dfrac{dx}{dt} = mv_0$. Since, position of the front fact is asked at $t = 150\,\text{s}$, it leads to . Accordingly,

$(m + A\rho x)dx = mv_0 dt$, it leads

$\displaystyle\int_0^x (m + A\rho x)dx = \int_0^{150} mv_0 dt \rightarrow \left[mx + A\rho\dfrac{x^2}{2} \right]_0^x = 10^3[t]_0^{150} \rightarrow x^2 + \dfrac{2m}{A\rho}x - \dfrac{300mv_0}{A\rho} = 0$. Substituting the

values of the variables it reduces to

$x^2 + 2\times10^5 x - 3\times10^{10} = 0 \rightarrow x = \dfrac{-2\times10^5 \pm \sqrt{2\times10^{10} - 4\times1\times\left(-3\times10^{10}\right)}}{2}$. Accordingly, $x = -3\times10^5\,\text{m}$

and $10^5\,\text{m}$, Since cylinder in (=) X-direction with $x = 0$ at $t = 0$ and hence answer is $x = 10^5\,\text{m}$.

N.B.: It is advisible to pursue solution of problem in algebric form and substitute values f variables at last stage to avoid calculation errors.

| I-17 | In this case expression would tend to be too algebric and hence it is essential to use given $\sin\theta = \tan\theta = 0.05$ it leads to θ is small and hence . $\cos\theta = 1$ The problem first needs to be resolved for maximum frictional force $f = \mu N = \mu\, m\, g\sin\theta$. It which will be always against direction of motion, Acoordingly, for mass A, $f_A = \mu m_A g\sin\theta$, and for mass B, it will be $f_B = \mu m_B g\sin\theta$. Therefore, when masses are moving upward, |

$f_{Au} = m_A g\sin\theta + \mu m_A g\cos\theta = m_A g(\sin\theta + \mu\cos\theta)$.

Accodingly, $f_{Au} = m_A g(0.05 + 0.25\times1) = 0.3 m_A g = 3 m_A\,\text{N}$. But, when moving downward

$f_{Ad} = m_A g\cos\theta - \mu m_A g\cos\theta = m_A g(0.05 - 0.25) = -2 m_A$ .N. Likewise, mass B

$f_{Bu} = m_B g(0.05 + 0.25) = M\times g\times0.3 = 3M$ N. Since movement of block B is not involved in the problem correspondig force during the motion is not calculated.

Rest of the problem is of energy balance in four stages as under –

a. When block A with initial velocity $v_{a1} = 10\,\text{m/s}$ reaches block B – it looses kinetic energy in friction during travel, up the the slope, through a distance d and convesion into potential energy due to rise through a height $d\sin\theta$ and the block attains a velocity v_{a2}.

Energy equation for this works out to $\Delta K_{A1} = \dfrac{1}{2}m_A\left(v_{a1}^2 - v_{a2}^2\right) = f_{Au}d$. It leads to

$\dfrac{1}{2}m_A\left(10^2 - v_{a2}^2\right) = 3m_A\times6 \rightarrow v_{a2}^2 = 100 - 36 = 64 \rightarrow v_{a2} = 8\,\text{m/s}$.

b. When block A in-ellastically collides block B with a coefficient of restitution e with velocities of block A changing from v_{a2} to v_{a3} and velocty of block B changing from $v_{b1} = 0$ to v_{b2} m/s.

Accordingly., $e = -\dfrac{\text{Relative velocity of seperation}}{\text{Relative velocity of approach}} = -\dfrac{v_{b2} - (-v_{a3})}{v_{b1} - v_{a2}} = \dfrac{v_{b2} + v_{a3}}{v_{a2}}$ here post collision

velocities of block A and B, v_{a3} and v_{b2} are to be determined, while pre collision velocities v_{a2} has beenndetermined at step (a), and it is given that $v_{b1} = 0$

c. Block A, with the residual kinetic energy, due to velocity v_{a3} after collision, it descends through a height $d\sin\theta$ and looses part of it in friction during travel down the slope through a distance d. At this point velocity of the ball A is $v_{a4} = 1\,\text{m/s}$.
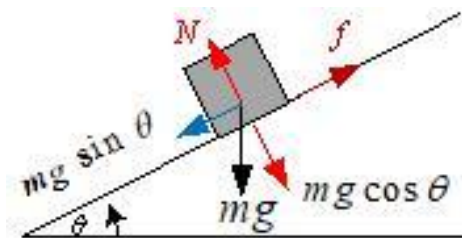
Energy equation for this works out to $\Delta K_{A2} = \frac{1}{2} m_A \left(v_{a3}^2 - v_{a4}^2 \right) = f_{Ad} d$. It leads to

$$\frac{1}{2} m_A \left(v_{a3}^2 - v_{a4}^2 \right) = 2 m_A \times 6 \rightarrow v_{a3}^2 = v_{a4}^2 + 24 \rightarrow v_{a3} = \sqrt{1 + 24} = 5 \text{ m/s}.$$

d. Loss of kinetic energy by Block B, during movement up the slope by a distance $x = 0.5$ m and conversion in potential energy due to rise of height by $x \sin\theta$ and its velocity becomes $v_{b3} = 0$ m/s.

Energy equation for this works out to $\Delta K_{B2} = \frac{1}{2} m_B \left(v_{b2}^2 - v_{b3}^2 \right) = f_{Bu} d$. It leads to

$$\frac{1}{2} m_B \left(v_{b2}^2 - v_{b3}^2 \right) = f_{Bu} d \rightarrow \frac{1}{2} M \left(v_{b2}^2 - 0 \right) = 3M \times 0.5 \rightarrow v_{b2}^2 = 3 \rightarrow v_{b2}^2 = \sqrt{3} \rightarrow v_{b2} = 1.73 \text{ m/s}.$$

Therefore, with values of v_{a3} and v_{b2} determined in step (c) and (d) respectively, $e = \dfrac{5 + 1.732}{8} = \dfrac{6.732}{8} = 0.84$, this part (i) of the answer.

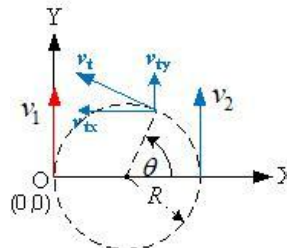As regards mass of block B can be determined from conservation of momentum during collision and accordingly.-

$$m_A v_{a2} + m_B v_{b1} = m_A v_{a3} + m_B v2 \rightarrow 2 \times 8 + M \times 0 = 2 \times (-5) + M \times 1.732 \rightarrow M = \frac{16 + 10}{1.732} = \frac{26}{1.732} = 15.12$$
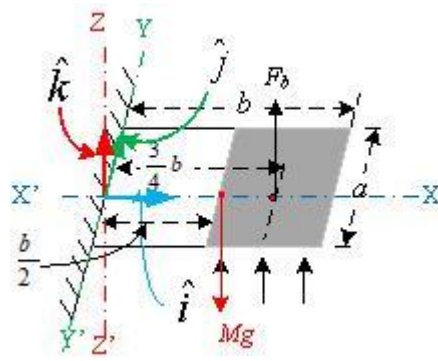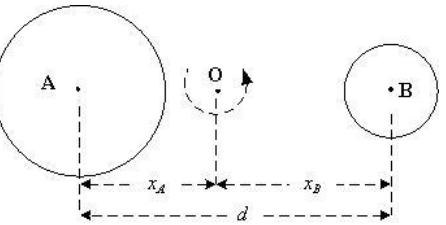
kg. This part (ii) of the answer

N.B: Decomposing the a complex problem, help in clarity of solution and avoiding algebric and calculation errors.

| I-18 | Time t_0 taken by a canon ball of mass $m_1 = 1$ kg fired from P to hit carriage of mass $m_2 = 9$ kg at a depth $h = -120$ m, can be determined with Second Euation of motion under gravity applied to vertical velocity $v_v = v \sin 30^0 = 100 \times \frac{1}{2} = 50$ m/s., and $v_h = v \cos 30^0 = 100 \times \frac{\sqrt{3}}{2} = 50\sqrt{3}$ Accordingly, $h = v_h t_0 - \frac{1}{2} g t_0^2$. It leads to $-120 = 50 t_0 - 5 t_0^2 \rightarrow t_0^2 - 10 t_0 - 24 = 0 \rightarrow t_0 = \frac{10 \pm \sqrt{10^2 - 4 \times 1 \times (-24)}}{2} = \frac{10 \pm \sqrt{10^2 + 96}}{2}$. This being a quadratic equation has two values of $t_0 = \frac{10 \pm 14}{2} = 12, -2$. Since, t_0 cannot be (-)ve and hence $t_0 = 12$ s. Relative velocity of ball w.r.t. ground is $v_b = v_p + v_h = 5\sqrt{3} + 50\sqrt{3} = 55\sqrt{3}$ and sticks, as per conservation of momentum stationery carriage would acquire a velocity v_{c2} such that $m_b v_b + m_c v_{c1} = (m_1 + m_c) v_{c2}$. Accordingly, it leads to $1 \times 55\sqrt{3} + 9 \times 0 = (1 + 9) v_{c2} \rightarrow v_{c2} = 5.5\sqrt{3}$. When second ball is fired at t_0, the car would have travelled a distance $d = 5\sqrt{3} \times t_0 = 60\sqrt{3}$ m. Thus for second canon to hit and stick to carriage, distance travelled by carriage, as per second equation of motion, shall also be $60\sqrt{3} = v_{c2}(t_0) + \frac{1}{2} a(t_0)^2$. Thus, $2 \times 60\sqrt{3} = 2 \times 5.5\sqrt{3} \times 12 + a \times 12 \times 12$. Accordingly, uniform friction between carriage and trail is $a = \frac{120\sqrt{3} - 132\sqrt{3}}{288} = \frac{-12}{288}\sqrt{3}$ m/s^2. Therefore, velocity of carriage when second ball hits after t_0 sec, as per |

first equation of motion would be $v_{c3} = v_{c2} + at_0 \rightarrow v_{c3} = 5\sqrt{3} + \left(-\dfrac{12\sqrt{3}}{288}\right)12 = \dfrac{1440-144}{288}\sqrt{3} = \dfrac{1296}{288}\sqrt{3}$, or

$v_{c3} = \dfrac{9\sqrt{3}}{2}$ m/s.

Thus, velocity of carriage, just after second impact as per COM, shall be $m_b v_b + (m_b + m_c)v_{c3} = (2m_b + m_c)v_{c4}$.   Accordingly,

$1 \times 55\sqrt{3} + 10 \times \dfrac{9\sqrt{3}}{2} = (2\times1+9)v_{c4} \rightarrow 2v_{c4} = \dfrac{(2\times55+10\times9)\sqrt{3}}{11} = \dfrac{(110+90)\sqrt{3}}{11} = \dfrac{200\sqrt{3}}{11}$.

Thus $v_{c4} = \dfrac{100\sqrt{3}}{11} = 15.75$ m/s. This is the answer (ii).

I-19	Let at any instant t, the radial joining the particle to the centre of the citcle has rotated through an angle $\theta = \omega t$. Since particle has uniform speed $v_2 = R\omega$, here ω is the corresponding uniform angular velocity.Therefore, velocity vector of particle $\vec{v}_t = v_x \hat{i} + v_y \hat{j} = v_2 \cos(90+\theta)\hat{i} + v_2 \sin(90+\theta)\hat{j} = -v_2 \cos\theta\, \hat{i} + v_2 \cos\theta\, \hat{j}$, while velocity of the man is $\vec{v}_m = v_1 \hat{j}$. There relative velocity of the particle w.r.t. man is $\vec{v}_{t,m} = \vec{v}_t - \vec{v}_m$ man and accordingly linear momentum $\vec{L} = m\vec{v}_{t,m} = m\left((-v_2\cos\theta\,\hat{i} + v_2\cos\theta\,\hat{j}) - (v_1\hat{j})\right) = m\left(-v_2\cos\theta\,\hat{i} + (v_2\cos\theta - v_1)\hat{j}\right)$ and replacing $\theta = \dfrac{v_2}{R}t$ in terms of known variables $\vec{L} = m\left(-v_2\cos\left(\dfrac{v_2}{R}t\right)\hat{i} + \left(v_2\cos\left(\dfrac{v_2}{R}t\right)\theta - v_1\right)\hat{j}\right)$, this is the answer.
I-20	With the given $x_1 = v_0 t - A(1-\cos\omega t)$, since there is no external force COM shall maintain velocity v_0 such that $x = \dfrac{m_1 x_1 + m_2 x_2}{m_1 + m_2} = v_0 t$, and postion of the two masses about COM shall be $(x-x_1)m_1 + (x-x_2)m_2 = 0$. Accordingly, $x_2 = \dfrac{(m_2+m_1)x - m_1 x_1}{m_2} \rightarrow \left(1 - \dfrac{m_1}{m_2}\right)v_0 t - \dfrac{m_1}{m_2}(v_0 t - A(1-\cos\omega t)) = v_0 t + A\dfrac{m_1}{m_2}(1-\cos\omega t)$. This is answer (a). Now velocity of mass m_1 shall be $v_1 = \dfrac{d}{dt}(v_0 t - A(1-\cos\omega t)) = v_1 = -A\omega\sin\omega t \rightarrow a_1 = \dfrac{d}{dt}v_1 = -A\omega^2$, Further, $x_2 - x_1 = \left(v_0 t + A\dfrac{m_1}{m_2}(1-\cos\omega t)\right) - (v_0 t - A(1-\cos\omega t)) = A\left(\dfrac{m_1}{m_2}+1\right)(1-\cos\omega t)$. At $\cos\omega t = 0$, it leads to at $x_2 - x_1 = l_0 = A\left(\dfrac{m_1}{m_2}+1\right)$, it is part (b) of the answer.

I-21	Center of mass the plate about its central line X-X' and located at $\frac{b}{2}$ from the wall. Therefore moment of the COM about the wall is $\vec{\tau}_p = -Mg\left(\frac{b}{2}\right)\hat{k}$. Now the balls striking plate with velicity $v\,\hat{j}$, from bottom, on right half keep it in horizontal and make elastic collision and therefore after collision balls would return backward with velicty $-v\,\hat{j}$. Therefore, centre of vertical force by the ball would be $\vec{F}_b = nm\left(\frac{ab}{2}\right)\left(v\,\hat{j} - \left(-v\hat{j}\right)\right) = nmabv\,\hat{j}$. Center of the uniform force caused by the balls shall be $\frac{3}{4}b\hat{i}$ Accordingly, moment caused balls striking the platea would be $\vec{\tau}_b = \left(\frac{3}{4}b\hat{i}\right) \times \left(nmabv\hat{j}\right) = \frac{3}{4}nmab^2v\hat{k}$. Given that plaste remain in horizontal position and the is possible when $\vec{\tau}_p + \vec{\tau}_p = 0 \rightarrow -\frac{1}{2}Mgb\hat{k} + \frac{3}{4}nmab^2v\hat{k} = 0 \rightarrow v = \frac{2}{3}\left(\frac{Mg}{nmab}\right) = \frac{2}{3}\left(\frac{3 \times 10}{100 \times 0.01 \times 1 \times 2}\right) = 10\,\text{m/s}$, this is the answer.
I-22	Since no external force including friction is acting and hence principle of coefficient of restitution can be applied to determine velicities at two stages. In first elastic as per principle of COM $m_A v_{Ai} + m_B v_{Bi} = m_A v_{Af} + m_{Bf}$, it leads to $9m = mv_{Af} + 2mv_{Bf} \rightarrow v_{Af} + 2v_{Bf} = 9$. As per principle of COE, $\frac{1}{2}m_A v_{Ai}^2 + \frac{1}{2}m_B v_{Bi}^2 = \frac{1}{2}m_A v_{Af}^2 + \frac{1}{2}m_B v_{Bf}^2$ which calculates to $81m = mv_{Af}^2 + 2mv_{Bf}^2 \rightarrow v_{Af}^2 + 2v_{Bf}^2 = 81$. Accordingly, $2v_{Bf}^2 = 81 - v_{Af}^2$, which further becomes $2v_{Bf}^2 = 81 - \left(9 - 2v_{Bf}\right)^2 \rightarrow 2v_{Bf}^2 = 81 - \left(81 - 36v_{Bf} + 4v_{Bf}^2\right) = 6v_{Bf}^2 - 36v_{Bf} = 0$. It reduces to $v_{Bf} = 6$ m/s. Now the second collision being fully inelastic and there B coalesces in to C and therefore, as per which is stationery and therefore as per COM $m_B v_{Bf} + m_C v_{Ci} = \left(m_B + m_C\right)v_{Cf} \rightarrow 2m \times 6 = \left(2m + m\right)v_{Cf} \rightarrow v_{cf} = \frac{12}{3} = 4$ m/s, This is the answer.
I-23	In cosmic scale, radius of the celestial bodies is too small as compared to their distances and thus they can be approximated to point masses for applying in mechanics. Accordingly, moment inertia of the two stars about their combined CG at O would be $I_A = m_A x_A^2$ and $I_B = m_B x_B^2$ Therefore, Angular momentum of the Twin star about O is $L = \left(I_A + I_B\right)\omega$ while that of star B is $L_B = I_B\omega$. Thus $\frac{L}{L_B} = \frac{\left(m_A x_A^2 + m_B x_B^2\right)\omega}{m_B x_B^2\omega} = 1 + \frac{m_A x_A^2}{m_B x_B^2}$. Since, net moment of distributed masses at its CG is Zero and hence $m_A x_A + m_B x_B = 0 \rightarrow \frac{x_A}{x_B} = -\frac{m_B}{m_A}$, accordingly, $\frac{L}{L_B} = 1 + \left(\frac{m_A}{m_B}\right)\left(\frac{m_B^2}{m_A^2}\right) = 1 + \frac{11M_s}{2.2M_s} = 1 + 5 = 6$, this is the answer.

	N.B.: Approximation, wherever necessary, has to be applied, in respect undefined quantities, in a considered manner, for simplification of te problem and to arrive at the solution.
I-24	Velocity of the particle at a given instant $t = \dfrac{v_0}{g}$ projecteed at an angle 45^0 is
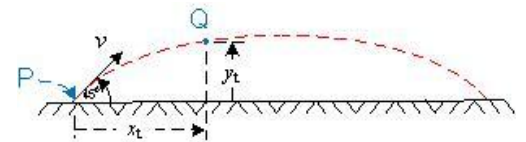
$\vec{v}_t = v_0 \cos 45^0 \hat{i} + \left(v_0 \sin 45^0 - gt\right)\hat{j} = \dfrac{v_0}{\sqrt{2}}\hat{i} + \left(\dfrac{v_0}{\sqrt{2}} - g\dfrac{v_0}{g}\right)\hat{j}$.

Accordingly, $\vec{v}_t = \left(\dfrac{\hat{i} + \left(1 - \sqrt{2}\right)\hat{j}}{\sqrt{2}}\right)v_0$, and position of partcile, at the instant shall be

$x_t\hat{i} = \left(v_0 \cos 45^0\right)t\,\hat{i} = \dfrac{v_0}{\sqrt{2}}\dfrac{v_0}{g}\hat{i} = \dfrac{v_0^2}{\sqrt{2}g}\hat{i}$ and $y_t\hat{j} = \left(\left(v_0 \sin 45^0\right)t - \dfrac{1}{2}gt^2\right)\hat{j} = \left(\dfrac{v_0}{\sqrt{2}}\dfrac{v_0}{g} - \dfrac{1}{2}g\left(\dfrac{v_0}{g}\right)^2\right)\hat{j}$, which

leads to $\vec{r}_t = \left(\dfrac{\sqrt{2}\hat{i} + \left(\sqrt{2} - 1\right)\hat{j}}{2}\right)\dfrac{v_0^2}{g}$. Accordingly angular momentum of the particle is $\vec{L} = m(\vec{r} \times \vec{v})$ which

resolves into $\vec{L} = m(\vec{r} \times \vec{v}) = m\left(\left(\dfrac{\sqrt{2}\hat{i} + \left(\sqrt{2} - 1\right)\hat{j}}{2}\right)\dfrac{v_0^2}{g}\right) \times \left(\left(\dfrac{\hat{i} + \left(1 - \sqrt{2}\right)\hat{j}}{\sqrt{2}}\right)v_0\right)$. It simplifies into
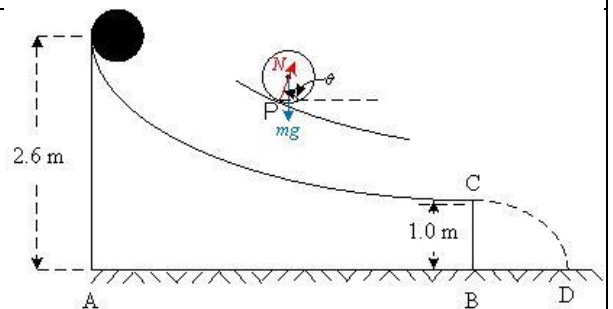
$\vec{L} = m\left(\dfrac{\left(\sqrt{2} - 1\right)\left(-\hat{k}\right) + \left(\sqrt{2} - 2\right)\hat{k}}{2\sqrt{2}}\right) = m\left(\dfrac{\left(\sqrt{2} - 2\right) - \left(\sqrt{2} - 1\right)}{2\sqrt{2}}\right)\hat{k} = -\dfrac{m}{2\sqrt{2}}\hat{k}$. Thus magnitude is $\dfrac{m}{2\sqrt{2}}$ and

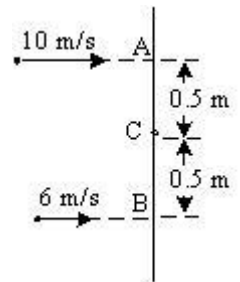direction is $\left(-\hat{k}\right)$ i.e. towards entering the paper

N.B.: In this problem value of g is redundant, since it cancels out in final form of answer. |
| I-25 | It is since a case of rolling without slipping and therefore it is pure rolling and therefore applying principles of conservation of energy $\Delta PE = mg(2.6 - 1) = 16m = KE_R + KE_T$. Here, rotational motion shall have $v = r\omega$, where v is translational velocity , ω is angular velocity and r is radius of the ball. Accordingly, rotational kinetic energy of the ball $KE_R = \dfrac{1}{2}I\omega^2 = \dfrac{1}{2}\left(\dfrac{2}{5}mr^2\right)\left(\dfrac{v}{r}\right)^2 = \dfrac{1}{5}mv^2$ and |

translational kinetic energy of the ball is $KE_T = \frac{1}{2}mv^2$. Accordingly,

$mgh = \frac{1}{5}mv^2 + \frac{1}{2}mv^2 = \frac{7}{10}mv^2 \to 16 = \frac{7}{10}v^2$. It leads to $v = 4\sqrt{\frac{10}{7}}$ m/s.

Having determined, the ball after leaving horizontal track at C, at height 1 m above B, shall perform a projectile motion and accordingly point D would be at a distance $x = vt$, here time of free fall t, through a height of 1m.

Accordingly, as per Second Equation of Motion $1 = 0 \times t + \frac{1}{2}gt^2 \to t = \sqrt{\frac{1}{5}}$. Thus

$x = \left(4\sqrt{\frac{10}{7}}\right)\left(\frac{1}{\sqrt{5}}\right) = \left(4\sqrt{\frac{2}{7}}\right)$ m, this is the answer for part (a).

During flight, the ball has not contact surface and its line of force (weight) acting on it is passing through its CG, and hence no torque is acting on the ball which would either increase or decrease angular velocity ω. Therefore, it would continue to roll at ω as at point C. This is unlike the conditions causing torque when ball is on the track. Answer, therefore answer to part (b) is Yes.

I-26	In this problem principle of conservation of momentum applies in two stages – (a) Translational Momentum caused by change of translational velocity and (b)angular momentum caused by hitting of partles away from COM of bar and its consequent abgualr velocity. Let, after collision the bar together with masses sticking to it acquire translational velocity v and an angular velocity ω.

It is analysed as under partcles striking the rod strike stick to the bar therefore change of momentum after striking at A is $\Delta\vec{p}_A = m(10-v)\hat{i}$ and likewise, at B is $\Delta\vec{p}_B = m(6-v)\hat{i}$, and of bar $\Delta\vec{p}_R = M(0-v)\hat{i}$. Therefore, as per COM (translational) $\Delta\vec{p}_A + \Delta\vec{p}_B + \Delta\vec{p}_R = 0$, accordingly, $(0.8-0.08v)+(0.48-0.08v)-0.16v = 0 \to 1.28 = 0.32v \to v = 4$ m/s.

As regards angular moentum of particle at A is $\vec{L}_A = m_A(\vec{r}_A \times \vec{v}_A) = m_A r_A v_A(-\hat{k}) = -m_A r_A v_A \hat{k}$ and of particle at B $\vec{L}_B = m_B(\vec{r}_B \times \vec{v}_B) = m_B r_B v_B(\hat{k}) = m_B r_B v_B \hat{k}$. Thus, angular momentum of particles before collision $\vec{L}_p = mr(v_b - v_A)\hat{k}$, $m = m_A = m_b = 0.08$ kg, and $r = r_A = r_b = 0.5$ m. Accordingly, $\vec{L}_p = 0.08 \times 0.5 \times (6-10)\hat{k} = -0.16\hat{k}$ Whereas for the rod whose moment of inertia about its COM is

$I_R = \frac{Ml^2}{12} = \frac{0.16(\sqrt{3})^2}{12} = 0.04$, MI of two particles about COM $I_p = I_A + I_B = 2 \times 0.08 \times 0.5^2 = 0.04$ and therefore, MOI of system $I = I_R + I_P = 0.004 + 0.04 = 0.08$. Accordingly, post collision $\vec{L} = I\vec{\omega}$. Applying,

COM (angular) $\vec{L}_p + \vec{L} = 0 \to -0.16\hat{k} + 0.08\vec{\omega} = 0 \to \vec{\omega} = \frac{0.16}{0.08}\hat{k} = 2\hat{k}$, i.e. 2 rad/ds in anticlockwise direction.

Writing energy balance equation $K_{AT} + K_{BT} = K_{ST} + K_{SR} \to \frac{1}{2}m(v_A{}^2 + v_A{}^2) = \frac{1}{2}((2m+M)v^2 + I\omega^2) + \Delta E$

Accordingly, $\Delta E = \frac{1}{2}0.08(10^2 + 6^2) - \frac{1}{2}((2 \times 0.08 + 0.16)4^2 + 0.08 \times 2^2) = \frac{1}{2}0.08(136 - (64+4))$J. Thus loss of energy is $\Delta E = 0.04 \times 68 = 2.72$ J, this is the answer.

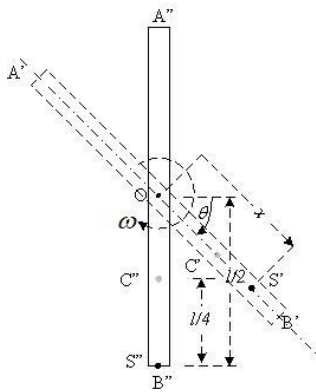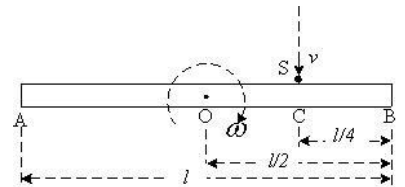| I-27	Let m is the mass of the carpet roll when radius of the roll becomes $\dfrac{R}{2}$, then $\dfrac{m}{M} = \dfrac{\pi\left(\dfrac{R}{2}\right)^2}{\pi R^2} \to m = \dfrac{M}{4}$. During unrolling, centre of mass of roll descends from R to $\dfrac{R}{2}$ and thus change in potential energy is $\Delta PE = MgR - mg\dfrac{R}{2} \to gR\left(M - \dfrac{M^2}{4} \times \dfrac{1}{2}\right) = gR\left(\dfrac{8M - M}{8}\right) = \dfrac{7}{b}MgR$. Let at that point radius of the roll is linear velicity of the COM is $v = \dfrac{R}{2}\omega \to \omega = \dfrac{2v}{R}$. At the point energy of the unrolled pack shall have two constituents translation energy of CM and rotational energy of the COM thus, $\Delta KE = \dfrac{1}{2}mv^2 + \dfrac{1}{2}I\omega^2 = \dfrac{1}{2}\left(\dfrac{M}{4}v^2 + \dfrac{m\left(\dfrac{R}{2}\right)^2}{2}\left(\dfrac{2v}{R}\right)^2\right) = \dfrac{1}{2}\left(\dfrac{M}{4}v^2 + \dfrac{mv^2}{2}\right) = \dfrac{1}{2}\left(\dfrac{M}{4} + \dfrac{1}{2} \times \dfrac{M}{4}\right)v^2 = \dfrac{3}{16}Mv^2$. Thus, energy balance equation is $\Delta PE = \Delta KE \to \dfrac{7}{8}MgR = \dfrac{3}{16}Mv^2 \to v = \sqrt{\dfrac{14gR}{3}}$ m/s, this is the answer .
I-28	Angular momentum of the insect about point O is $\vec{L}_I = M\left(\dfrac{l}{4}\hat{i}\right) \times (-\hat{j}v) = -\dfrac{Mlv}{4}\hat{k}$. As soon as insects falls on the rod, its angluar moment is transferred to the rod with insect having angular momentum $I = \dfrac{Ml^2}{12} + M\left(\dfrac{l}{4}\right)^2 = \dfrac{7Ml^2}{48}$ and it wil be set into an angular velocity ω such that as per conservation of momentum (angular $\vec{L}_I = \vec{L}_S = I\vec{\omega}$. Accordingly, $\vec{L}_I = -\dfrac{Mlv}{4}\hat{k} = \dfrac{7}{48}Ml^2\omega \to \omega = \dfrac{12v}{7l}$ i.e. $\dfrac{12v}{7l}$ rad/s in clockwise direction. This is part (a) of the answer. When the insect moves towards B, the angular velocity ω of the system remains constant. This is a condition priory in attempting part (b). Let at any instant t the particle is at a distance x from O and therefore moment inertia of the system would be $I_t = \dfrac{1}{12}Ml^2 + Mx^2$ and angular momentum $L_t = I_t\omega = \left(\dfrac{1}{12}Ml^2 + Mx^2\right)\omega$, and torque is $\vec{\Gamma}_t = \dfrac{d}{dt}\vec{L}_t = \dfrac{d}{dt}\left(\dfrac{1}{12}Ml^2 + Mx^2\right)\omega(-\hat{k}) = -2Mx\omega\dfrac{dx}{dt}\hat{k}$. Alternatively, angular torque can be written as $\vec{\Gamma}_t = \vec{x} \times Mg\,\hat{j} = xMg\sin(90-\theta)(-\hat{k})$ which comes to $\vec{\Gamma}_t = -xMg\cos\theta\,\hat{k}$. Equating the two angular torques $\vec{\Gamma}_t = -2Mx\omega\dfrac{dx}{dt}\hat{k} = -xMg\cos\theta\,\hat{k} \to dx = \dfrac{g}{\omega}\cos\theta\,dt$, here $\theta = \omega t \to dt = \dfrac{1}{\omega}d\theta$. With initial position of insect on the bar at C to final position B, x changes from $\dfrac{l}{2}$ to $\dfrac{l}{4}$., it given that θ changes from 0 to $\dfrac{\pi}{2}$.

Accordingly, $\Gamma dx = \frac{g}{\omega^2}\cos\theta\,d\theta$, and on integration with the limits $\int_{\frac{l}{4}}^{\frac{l}{2}} dx = \frac{g}{\omega^2}\int_0^{\frac{\pi}{2}}\cos\theta\,d\theta \rightarrow [x]_{\frac{l}{4}}^{\frac{l}{2}} = \frac{g}{\omega^2}[\sin\theta]_0^{\frac{\pi}{2}}$.

It leads to $\frac{l}{4} = \frac{g}{\omega^2}\left(\sin\left(\frac{\pi}{2}\right) - \sin 0\right) = \frac{g}{\omega^2}$, $\omega^2 = \frac{4g}{l} \rightarrow \omega = 2\sqrt{\frac{g}{l}}$. Now from value of determined in part (a)

of the problem $2\sqrt{\frac{g}{l}} = \frac{12v}{7l} \rightarrow v = \frac{7}{6}\sqrt{gl} = \frac{7}{6}\sqrt{10\times1.8} = \frac{7}{6}\sqrt{2\times9} = \frac{7}{6}\times3\sqrt{2} = 3.5\times1.41 = 4.23\,\text{m/s}$, This is the answer of part (b).

N.B.: (a) In this insect sits on rod during collision, which makes an inelastic collision. After the collision it starts moving towards B.
(b) By common logic as insect moves away from fulcrum O, and towards B, torque would increase and it would tend increase ω.
(c) Since, a condition that angular velocity ω remains constant, during travel of insect travels from B to C, it implies that there is loss of energy taking place during movementof insect on rod to prevent increase in as stated at (b). Accordingly, torque equations during movement of insect has been written in this illustration.
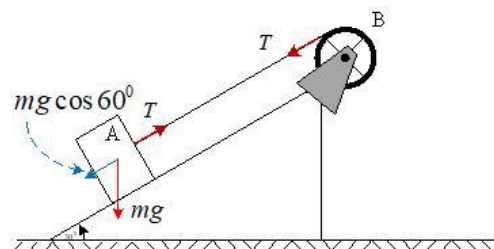(d) If equations are formulated for final change in potential energy when rod becomes vertical and final kinetic energy of the system with insect at B, the element of consumption of energy in maintaining as constant ω would be missed and it would lead to wrong answer.
(e) Statement of constant ω in the problem is made so tangentially that it would skip the attention of student. Such statements act as discriminant in filtering across students. Therfore reading question carefully make minute observation, in statement of question, is extremely important.
(c) Further, this is another example of why one should not make a haste in using numerical values, it should be left to last. Questions at this level are designed to text analytical ability and not the numerical skill of students.

I-29	Body A of mass m, and initially starts moving up the plane and it finally comes to rest as given in part (b) of the question, it implies that it experiences a linear retardation a and accordingly, $mg\cos60^0 - T = ma$.

As regards drum B, $\tau = Tr = I\alpha$, here $I = \frac{1}{2}Mr^2$ by approximating the drum to be a cylindrical ring, and α is angular retaradtion of the

drum we get $T = \frac{Mr^2}{2r}\alpha = \frac{Mr}{2}\alpha$. Since, string is instrechable, therefore, velocity of block

$v = r\omega \rightarrow a = r\frac{d\omega}{dt} = r\alpha$. Thus net equation of A is $\frac{mg}{2} - \frac{Mr\alpha}{2} = mr\alpha$ and thus angular retardation of the

drum is $(M+2m)r\alpha = mg \rightarrow \alpha = \frac{mg}{(M+2m)r} = \frac{0.5\times10}{(2+2\times0.5)\times0.2} = \frac{25}{3} = 8.3\,\text{rad/s}^2$. Therefore, tension in the

string, with the given and derived data is $T = \frac{2\times0.2}{2}\times8.3 = 1.66\,\text{N}$, it is part (a) of the answer.

As regards part (b) of the question, linear retardation $a = r\times\alpha = 0.2\times8.3 = 1.66\,\text{m/s}^2$. And given that at any instant angular velocity of the drum B is 10 rad/s, which will translate into linear velocity of A $v = r\times w = 0.2\times10 = 2\,\text{m/s}$. Therefore, from this instance, distance covered by A to come to rest as per third

equation of motion shall be $0 = 2^2 - 2\times1.66\times s \rightarrow s = \frac{2}{1.66} = 1.2\,\text{m}$, this is the answer for part (b)

I-30	Angular momentum of object hitting the assembly is $\vec{\tau} = m\vec{r}\times\vec{v} = m(0.6+0.6)(-\hat{j})\times(v\hat{i}) = 0.05\times1.2v\hat{k}$, it

leads to $\vec{\tau} = 0.06v\hat{k}$ Transfer of angular moentum to the assembly suspended from P, would require its moment

of inertia about the point and it is $I = \left(\dfrac{m_A l^2}{12} + m_A \left(\dfrac{l}{2}\right)^2\right) + \left(\dfrac{m_B l^2}{12} + m_B \left(\dfrac{3l}{2}\right)^2\right) + m_C (2l)^2$. It solves into
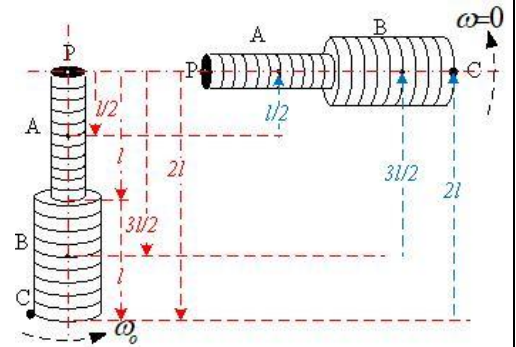
$I = \left(\left(\dfrac{1}{12} + \dfrac{1}{4}\right)m_A + \left(\dfrac{1}{12} + \dfrac{9}{4}\right)m_B + 4m_C\right)l^2$,   which   reduces

numerically, $I = \left(\dfrac{0.01}{3} + \dfrac{7 \times 0.02}{3} + 4 \times 0.05\right)(0.6)^2$. It reduces to

$I = \left(\dfrac{0.01 + 0.14 + 0.6}{3}\right) \times 0.36 = 0.75 \times 0.12 = 0.09$, kg-m^2, Thus as

per conservation of momentum $\vec{\tau} = 0.06v\hat{k} = 0.09\vec{\omega}$, and therefore

$0.06v = 0.09\omega \rightarrow \omega = \dfrac{2}{3}v$ rad/s. This is an a inelastic collision

Now to determine velocity principle of conservation of energy is applied to equate rotational kinetic energy of the system post collision and increase in potential energy of the system comprising of three elements A, B and C. Thus, $\Delta PE = \Delta PE_A + \Delta PE_B + \Delta PE_C$,   and   therefore,

$\Delta PE = \left(m_A \dfrac{l}{2} + m_B \dfrac{3l}{2} + m_C 2l\right)g = \left(\dfrac{0.01}{2} + \dfrac{3 \times 0.02}{2} + 0.05 \times 2\right)0.6 \times 10 = \left(\dfrac{0.01 + 0.06 + 0.2}{2}\right) \times 6 = 0.27 \times 3$,

here take $g = 10$ m/s^2. Thus $\Delta PE = 0.81$ N-m. Since, angular velocity of the system when it becomes horizontal is zero and hence its kinetic energy is also Zero. Therefore, rise in potential energy is equated to rotational kinetic

energy of the system, post collision, when it is vertical leads to . $\Delta PE = KE \rightarrow KE = \dfrac{1}{2} \times I \times \omega^2 = \dfrac{0.09}{2} \times \omega^2$

.Therefore It leads to $\Delta PE = KE \rightarrow 0.81 = 0.045 \times \omega^2 \rightarrow \left(\dfrac{2v}{3}\right)^2 = \dfrac{810}{45} \rightarrow v^2 = \dfrac{18 \times 9}{4} = \dfrac{9^2}{2} \rightarrow v = \dfrac{9}{\sqrt{2}}$, thus a

$v = \dfrac{9}{\sqrt{2}} = 6.36 \approx 6.4$ m/s. this is the answer.

N.B.: (a) In this question, neither external force is acting nor any internal energy is being consumed in adhering to problem conditions. Therefore mere energy balance is good enough, unlike in question 28.

(b) In this case stepwise reducing algebraic expression int numerical value would simply handing of long algebraic expressions.

(c) It is a good example of making a considered choice between intermediate numerical calculations and that at the last stage. This intuition comes with practice of solving problems.

(d) Value of $g = 10$ m/s^2 is taken, which is not specified. This value as taken by student would marginally affect the answer.

I-31	When cylinder is resting on the edge, its CG is passing through the edge and is along the vertical surface adjoining the edge. As a result there is no torque and no motion and hence no frictional force.

As the cylinder is slightly, displaced, its CG drifts away fromg the edge, causing a clock wise rotational torque τ_R such that it slightly exceeds frictional torque τ_F causing an inceremetal tilt angle θ. As $\theta = \theta_C$, the cylinder starts to roll along the vertical surface with its linear velocity v parallel to the vertical surface of the rectangualr block.

Accordingly, during transition from state of rest to leaving the edge contact cylinder
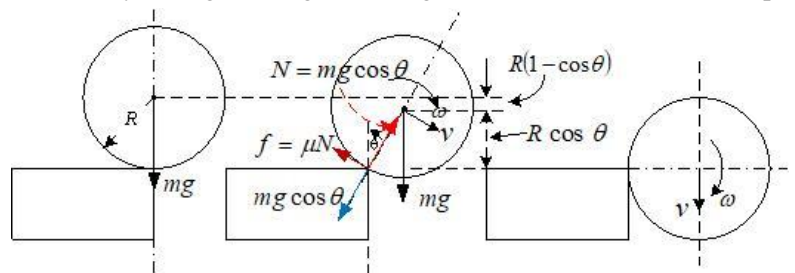
rotates about the edge through an angle $\theta = 0$ to $\theta = \theta_c$. During this energy changes are – (a) Loss of potential energy due to descend of CG of cylinder $\Delta PE = mg(R - R\cos\theta) = mgR(1 - \cos\theta)$ (b)Gain of linear kinetic energy due to linear velocity of the CG of the cylinder $KE_L = \frac{1}{2}Mv^2$, and (c) gain in rotational kinetic energy of the cylinder about the CG $\Delta KE_R = \frac{1}{2}I\omega^2 = \frac{1}{2} \times \frac{MR^2}{2} \times \left(\frac{v}{R}\right)^2 = \frac{1}{4}Mv^2$, here moment of inertia of cylinder , and since cylinder is rolling and there $v = R\omega \rightarrow \omega = \frac{v}{R}$. Thus energy balance equation at any angle during turing is $\Delta PE = \Delta KE_L + \Delta KE_R \rightarrow mgR(1 - \cos\theta) = \frac{1}{2}mv^2 + \frac{1}{4}mv^2 = \frac{3}{4}mv^2 \rightarrow \frac{v^2}{R} = \frac{4}{3}g(1 - \cos\theta)$.

At angle θ_c when the cylinder leaves the edge normal reaction $N = 0 = mg\cos\theta_c - \frac{mv^2}{R} \rightarrow \frac{v^2}{R} = g\cos\theta_c$.

Thus equating $\frac{v^2}{R}$ from equation of energy equilibrium and equilibrium of forces $\frac{4}{3}g(1 - \cos\theta_c) = g\cos\theta_c$, it leads to $\frac{4}{3}(1 - \cos\theta_c) = \cos\theta_c \rightarrow \left(1 + \frac{4}{3}\right)\cos\theta_c = \frac{4}{3} \rightarrow \cos\theta_c = \frac{4}{7} \rightarrow \theta_c = \cos^{-1}\left(\frac{4}{7}\right)$. This is the answer of part (a) .

Next part is speed v of the CG of the cylinder at angle θ_c when leaving the edge, from energy balance equation $\frac{v_c^2}{R} = \frac{4}{3}g(1 - \cos\theta_c) = \frac{4}{3}g\left(1 - \frac{4}{7}\right) = \frac{4}{3}g\frac{3}{7} = \frac{4}{7}g \rightarrow v_c = \sqrt{\frac{4}{7}gR}$ m/s., this is the answer of part (b).

Once, the cylinder leaves the edge of the block and there is no torque. Therefore rotational energy of the cylinder would remain unchanged. But, kinetic energy of linear motion would change due to change in potential energy during further fall of CG from height $R\cos\theta_{cc}$ $\Delta PE = mgR\cos\theta_c = \frac{4mgR}{7}$ above the edge to the level of the edge.

Thus, $KE_R = \frac{1}{2}I\omega_c^2 = \frac{1}{2}\frac{mR^2}{2}\left(\frac{v_c}{R}\right)^2 = \frac{1}{4}mv_c^2 = \frac{1}{4}m\left(\sqrt{\frac{4}{7}gR}\right)^2 = \frac{1}{4}m\left(\frac{4}{7}gR\ri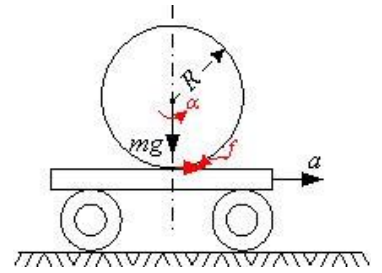ght) = \frac{mgR}{7}$ and kinetic energy at that instant would be $KE_c = \frac{1}{2}mv_c^2 = \frac{1}{2}m\left(\sqrt{\frac{4}{7}gR}\right)^2 = \frac{1}{2}m\left(\frac{4}{7}gR\right) = \frac{2mgR}{7}$ and total linear kinetic of the cylinder as per principle of conservation of energy is $KE_{TL} = KE_C + \Delta PE = \frac{2mgR}{7} + \frac{4mgR}{7} = \frac{6mgR}{7}$.

Therefore, required ratio $\frac{KE_{TL}}{KE_R} = \frac{\frac{6mgR}{7}}{\frac{mgR}{7}} = 6$. This answer of part (c).

| I-32 | Analysis of the problems leads to the fact that when truck accelerates at $a = 9$ m/s^2 w.r.t. road the sysem will remain in position only in the event that its acceleration w.r.t. truck is Zero. Thus $a\hat{i} + a_R\hat{i} = 0 \rightarrow a_R\hat{i} = a(\hat{i})$, Thus, a_R is the acceleration acting along $(-\hat{i})$ and it is reaction of a along $(+\hat{i})$ and $a = a_R$. This $\vec{a}_R = a(-\hat{i})$ will cause a frictional force f such that $\vec{f} = -m(a_R) = ma\hat{i}$. Let, f is the force of friction offered by the platform of the truck which is havin an acceleration a along X-axis |

i.e. $\hat{i}$. This acceleration of the truck would create a psuedo force tending to move it along $(-)\hat{i}$ and, therefore, frictional force would act along $(+)\hat{i}$ and a resultant acceleration would be $\vec{a}_o = \dfrac{\vec{f}}{m} = \dfrac{f}{2}\hat{i}$. As a result of friction at $\vec{\tau} = R(-\hat{k}) \times f(\hat{i}) = Rf(-\hat{j})$. This torque would create an angular acceleration $\vec{\tau} = I\vec{\alpha} = \dfrac{MR^2}{2}\vec{\alpha}$ and $\vec{a}_0^{'} = R(-\hat{k}) \times \alpha(-\hat{j}) = R\alpha(\hat{k} \times \hat{j}) = R\alpha(-\hat{i})$,

Further, $a = a_0 + a_0^{'} = \dfrac{f}{2} + R\left(\dfrac{\tau}{I}\right) = \dfrac{f}{2} + R\left(\dfrac{fR}{\dfrac{MR^2}{2}}\right) = \dfrac{f}{2} + f = \dfrac{3}{2}f \rightarrow 9 = \dfrac{3}{2}f \rightarrow f = 6\,\text{N}$. This is the answer of part (a).

Magnitude and direction of frictional torque about point O, centre of the rod joining to wheels shall be as under –
Torque due to friction at P is

$\vec{\tau}_P = R_P \times \vec{f} = \left(\dfrac{l}{2}\hat{j} - R\hat{k}\right) \times (f\,\hat{i}) = (0.1\hat{j} - 0.1\hat{k}) \times (6\hat{i}) = 0.6(-\hat{i}$

or magnitude of torque τ_P is $0.6 \times \sqrt{2} = 0.85\,\text{N-m}$ on Y-Z plane in fourth quadrant along at bisector of Y-Z axes.
Likewise, torque at Q is

$\vec{\tau}_Q = R_P \times \vec{f} = \left(-\dfrac{l}{2}\hat{j} - R\hat{k}\right) \times (f\,\hat{i}) = (-0.1\hat{j} - 0.1\hat{k}) \times (6\hat{i}) = -0.$

or $\vec{\tau}_Q = 0.6(\hat{k} - \hat{j})$ magnitude of torque τ_P is $0.6 \times \sqrt{2} = 0.85\,\text{N-m}$ on Y-Z plane in second quadrant along at bisector of Y-Z axes.
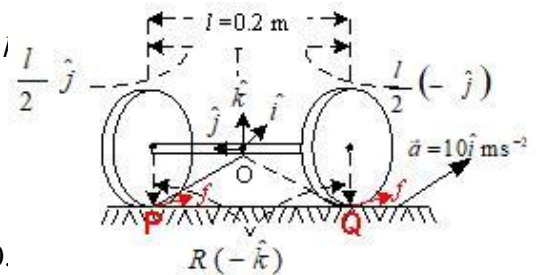
I-33	A disc of radius R and mass m mass would produce a frictional force $f = \mu N = \mu mg$ and a linear retardation $a_L = \dfrac{f}{m} = \dfrac{\mu mg}{m} = \mu g$. This frictional force would prodive a torque about COM and thus $\tau = Rf = I\alpha \rightarrow R\mu mg = \dfrac{mR^2}{2}\alpha \rightarrow \alpha = \dfrac{2\mu g}{R}$. Here, moment of inertia of the circular disc is $I = \dfrac{mR^2}{2}$ and α is angular acceleration of the disc. Given that as $t, 0 \rightarrow t_0$ linear velocity $v_0 \rightarrow v$ due to retardation a_L and angular velocity $\omega_0 = 0 \rightarrow \omega$ due to angular acceleration α of the disc. Accordingly becomes v as per First equation of motion for linear velocity $v = v_0 - a_L t_0 = v_0 - \mu g t_0$, and

angular velocity $\omega = \omega_0 + \alpha t_0 \rightarrow 0 + \dfrac{2\mu g}{R}t_0 = \dfrac{2\mu g}{R}t_0$. When disc starts pure rolling, $v = R\omega$ and using values of v and ω from above two equations
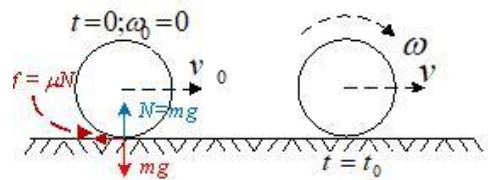
$v = v_0 - \mu g t_0 = R\left(\dfrac{2\mu g}{R}t_0\right) = 2\mu g t_0 \rightarrow v_0 = 3\mu g t_0 \rightarrow t_0 = \dfrac{v_0}{3\mu g}$.

This is part (b) of the answer.

Using value of t_0 in First equation of motion for linear velocity $v = v_0 - \mu g\left(\dfrac{v_0}{3\mu g}\right) = \dfrac{2}{3}v_0$, this is part (a) of the answer.

As required in last part of the question work done by friction as function of time is obtained from Work-Energy theorem. Thus, $W_t = \dfrac{1}{2}mv_0^2 - \left(\dfrac{1}{2}m(v_0 - at)^2 + \dfrac{1}{2}\dfrac{mR^2}{2}(\alpha t)^2\right) = \dfrac{m}{2}\left(v_0^2 - \left(\left(v_0^2 - 2v_0 at + a^2t^2\right) + \dfrac{R^2\alpha^2t^2}{2}\right)\right)$

, using values of a and α, $W_t = \dfrac{m}{2}\left(-\left(\left(-2v_0\mu gt + a^2t^2\right) + \dfrac{R^2}{2}\left(\dfrac{2\mu g}{R}\right)^2 t^2\right)\right) = \dfrac{m\mu gt}{2}(2v_0 - 3\mu gt)$.

Accordingly, work done until $t = t_0$ is $W_{t_0} = \dfrac{m\mu g\left(\dfrac{v_0}{3\mu g}\right)}{2}\left(2v_0 - 3\mu g\left(\dfrac{v_0}{3\mu g}\right)\right) = \dfrac{mv_0}{6}(2v_0 - v_0) = \dfrac{mv_0^2}{6}$. Thus

part (c) of the answer are $W_t = \dfrac{m\mu gt}{2}(2v_0 - 3\mu gt)$ and $W_{t_0} = \dfrac{mv_0^2}{6}$

N.B.: (a) It is to be noted that answers to the part of question need not be arrived at in sequence they are asked. Interchange of order, is based on sequence of mathematical operations .

(b) In this case relationship between a and α is valid at t_0 when disc attains pure rolling and hence use Work Energy theorem becomes essential.

(c) Phenomenor of friction is microsocopically inelastic. Though the frictional force is uniform during motion of the disc, but it is difficult to mathematically model work done by it. Therefore, workdone by friction cannot be calculated by simple equation $W_t = fx_t$. But, effect of friction in linear reatdation and angular acceleration is perceviable and can be easily calculated by determining change in linear and angular velocity. This makes it easy to apply Work-Energy Theorem.

I-34	CG of the disc is at C initiallys above ground by $\dfrac{R}{4}$ descends below ground by same. So also the particle initially above ground by $\dfrac{5R}{4}$ descends by the same, and hence decrease in potential energy of the system is $\Delta PE = m\left(-\dfrac{R}{4}-\dfrac{R}{4}\right) + m\left(-\dfrac{5R}{4}-\dfrac{5R}{4}\right) = -2m\left(\dfrac{R}{4}+\dfrac{5R}{4}\right) = -3mR$ .In the process disc is to be freely rotating and therefore it will gain kinetic energy about the line of rotation PQ $\Delta KE = \dfrac{1}{2}I\omega^2$. Here, moment of inertia of the system is $I = m\left(\dfrac{R}{4}\right)^2 + m\left(\dfrac{5R}{4}\right)^2 = \left(\dfrac{1}{16}+\dfrac{25}{16}\right)mR^2 = \dfrac{13}{8}mR^2$. Accordingly, as per principle conservation of energy $\Delta PE + \Delta KE = 0 = -3MR + \dfrac{1}{2}\left(\dfrac{13}{8}mR^2\right)\omega^2 \rightarrow \dfrac{13}{16}mR^2\omega^2 = 3MR \rightarrow \omega = \sqrt{\dfrac{48}{13R}}$. Thus, $\omega = 4\sqrt{\dfrac{3}{13R}}$. Assume the particle while descending the disc rotates clockwise, hence linear velocity of the particle when it reaches its lowest position $\vec{v} = \vec{R}\times\vec{\omega} = R(\hat{j})\times\left(4\sqrt{\dfrac{3}{13R}}\right)(-\hat{k}) = 4\sqrt{\dfrac{3R}{13}}(-\hat{j})$. Therefore, linear speed of the particle is $v = 4\sqrt{\dfrac{3R}{13}}$. N.B.: Since disc can freely rotate, it can do either clockwise or anticlockwise, and therefore velocity of the particle can be along $(-\hat{j})$ or $(+\hat{j})$ but its magnitude will remain the same. This is the reason speed of the particle is asked, and should be answered correctly.
I-35	The problem is split in Two parts with their FBDs seperately shown in the figures.. Force F on the flank produces motion in it and a frictions $f_1 = \mu mg$ and thus net acceleration of the plank is $\vec{a}_1 = \dfrac{\vec{F}-\vec{f_1}}{m_1} = \dfrac{F-f_1}{m_1}\hat{j}$. In this problem it possible to go without consideration of coefficient of friction, and mpreover it is not specified also. Since there is no slipping and rolling of the cylinder is about Q and hence angular acceleration α of every point of on the diameter PCQ, being rigid body, is uniform. Accordingly, linear acceleration of P and C about point Q are $\hat{a}_1 = (2R\hat{k})\times(\alpha\hat{i}) = 2R\alpha\,\hat{j} \rightarrow a_1 = 2R\alpha$ and $\hat{a}_2 = (R\hat{k})\times(\alpha\hat{i}) = R\alpha\,\hat{j} \rightarrow a_2 = R\alpha$, it leads to $a_1 = 2a_2$. Further, on cylinder forces f_1 and f_2 cause linear acceleration such that $a_2 = \dfrac{f_1+f_2}{m_2}$ while angular acceleration of cylinder α_C about C, causing angular velocity ω_C is $\vec{\tau}_C = R\hat{i}\times f_1\hat{j} + R(-\hat{i})\times f_2\hat{j} = R(f_1-f_2)\hat{k} = I_C\vec{\alpha}_C$, here, $I_C = \dfrac{m_2R^2}{2}$. Accordingly, $\dfrac{m_2R^2}{2}\vec{\alpha}_C = R(f_1-f_2)\hat{k}$ and, therefore, $\alpha_C = \dfrac{2(f_1-f_2)}{m_2R}$. In rolling without slipping linear acceleration of COM of the cylinder C $a_2 = R\alpha_C = R\left(\dfrac{2(f_1-f_2)}{m_2R}\right) = \dfrac{2(f_1-f_2)}{m_2}$. Equating this value of a_2 with that determined from linear

motion $\dfrac{2(f_1 - f_2)}{m_2} = \dfrac{(f_1 + f_2)}{m_2} \rightarrow 2(f_1 - f_2) = f_1 + f_2$. It leads to $f_1 = 3f_2$. Accordingly,

$a_2 = \dfrac{f_1 + \dfrac{4}{3}f_1}{m_2} = \dfrac{4f_1}{3m_2}$. Using, this $a_1 = 2\left(\dfrac{4f_1}{3m_2}\right) = \dfrac{F - f_1}{m_1} \rightarrow \dfrac{8f_1}{3m_2} + \dfrac{f_1}{m_1} = F \rightarrow \dfrac{8m_1 + 3m_2}{3m_2}f_1 = F$. It leads

to $f_1 = \dfrac{3m_2 F}{8m_1 + 3m_2}$, therefore, $f_2 = \dfrac{1}{3}f_1 = \dfrac{1}{3}\left(\dfrac{3m_2 F}{8m_1 + 3m_1}\right) = \dfrac{m_2 F}{8m_1 + 3m_1}$. Accordingly,

$a_2 = \dfrac{1}{m_2}\left(\dfrac{3m_2 F}{8m_1 + 3m_2} + \dfrac{m_2 F}{8m_1 + 3m_1}\right) = \dfrac{4F}{8m_1 + 3m_2}$, and, therefore, $a_1 = 2\left(\dfrac{4F}{8m_1 + 3m_2}\right) = \dfrac{8F}{8m_1 + 3m_2}$. Thus

answer to part (a) is $a_1 = \dfrac{4F}{8m_1 + 3m_2}$, $a_2 = \dfrac{4F}{8m_1 + 3m_2}$ and part (b) is $f_1 = \dfrac{3m_2 F}{8m_1 + 3m_2}$, $f_2 = \dfrac{m_2 F}{8m_1 + 3m_1}$.

N.B.: (a) Getting answer to part (b) is arrived at first and part (a) is arrived at later. This is due to the fact that determination of a_1 requires to determine f_1.

(b) Any effort to determine f_1 and f_2 using coefficient of friction μ is not required as stated in the illustration

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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

There are two educations.
One should teach us how to make a living,
and the other how to live.

- John Adams

—00—

Theme Song :

PREMISE:*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 **E**ach **A**chieves **M**ore
(**TEAM**)

Every end, so also end of this e-Bulletin, is a pause for a review, before

Resuming of the journey far beyond ...