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Panini's Sanskrit grammar "metarule" solved**Why in Newspapers?**

A **grammatical problem** that has puzzled scholars since the fifth century BC has been solved by a **Cambridge University student** and the discovery could **"revolutionize the study of Sanskrit"**.

Quick Issue?

- 27-year-old **Rishi Rajpopat** has decoded a **rule taught by Panini**, the great scholar of **ancient Sanskrit language**, about **2,500 years ago**.

Historical Background?

- Pāṇini was the **grammarian of the ancient Sanskrit language**. Pāṇini's grammar "**Astadyayi**" relies on a system that uses an **algorithm to convert dhatu** (root form) and suffix of a word into **grammatically correct words and sentences**. acts like
- Two or more of Panini's rules are often applied simultaneously, resulting in a contradiction in rules. Pāṇini taught a "**metarule**", which has been

traditionally interpreted by many scholars. These scholars took this to mean that "in the **event of a conflict between two rules of equal force, the rule that comes later in the chronological order of grammar prevails**". However, this interpretation also often gives **grammatically incorrect results**.

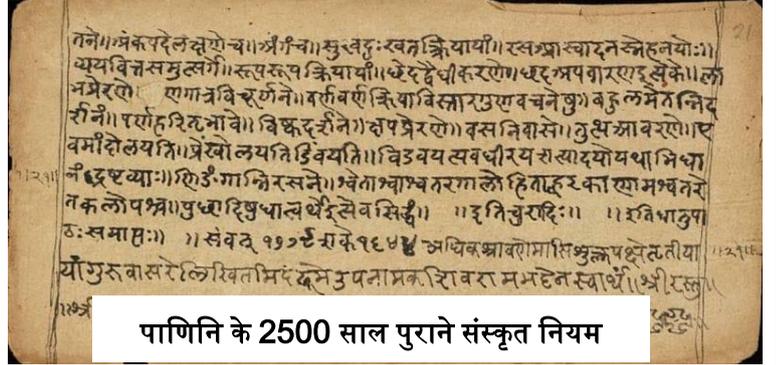
- Rajpopat **rejected the traditional interpretation** of metarule and argued that what Pāṇini meant was that between the rules that apply to the left and right sides of a word respectively, **the rule that applies to the right side should be chosen**.

Other Key Facts?**Panini**

- He was born in **Shalatul** on the **Indus River** in **present-day Pakistan**.
- He was a **Sanskrit grammarian** and gave a **comprehensive and scientific theory of phonetics, phonology and word formation**.
- He is considered the **founder of Sanskrit language and literature**.
- His major works include the book **Ashtadhyayi (Ashtaka)**.
- It consists of **eight chapters**, each of which is divided into **quarter chapters**.
- Under **Ashtadhyayi**, he made a **distinction between the language of the sacred texts and the common language of dialogue**.
- He gave **formal production rules and definitions to describe Sanskrit grammar**.
- He gave about **1700 basic elements** like **nouns, verbs, vowels, consonants** and placed them in classes.
- Pushyamitra Sunga** is a **post-Mauryan king** while **Panini's year of birth is not known**. Experts give dates for Panini's birth in the **4th, 5th, 6th and 7th centuries**, all pre-Mauryan times.
- Ashtadhyayi** (or **Ashtaka**) is the main work related



- Making this interpretation practical, he found that **Panini's "language machine"** produced **grammatically correct words almost without exception.**
- Rishi has solved this mystery in his research paper - **"In Panini, We Trust Discovering the Algorithm for Rule Conflict Resolution in the Astadhyayi".**
- According to the University of Cambridge, leading Sanskrit experts have described Rajpopat's discovery as **"revolutionary"** and mean that **even Panini's grammar can be taught to computers for the first time.**
- Sanskrit is an **ancient and classical Indo-European language** of South Asia. Although spoken in India today by only an estimated **25,000 people**, it has influenced many other languages and cultures around the world.
- **Ashtadhyayi** is one of the most important works of Panini. It is a grammar that essentially defines the ancient language of Sanskrit.
- It contains **3,959 sutras in 8 chapters.** Each of these chapters is **divided into four sections.**
- It is a **prescriptive and generative grammar with algebraic rules** governing all aspects of Sanskrit.
- Since the discovery of this work over the centuries, scholars have not been able to properly use the rules and regulations provided by the **Ashtadhyayi.**
- **Ashtadhyayi's rules work like an algorithm.** If the base and suffix of a word are provided, **the algorithm will convert it into grammatically correct words, phrases and sentences.** This makes it a **meticulous process.**
- Conflict occurs **when two or more of Panini's laws are applied simultaneously,** which is usually the case. In such events, Panini's Metarule can be used.



Expected Questions for Preliminary Exam

- Q. Who was Panini?
- (a) A Vedic sage who wrote most of the Atharvaveda
 - (b) A poet in the court of Emperor Vikramaditya VI
 - (c) A health scientist who performed complex surgeries
 - (d) A scholar who prepared grammar for Sanskrit language

Answer: (d) A scholar who prepared grammar for Sanskrit language



Other News

Oran Land

- The people of Jaisalmer (Rajasthan) are demanding that the **Oran land be declared a sacred place** protected by the community. This demand is **currently being made in protest against its barren land status**.
- Orans are **sacred sites**, which are **rich in bio-diversity**. A water body is also usually found at these sites. Oran is the abode of **Great Indian Bustard, Desert Cat etc**.
- Orans are also places where **shepherds take their animals for grazing**. Oran sites are also used for **community gatherings, festivals and other social events**.

Goa Liberation Day

- It is celebrated every year on **19 December** to commemorate the **defeat of the Portuguese colonial powers in 1961 and the liberation of Goa**.
- **Operation Vijay** - Goa was merged with India with the help of a military operation on 18 and 19 December, 1981. **The name of this campaign was "Operation Vijay"**.

Publication of scientific papers in India

- The **National Science Foundation (NSF) of the United States of America** has released a report titled '**Science and Engineering Indicators 2022**'. According to this report, India's global ranking in publications of scientific research papers has improved. Now India has moved from **seventh place to third place**.
- In India, **1,49,213 research papers** were published in the year **2020** as compared to **60,555 research papers published in the year 2010**.
- In addition, it has been learned from the **National Science and Technology Management Information System** under the **Department of Science and Technology** that
- The Central Government contributed only 45.4% of the funding for the total research works during the period 2001-20. Despite this, **IITs, CSIR, Central Universities** and other institutions under the Center **contributed 67.5% of the total research work during the same period**.
- In comparison, other institutions (private and under state governments) have contributed only one-third of the total research work despite higher expenditure.

Water World

- Astronomers have found evidence of the fact that **Kepler-138c and Kepler-1380** are '**water worlds**'. These are two **exoplanets orbiting a red dwarf star**. A large part of these two exoplanets has been estimated to have water.
- These exoplanets are located **218 light years away from Earth** in a constellation called '**Lyra**'. Both the planets are different from any other planet found in the Solar System.
- However, water has not been directly detected on **Kepler-138C and Kepler-138D**.



- Instead, astronomers have concluded that a significant portion of the volume of these exoplanets must be composed of material that is lighter than rocks but heavier than hydrogen or helium.
- Planets located outside the solar system are called **exoplanets**.

India Water Impact (WI) Summit-2022

- The **7th edition of the India Water Impact (WI) Summit** concluded.
- The theme of the summit was '**Revitalization and Conservation of Small Rivers in a Large Basin**'.
- The conference emphasized on selected aspects of mapping and convergence of '**5Ps—People, Policy, Plan, Program and Project**'.
- **Main Findings** - A consensus emerged among all the stakeholders on the need to prepare a **National River Framework**. The framework will set parameters for monitoring river **cleanliness, process and accountability**. A system will be established for **exchange of official information** in water-related issues.

Modern Mammals

- A new research has revealed that mammals evolved in **Gondwana 50 million years earlier than the estimated period**.
- Mammals are **warm blooded animals**. These are **hairy vertebrates**.
- Modern mammals are **divided into three sub-groups**
- **Montremis**: These are the **oldest mammals**, which lay **eggs of large size**. Also, they have **common exits for the urogenital system and the digestive system**.
- The platypus and echidna of Australia can be included in this type of creatures.
- **Masupials**: Those mammals whose young are born in an underdeveloped form. Their complete development takes place inside a pouch located on the abdomen of the female.
- The platypus and echidna of Australia can be included in this type of creatures.
- **Placentals**: Such organisms remain in embryonic form till the last stage of development.
- Most mammals including humans can be included in this group.

International River Water Dispute

- The Supreme Court has given **three months time to the central government to set up a tribunal to resolve the Penniyar river water dispute** between Tamil Nadu and Karnataka.
- **About the inter-state river water dispute:-**
 - **Article 262** of the Constitution provides for **adjudication of disputes** or complaints relating to the waters of inter-state rivers or river basins.
 - Parliament has provided through law that **neither the Supreme Court nor any other court shall have any jurisdiction in respect of water dispute** or any complaint related to it.
 - The **Inter-State Water Disputes Act, 1956** and the **River Board Act, 1956** have been enacted to deal with issues related to water disputes in India.



- **Other Tribunals:** Godavari Water Disputes Tribunal, Krishna Water Disputes Tribunal etc.

Sovereign Gold Bond Scheme-2022-23

- The **Reserve Bank of India (RBI)** will issue two tranches of **Sovereign Gold Bonds (SBGs)** in December (Series III) and March (Series IV).
- The SGB scheme was launched in the year **2015** under the **Gold Monetization Scheme**.
- SGB is issued by RBI on behalf of the government.
- **Features of SGB:**
 - The basic unit of denomination is 1 gram.
 - Benefit of fixed interest rate of 2.5% per annum will be given. It will be payable half yearly at a nominal cost.
 - There will be an exit option in the 5th, 6th and 7th year. Also, the total holding / maturity period of the bond will be 8 years.
 - It is tradable on stock exchanges.
 - They can be used as collateral for loans etc.

Turnkey Plan

- **National Mineral Development Corporation (NMDC)** has issued a standard bidding document for turnkey works. About Turnkey Project
- It is a type of contract. Under this a company engaged in a manufacturing / business /Service agrees to completely design, build and equip the unit. The project is then handed over to the buyer when it is ready to operate for consideration.
- It is one of the ways to **complete international business projects**.
- It will help NMDC to maintain and **adhere to the four principles of public procurement** namely **transparency, equity, fairness and competitiveness**.

Guidelines for the training of teachers by the University Grants

Commission (UGC)

- The **University Grants Commission (UGC)** has released draft guidelines for training of faculty members under the **Indian Knowledge System (IKS)**. Under this, Vedic Mathematics, **Indian Economic History, Chapters of Mahabharata** etc. have been included in the syllabus.
- The guidelines are in line with **the National Education Policy (NEP) 2020**.
- IKS guidelines will be part of training modules named as Malviya Mission under **Pandit Madan Mohan Malviya National Teacher Training Mission (PMMNMTT)**.
- **Indian Knowledge Systems (IKS)** - It is a **division of the Ministry of Education**. It facilitates and coordinates IKS based/related **interdisciplinary and interdisciplinary work** done by different institutions in India and abroad including universities.



EV Yatra, web portal and mobile app launched

- They are launched by the President on the occasion of **National Energy Conservation Day**. It aims to **encourage people to adopt e-mobility (electric vehicles) in the country**.
- The **mobile application** will facilitate navigation to the **nearest public EV charging station**. The web portal will disseminate information about initiatives taken to **promote e-mobility**.
- These have been developed by the **Bureau of Energy Efficiency (BEE)**. BEE will act as the **central nodal agency for rolling out the EV public charging infrastructure**.
- The President has also presented **National Energy Conservation Awards (NECA)** and **National Energy Efficiency Innovation Awards (NEEIA)**.
- NECA is awarded to **industrial units for their achievements in energy savings**.
- NEEIA aims to **promote energy efficiency through innovative measures**.

Patriot missile

- The US is finalizing plans to deliver **Patriot missiles to Ukraine**.
- **About Patriot Missile:**
 - It is a **surface-to-air guided missile system**. The aircraft can target **cruise missiles and short-range ballistic missiles**.
- **Other similar missile systems:**
 - **Russian S-400 Triumph surface-to-air missile system;**
 - **Terminal High Altitude Area Defense (THAAD) etc.**

Geographical Indication status to Gamosa

- Gamosa is a **rectangular piece of hand-woven cloth of white colour**. The **edges of this cloth are of red colour**. Also it has **different designs and motifs**. Gamosa is often presented as a **symbol of honor and pride by the Assamese people**.
- Geographical Indication is a part of Intellectual Property Rights. It comes under the '**Paris Convention for the Protection of Industrial Property**'.
- Geographical Indication is covered under **Trade Related Aspects of Intellectual Property Rights Agreement (TRIPS)**.
- In India, Geographical Indication registration is administered by the **Geographical Indications of Goods (Registration and Protection) Act of 1999**.

Gond tribe

- Rajya Sabha has approved the **bill to transfer 'Gond community'** from the list of **Scheduled Castes to Scheduled Tribes in four districts of Uttar Pradesh**.
- Gonds are one of the **largest tribal groups living in Madhya Pradesh and Chhattisgarh**. They also live in **parts of Maharashtra, Andhra Pradesh, Odisha and Uttar Pradesh**.
- They are mostly farmers and nature worshippers.
- People of this tribe speak **Gondi language**. It belongs to the **Dravidian language family**.