Hydroponics:—
Romancing With Chemistry

It is not overstating to say that life is nothing but Chemistry. Can you believe that our body is the biggest chemical factory which produces more than about twenty thousand chemical. In fact, as per the most accepted theory of origin of life, the life started as a result of chemical reaction, deep in the sea, near hydrothermal vent. As a result of chemical reaction, life originated from simple elements, in which the large organic molecules were formed. From those simple organic molecules, today the life has evolved to a complex form. Interestingly, the animal life cannot be sustained on this earth even today, if plants stop photosynthesis, again a photo-chemical reaction. As a result of photosynthesis, chlorophyll, one of the largest organic complex molecules, used simple elements from the air and water and convert them into carbohydrates, which provide us food on regular basis. Just think, what will be our fate if plants stop photosynthesis (photo-chemical reaction) (!)

If we look at our body, it is made up of 25 basic elements, some in large quantity and some in micro quantity. These basic element are provided to our body by the food we eat. For example, out of 92 natural elements, just four i.e.; carbon, oxygen and nitrogen make up 96% of the living matter. Phosphorus, calcium, Potassium, Sulphur, Sodium, Chlorine, Magnesium and few other elements known as trace elements account for the 4% of an remaining organism weight. Trace element are required by all life form in very minute quantity. They play a catalytic role in all enzymatic activities. The requirement of these trace elements generally vary from species to species like iron is required by all life form. But Iodine is required by vertebrates (having backbone), for the synthesis of a hormone called thyroxin. If there is a deficiency of Iodine in human body, the result is goiter-the enlargement of thyroid gland to abnormal size.

No doubt plant has definite edge over the animal life form because of the presence of chlorophyll. They can synthesize their food by photosynthesis, which animal life form cannot do. However, plants also need certain element for proper growth, which are 17 in number. Like animals, plants also need certain element in larger quantity and some in very small quantity. The elements needed by plants in larger quantity are called macro nutrients and those in a small amount are called micro nutrients. All these elements are taken by the plants either through soil, water and air. Plants get majority of...
Hydroponics in India since Ages:

- All modern workers have traced the history of hydroponics back to the Hanging Gardens of Babylon. These gardens were a series of terraces filled with plants. Excavations have found an elaborate tunnel and pulley system that apparently brought water from the ground level to the top terrace.
- Whether the Hanging Gardens were hydroponic depends upon a simple question. The question is whether nutrients were added to the water?
- The plants in these hanging gardens were thought to be growing in soil, which would at first glance remove these gardens from consideration as a hydroponics system. But soil could be used as the medium, with water and nutrients delivered from the water system.
- The mother nature is busy from the very beginning in growing plants hydroponically elsewhere in sand, gravel and water. All free-floating hydrophytes plants are hydroponics.
- There is an intriguing possibility that the water used for the plants may have been waste water from the human inhabitants. If so, the system would qualify as hydroponic (because nutrients were added to the water) and would be an example of technology we are just beginning to rediscover our household grey water (from bathing and washing etc.) for irrigating out kitchen gardens, and landscaping.

Hydroponics may also be called “Controlled Environment Agriculture”

In a complete controlled environmental agriculture system we control:

<table>
<thead>
<tr>
<th>Light</th>
<th>Temperature</th>
<th>Water</th>
<th>Carbon dioxide</th>
<th>Oxygen</th>
<th>pH</th>
</tr>
</thead>
</table>

Dr. Hoagland standard solution
Developed at University of California

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Amount for 1 gallon of stock solution</th>
<th>Amount of stock solution for 25 gallons of nutrient solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boric Acid(H---,BO₃⁻)</td>
<td>2 teaspoons</td>
<td>1/2 pint</td>
</tr>
<tr>
<td>Manganese chloride(MnCl₂,4H₂O)</td>
<td>1 teaspoon</td>
<td>1/2 pint</td>
</tr>
<tr>
<td>Zinc sulfate(ZnSO₄,4H₂O)</td>
<td>2 teaspoons</td>
<td>1/2 teaspoon</td>
</tr>
<tr>
<td>Copper Sulfate(CuSO₄,5H₂O)</td>
<td>1 teaspoon</td>
<td>1/2 teaspoon</td>
</tr>
<tr>
<td>Iron Sulfate(FeSO₄,7H₂O)</td>
<td>4 teaspoons</td>
<td>1/2 pint</td>
</tr>
</tbody>
</table>

If we go by the above definition and consider the Hanging Gardens of Babylon as hydroponics, then following systems are qualified to be Hydroponics as well. These methods are being practiced in India since time immemorial.

1. The River bed Cultivation of Vegetables and Fruits like watermelon in India.
2. The Floating Gardens of Kashmir (Similar to floating gardens of the Mexican Aztecs):
3. The Paddy Cultivation on Phumdis in Loktak Lake of Manipur
4. The Makhana (Euryale ferox) Cultivation in the wetlands of Bihar.
5. Singhara or Water Chestnut (Trapa Species) Cultivation:
6. The Lotus Cultivation:

Suggestive Activities

- Carry out research of at least two examples of ancient hydroponic gardening.
- Write a complete summary describing the ancient hydroponic system you selected and explain why it is considered as hydroponic gardening.
- Do survey of water bodies/ponds of your area and find out whether something similar to Makhana or Singhara is cultivated in them.
- Explain under which type of hydroponic system the cultivation you discovered would fall.
- Give basis of your consideration why the discovered cultivation falls under hydroponic systems.
essential minerals from soil except carbon, hydrogen and oxygen, which they get from air and water. Let’s think of a situation, if we remove the soil and provide all essential elements to plant by supplying solutions of known composition, then is it possible to grow plant without soil? The answer is “yes”. If the entire essential mineral are present in the solution, then soil is not required for supplying the essential minerals. In such situation, soil is required only for anchoring the root of the plants to keep them erect against the gravity. To replace soil, some inert material like sand, pebbles etc can be used. If so, then we can grow plant without soil. If by any mechanical device, we can keep the plant erect, then we have possibility of removing even inert material completely and grow plant in mineral solution. So what we need to grow a plant without soil is a mineral solution and a mechanical device to keep the plant erect. (Please see picture below)

Knop’s Solution
Calcium nitrate Ca(NO₃)₂·4H₂O 0.8 gram/lt.
Potassium nitrate KNO₃ 0.2 gram/lt.
Magnesium sulfate MgSO₄·7H₂O 0.2 gram/lt.
Iron Phosphate FePO₄ Traces only

Sach’s Solution
Potassium nitrate (KNO₃) 0.5 gram/lt.
Calcium Phosphate (PO₄)₂ 0.5 gram/lt.
Magnesium Sulfate MgSO₄·7H₂O 0.5 gram/lt.
Zinc Chloride (ZnCl₂) 0.25 gram/lt.
Iron Sulfate (FeSO₄) traces only

Hoagland Solution
Ca(NO₃)₂·4H₂O 1.8 gram/lt.
KNO₃ 0.51 gram/lt.
KH₂PO₄ 0.14 gram/lt.
MgSO₄·7H₂O 0.49 gram/lt.
Ferric tartarate 0.005 gram/lt.

Combination developed by NBRI Lucknow for Vegetables and Floriculture
Magnesium Sulphate 0.5 gram
Double Superphosphate 0.5 gram
Potassium Nitrate 0.4 gram
Ammonium Sulphate 0.3 gram

Nutrient Solution from Organic Waste:
A few simple and safer nutrient solution can be prepared from the fully cured cow dung manure, compost and from vermiwash.

Solution from cowdung manure:
- Take about 200 gram of fully cured cowdung manure
- Dissolve it in about 500 ml of water and shake it well about 5 to 10 minutes.
- Keep it for an hour to allow the setting of the manure at the bottom.
- Take the strained supernatant and filter it using cotton or filter paper.
- The filtered solution can be used as nutrient solution
- Concentrate the solution by sun drying method (The potency of the solution will depend upon the quality of the manure. Standardize the solution by appropriate dilution through trail and error method.)

Cuttings showing rooting in mineral solution.
In 18th century this technique of growing plants in mineral solution was accomplished by Julius von Sachs (1860) Professor of Botany at the university of Wurzburg, and W. Knop (1861), an agriculture chemist. Knop is also called “The father of Water Culture”. It was Prof. Julius von Sachs who first developed standard formulation for a nutrient solution that could be dissolved in water and in which plant can be grown successfully. At that time this technique was known as 'Nutriculture'.

Interestingly, no interest in practical application of Nutriculture outside the lab was developed unless interest was shown by greenhouse industry. In greenhouse industry soil had to replace frequently to overcome the problem of mineral deficiency in soil and pests problem. It was only between 1920-1930 extensive development took place in modifying the laboratory technique of
Nutriculture to large scale crop production. In this area, the work of Dr. William F. Gerickein is remarkable as he took out the 'Nutriculture' from the bounds of laboratory and extended to field for large scale commercial production. He also gave a new name to Nutriculture i.e.-Hydroponics. The commercial use of hydroponics was spread throughout the world in 1950,

Dr. Gerick Grew vegetables hydroponically, including root crops such as beets, radishes, carrots, potatoes and cereal crops, fruits and ornamental flowers. Using water culture at the University of California, he succeeded in growing tomatoes to height of 25 feet and to pluck the

Hydroponic is now defined as the science of growing plants without the use of soil in mineral solutions of known composition using some inert medium such as gravel, sand, peat, vermiculite etc. With the development of plastic industry, hydroponic took another large step forward.

Today there are a number of standard solution formulations available for making nutrition solution for growing plants hydroponically. Using some chemicals from your lab, you can make some standard solutions. If you do not have such facility, then you can make your own non-standard solution from compost, garden soil or from water of a nearby pond. Any way you need to supply only essential 17 mineral for a plant to grow. Only condition is, your mineral solution should be free from all pathogenic contamination.

Vigyan Prasar is also in the process of developing a training module on Hydroponics. Interested clubs may kindly write to VIPNET for attending the workshop.

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Solution From The Self-Made Compost

What is Composting - It is a process of decomposition which involves the conversion of organic substances by micro-organism into utilizable form in the absence or presence of air to yield a sanitary soil supplement. (This supplement will be used to make nutrient solution). For our purpose of making compost we may use wastes from animal (droppings of cow, goat etc.), vegetable wastes, lawn cutting, garden trimming, leaves, aquatic weeds, wheat stalks. You may also add synthetic nitrogen, phosphorous and potash fertilizers but not necessary. For our purpose the Heap Composting (Aerobic) method would be ideal.

Tips for Facilitators – In nature all dead organic matter is gradually acted upon by the forces of nature such as sun, wind, rain and microbes, which serve to break-down complex material into simpler molecules. This process of decomposition can used to convent organic wastes especially vegetables peels from the kitchen and fallen leaves, dead leaves, dry weed, harvest residue, fallen flowers and fruits from the garden, to make compost.

The compost would be ready after 4 to 6 weeks depending upon the environmental temperature.
अक्षर बड़े पर पड़ी थी और में उन्हें पहचानने की कोशिश करता था कि सड़क पर कौन—कौनसी प्रजातियों के खुश है। अचानक मेरी नजर एक ताड़ के खुश पर पड़ी थी, जिसे देखकर मैं चिंतित रह गया। आप सोचने के ताड़ को देखकर आश्चर्य की बात थी कि ताड़ के खुश पर मृत्यु तथा नस्ल कानून से शाखाएं तक ही हटाई।

शास्त्रीय ताड़ को ‘होका’ कहा जाता है। ये शास्त्रीय ताड़ (Branched Palm) और वैधक ताड़ (Branched Palm) में एक प्रमुख के रूप में पाये जाते हैं। शास्त्रीय ताड़ गोवा के अलावा दिल्ली—दिनांगुर तक भी देखे जा सकते हैं।

विकास की कहानी में इस स्वादकों के दो जातियों में एक जाति के बीच की तारीह जाना जा सकता है, क्योंकि फूल़ डालने और पत्तां नीचे नक्सली (Mangoes) पौधों में अच्छी विकसित है। दिल्ली में इस शास्त्रीय ताड़ को ‘होका’ कहा जाता है, जिसका वैज्ञानिक नाम ‘हिपा इंडिका’ (Hyphaene Indica) है। इस प्रकार के शास्त्रीय ताड़ को 10 प्रजातियों पूर्व विश्व में विशेषकर—वैधक, मेलागारी, अरेबिया तथा पश्चिम अफ्रीका में देखा जाता है। इस पौधों के गन्धों में पूरा होता है तथा फल कई महीने तक पूरे होते हैं।

अगर आप के क्षेत्र में भी कुछ ऐसे खाल हों जो आपकी लगता है कि उसमें कुछ ऐसा है जो साधारण जानकारी के विपरीत है तो हमे सुनने का अवसर मिलता है। आपके संगठन या संस्थान के नाम से लिखने का आयोजन करें और आप के विज्ञान प्रसार की अवस्था का एक सेट प्रसार के रूप में भी मिलेगा।

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Dj kv Kukulkundh kule vkp; ZG
राष्ट्रीय विज्ञान दिवस

28 फरवरी, 2012
विषय: स्वच्छ उद्योग विकल्प और नामीकीय सुरक्षा

आप सभी वह जानते हैं कि राष्ट्रीय विज्ञान दिवस प्रत्येक वर्ष 28 फरवरी को मनाया जाता है। यह दिवस भारत की विज्ञान और तकनीकी समस्याओं की विकास के लिए दिन के रूप में मनाया जाता है। इस समारोह के माध्यम से, विज्ञान और तकनीक की महत्वपूर्ण भूमिका हमारे समय के मुख्य विषयों में समझा जाता है।

1928 में नामीकीय सुरक्षा का आयोजन और स्वच्छ उद्योग विकल्प का प्रचार शुरू हुआ था। इससे बाद नामीकीय सुरक्षा का महत्व पूरे देश में लगभग 20 वीं शताब्दी में भी इसे महत्वपूर्ण बनता रहा।

राष्ट्रीय विज्ञान दिवस के लिए विवरण

अंतरराष्ट्रीय वेबसाइट

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विभाग के स्वागत के लिए व्यक्ति और गैर-व्यक्ति के लिए अन्तरराष्ट्रीय विज्ञान दिवस के लिए आपका शुभकामना प्रेस कॉलेज की उम्मीद है।

विभाग के स्वागत के लिए व्यक्ति और गैर-व्यक्ति के लिए अन्तरराष्ट्रीय विज्ञान दिवस के लिए आपका शुभकामना प्रेस कॉलेज की उम्मीद है।
You all know that National Science day is celebrated every year on 28th Feb. The Day is observed to mark the novel discovery of Raman Effect by the great Indian Physicist Sir C. V. Raman on 28th February, 1928. Raman Effect is a phenomenon in spectroscopy discovered by the eminent physicist while working in the laboratory of the Indian Association for the Cultivation of science, Kolkata. After two years of this discovery, Sir C. V. Raman brought the first Nobel Award for the country in 1930. Hence the National Science Day is a great day for Indian Science and scientific community. National Science Day also offers an opportunity to bring issues of science on to centre stage. The activities organized on the occasion provide public with an occasion to personally attend various programmes and be aware of the emerging issues of immediate concern. Organizing activities with the involvement of large number of people results into purposeful interaction between the science fraternity and the common people for mutual benefit.

Why Do we Observe National Science?
The basic objective of observation of National Science Day is to spread the message of importance of science and its application among the people. This is essential to accelerate the pace of development. Even in the 21st century and despite many significant achievements certain sections of our society are still guided by blind faith and beliefs, which is reflected in the quality of decision making on developmental issues. Science has contributed a great deal to human welfare. Through the gospel of reason and experimental observation, by which it works, it has enabled man to acquire intellectual and mental excellence. From the materialistic point of view, ranging from environmental issues, disease eradication, space exploration, energy production, information highway to name a few, science and technology has broken barriers to bring peace and prosperity with a cleaner environment with sustainable use of resource for the benefit of mankind. It helps inculcate scientific temper among school children. Health and hygiene issues are prime concerns for the common people. The daily application of science like the use of clean drinking water, knowledge to eradicate contagious disease, the know how of various agricultural practices to increase crop production, the usefulness of biodiversity conservation, etc., should be disseminated to the future generation. Building of science communicators is another component of the NSD celebrations. Through this column of VIPNET, Vigyan Prasar appeal to all VIPNET clubs to celebrate National Science Day on February 2012 by organizing some theme based activities. The theme of this year’s NSD is “Clean Energy option & Nuclear Safety”. The issue is very pertinent and best way to celebrate this occasion would be to generate awareness among the stake holders on energy options available and risk associated with them particularly nuclear one. This opportunity may be used to address some of the issues as following:-

♦ Creating awareness about clean and safe energy options.
♦ Generating debates on nuclear energy options.
♦ Green & clean energy.

All VIPNET clubs may plan their activities ranging from a day to a full month either beginning or culminating on February 28, 2010. The activities may include debates; quiz competitions, exhibitions, lectures, etc., involving college and school students and teachers, women and general public. Kindly ensure that all programmes and activities may revolve round the theme. Also don’t forget to send the report of your activities to Vigyan Prasar, which will be published in the forthcoming issues of VIPNET. Once again good wishes from the entire family of Vigyan Prasar and a very Happy and Prosperous 2012 to all of you.□

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Indian Renewable Energy Development Agency (IREDA) has released the annual report for the year 2011. The report covers the performance of renewable energy projects and the initiatives taken by IREDA during the year. The report also highlights the challenges faced and the strategies adopted to overcome them. The report concludes with a forecast for the future and the role of IREDA in achieving the targets.

The report is available in both English and Hindi and can be downloaded from the IREDA website for free.

# Key Points

- **Wind Power:**
  - Total capacity installed: 1,220 MW
  - Total capacity commissioned: 1,040 MW
  - Total capacity sanctioned: 1,870 MW

- **Solar Power:**
  - Total capacity installed: 75 MW
  - Total capacity commissioned: 75 MW
  - Total capacity sanctioned: 100 MW

- **Biogas:**
  - Total capacity installed: 155 MW
  - Total capacity commissioned: 155 MW
  - Total capacity sanctioned: 220 MW

- **Hydro Power:**
  - Total capacity installed: 10 MW
  - Total capacity commissioned: 10 MW
  - Total capacity sanctioned: 30 MW

- **Other:**
  - Total capacity installed: 5 MW
  - Total capacity commissioned: 5 MW
  - Total capacity sanctioned: 10 MW

The report also provides details on the financial performance of IREDA, the projects sanctioned, the financial closure achieved, and the steps taken towards the development of renewable energy projects.
International Year of Chemistry 2011

India

Joshi

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December 2011 / Vol. 9 / No. 12
Vigyan Prasar is organizing six regional workshops for Vipnet Clubs in different parts of the country from the month of April-2012 to August-2012. In each workshop of 3-day duration VIPNET Clubs are invited.

If you are a Vipnet Club and your coordinator is above the age of 18, please send your nomination for the workshop, along with the documents as mention below:

1. Report of VIPNET Club activities for the past two years, specifying the types of activities organised with date and (if possible) photographs.
2. A two-page write up, about your expectations from Vigyan Prasar.
3. What special efforts you are making to make your clubs more active. (One Page)
4. What kind of special technical support you need from Vigyan Prasar.
5. Do you think that Your club can play the role of District facility cum-information centre for other VIPNET Clubs, If yes, justify.
6. How many persons you have in your club to act as resource person for science popularisation activities (Please mention their name, contract address and the area of expertise).

Nomination Form for VIPNET CLUBS For Regional Meet

1. VIPNET Club ID: ..........................................................
2. Name of Club: ..........................................................
3. Name of the coordinator: ...........................................
4. Sex: ...........................................................................
5. Weather the club is within school or outside school: ..........................................................
6. Profession: ..................................................................
7. Address of the Club with Pin Code: ..........................................................
8. Residential Address of the Coordinator: ..........................................................
9. Phone (must): ..........................................................
10. E-mail (must): ..........................................................
11. Have you attended any workshop/orientation programme of Vigyan Prasar? If yes, specify date, organizer and your contribution, if any?
12. If you are a working teacher, kindly give your school address, with phone/fax number and your nomination should be endorsed by School Principal)

Send nomination to: Desk-Regional Meet for VIPNET Club Vigyan Prasar, A-50, Institutional Area, Sector-62, Noida-201309 (U.P.)
Chemical Terminology Puzzle 21

B C E T F D E B H F R T S G J E
R A B R I N E E R F W F Z C V E
S B T G H R T D E O D F G R T D
C R F G F E R T Y R S E M R T Y
O H E R T D F G H M W E O T G H
P D F A P I T O X N R R T Y B
O D F G R T Y H J C D E P R T U
L T Y H F G E R T A T Y H D V F
A G H T R E R T Y C D W I R T O
M G H T N I C O T I N E N E S T
I F R E R E R T C D H R E T Y E
N T Y B L U E V I T R I O L R N
E R T G H V D E R T H Y R T E I
E R N E U R O T O X I N W D F N
E R V H G F R T G H V C E T E R
R T T Y L A T R O T O X I N T Y

Clue
1. Venom of Honeybee known as.
2. The venom of ant stings.
3. The venom of the most of the Snakes that acts specifically on nerve cells.
4. A venom extract form skin of Toad.
5. A neurotoxin found in the venom of Black Widow spiders.
6. A tropane alkaloid found in Datura plants.
7. Key constituents of tobacco.
8. The main toxic component in Opium poppy plant.
9. A toxin found in Ratti Seeds.
10. A pesticide with Chemical formula CuSO4.

Last date of receiving correct entries: 31 March, 2012

Please send your entries to:

The puzzle has been designed as part of International Year of Chemistry-2011

NAME OF THE WINNERS:
1. Nithin V.S. (Kerala)
2. Rashid Samsi (U.P.)
3. Yadu Narendran (Kerala)
Club speak

Environmental conservation - A Street Play

Galileo Science Centre, Madurai, Tamil Nadu, organised a street play and a camp about environment conservation and protection, at Chennai near Kuthar Kudi.

The resource person namely Mr. A. Manickavalen, Mr. M. Kalavianan, Ms. Muthurani have given the training for street play to 14 participants.