DAILY CURRENT AFFAIRS 17-09-2024

GS-1

1. **Trilobite fossils**
2. **Typhoon Yagi**

GS-3

3. **What are AM, FM and Signal modulation?**
4. **What is Open AI 01?**
5. **Ozone Pollution**

Trilobite fossils

Syllabus: GS-1: Geography – Fossils.

Context:

- **New Study**: *A new study, led by the* **American Museum of Natural History** *and* **Nanjing University**, *discovered an additional pair of legs in the trilobite species Triarthruseatoni.*
- **Published In**: *The study was published in the journal* **Palaeontology**.

Key Findings

- **Fifth Pair of Head Appendages**: *The discovery suggests that having a fifth pair of appendages under the head might be common among trilobites.*
- **Well-Preserved Fossils**: *Fossils from* **upstate New York** *provided exceptional preservation, allowing for detailed study of the appendages.*

Trilobite Anatomy

- **Extinct Arthropods**: *Trilobites, now extinct, are part of the arthropod group, with living relatives like* **lobsters** *and* **spiders**.
- **Segmented Body**:
    - *The trilobite body is segmented into regions:* **head**, **thorax**, *and* **tail**.
    - *Each segment is associated with appendages, ranging in function from* **sensing**, **feeding**, *to* **locomotion**.

Trilobite Head Structure

- **Head Segmentation**:
    - *Trilobite heads are composed of several fused segments.*
    - *Segments can be identified by:*
        - **Furrows (grooves)** *in the exoskeleton.*
        - **Antennae and legs** *on the underside (less commonly preserved).*
    - *The study reveals that* **six segments** *made up the trilobite head:*
        - **Anterior segment**– *linked with the* **eyes**.
        - *Five other segments – linked to* **one pair of antennae** *and* **four pairs of walking legs**.

Methodology and Comparison

- **Comparison with Other Species***:*
    - *The study compared the Triarthruseatoni fossils with Olenoides serratus from the* **Burgess Shale***.*
    - *This comparison helped resolve the mismatch in previous models of trilobite segmentation.*

Conclusion

- **Broader Implication***: The discovery suggests that additional head appendages might be more widespread in trilobites than previously thought, offering new insights into trilobite anatomy and evolutionary biology.*

Typhoon Yagi

Syllabus: GS-1: Geography – Climatology.

Context:

- **Vietnam and the Philippines** *are frequently hit by typhoons due to their location in the* **Western Pacific***, one of the most active regions for typhoon formation.*
- *These countries are situated* **along the Pacific typhoon belt***, where the combination of warm ocean waters, moist air, and favorable atmospheric conditions trigger the development of tropical storms.*
- *As the typhoons move westward, the Philippines and Vietnam are often on the frontlines.*

Key factors for their vulnerability:

- **Geographic Location***: Both countries are in the path of tropical cyclones that form in the Western Pacific Ocean.*
- **Warm Ocean Waters***: The region's warm waters fuel the intensity of storms.*
- **Seasonal Monsoons***: These monsoons can enhance the strength and impact of typhoons, especially between June and November.*
- **Long Coastlines and Low-Lying Areas***: Vietnam and the Philippines have extensive coastlines, making them vulnerable to coastal flooding and storm surges.*

- **Mountainous Terrain**: *This increases the risk of landslides when heavy rainfall accompanies storms.*

About Vietnam:

- *Vietnam is located in Southeast Asia, covering* **331,000 square kilometers** *and has a population of over* **100 million**.
- *It shares land borders with* **China**, **Laos**, *and* **Cambodia**, *and maritime borders with several countries in the* **South China Sea**.
- *Its capital is* **Hanoi**, *while its largest city is* **Ho Chi Minh City**. *The country is highly vulnerable to extreme weather due to its coastal geography and tropical climate.*

What are AM, FM and Signal modulation?

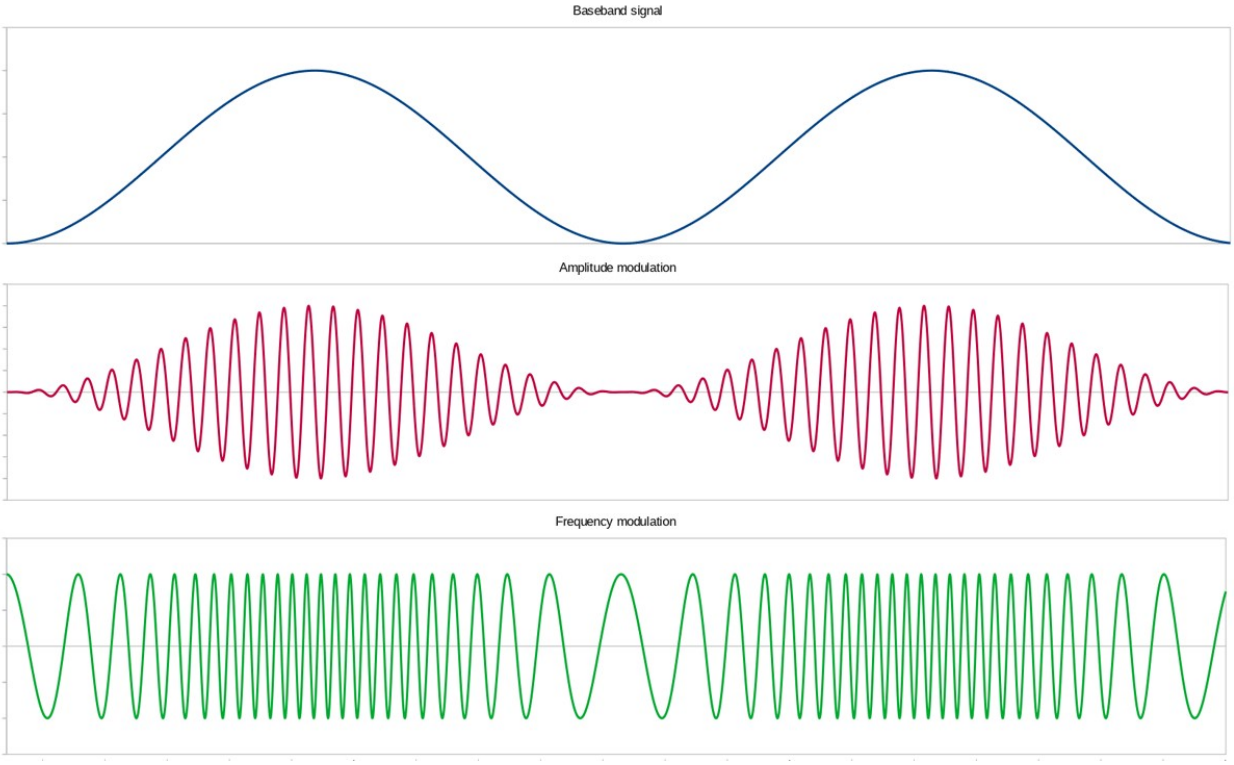
Syllabus: GS-3; Science and Technology

Context

- *The article discusses about Signal modulation which simplifies the technologies required to transmit signals carrying information, like the news on TV or songs on the radio*

What is Signal Modulation?

- *Signal modulation is the process of* **altering a carrier signal** *(typically a high-frequency wave) to* **encode the information** *(message signal) that needs to be transmitted.*
- *The purpose of modulation is to adapt the signal for transmission over a medium, such as radio waves or cable, and ensure that the information can be transmitted efficiently over large distances without degradation.*
- *There are several types of modulation techniques, including:*
  - *Amplitude Modulation (AM)*
  - *Frequency Modulation (FM)*
  - *Phase Modulation (PM)*



What is AM (Amplitude Modulation)?

- *Amplitude modulation is a technique where the* **amplitude (or strength) of the carrier wave is varied** *in proportion to the message signal (the information to be sent), while the frequency remains constant.*
  - **Carrier wave***: High-frequency wave used to carry the information.*
  - **Modulation:** *The amplitude (height) of the carrier wave changes based on the intensity of the audio signal (information being sent).*
  - **Example:** *AM is used in AM radio broadcasting. The variations in the amplitude of the radio waves represent the audio signal (music, voice, etc.).*

- **Advantages**: *Simple to implement and decode.*
- **Disadvantages**: *Prone to noise and interference because amplitude is easily affected by environmental factors.*

What is FM (Frequency Modulation)?

- *Frequency modulation involves* **varying the frequency** *of the carrier wave in relation to the amplitude of the message signal, while the amplitude remains constant.*
  - **Carrier wave**: *High-frequency wave used to carry the information.*
  - **Modulation:** *The frequency of the carrier wave changes based on the information signal.*
  - **Example:** *FM is used in FM radio broadcasting. The frequency of the carrier wave changes according to the sound being transmitted (music, voice, etc.).*
- **Advantages**: *Higher sound quality and less susceptible to noise and interference compared to AM.*
- **Disadvantages**: *Requires more bandwidth than AM.*

Key Differences between AM and FM

- *AM modulates the amplitude of the signal, while FM modulates the frequency.*
- *FM provides better sound quality with less noise, while AM is more susceptible to static and noise interference.*
- *AM is simpler but has lower sound quality, while FM requires more bandwidth but offers higher quality and reliability.*

What is Open AI 01?

Syllabus: GS-3: Science and Technology –Information Technology.

Context:

- *OpenAI has introduced a new AI model, "OpenAI o1," under its secretive "Project Strawberry."*
- *It is part of a series of "reasoning" models designed for solving complex tasks in science, coding, and maths.*
- *The o1 model is available in ChatGPT and through OpenAI's API as a preview version.*

Key Features of OpenAI o1:

- **Reasoning Abilities:**
  - *Designed to "think" more carefully about queries before responding, similar to human problem-solving.*
  - *Learns to approach problems from various perspectives, check its output, and improve from mistakes.*
- **Performance in Academic Domains:**
  - *Particularly excels in* **physics**, **chemistry**, **biology**, **maths**, *and* **coding**.
  - *Performs at a level comparable to PhD students in scientific disciplines.*
  - *Achieved an 83% success rate in solving complex maths problems (compared to 13% by earlier versions).*
  - *Ranks higher than 89% of coding participants in problem-solving contests.*

Limitations and Future Updates:

- **Current Limitations:**
  - *The model is still in the early stages and lacks features such as web browsing, file management, and image handling.*
- **Upcoming Updates:**
  - *OpenAI has planned regular updates to improve model performance and functionality.*

Specialized Version: OpenAI o1-Mini:

- **Purpose:**
  - *A cheaper, faster variant of OpenAI o1 designed for developers.*
- **Cost Efficiency:**
  - *80% cheaper than the o1-preview, making it a cost-effective solution for developers working on coding and reasoning tasks.*

Safety and Training:

- **Enhanced Safety Features:**
  - *OpenAI has introduced a new training methodology to ensure the model adheres to safety rules and avoids jailbreaking attempts.*

- *Significant improvement in safety compliance – scoring 84 in tests compared to 22 by earlier versions.*

- **Collaboration with Governments:**
  - *Collaborating with UK and US AI safety teams for better oversight and testing.*
  - *Includes safety tests like "red teaming" (spotting weaknesses) and expert evaluations.*

Impact on Jobs and Research:

- **Potential Job Displacement:**
  - *The model's capability in* **software development**, **data analysis**, **coding**, *and* **mathematical modelling** *could reduce human involvement in routine tasks.*
  - *Workers may need to focus on higher-order thinking skills like* **creativity**, **critical analysis**, *and* **problem-solving**.
- **New Opportunities:**
  - *Possible rise in roles related to* **AI safety**, **ethical AI use**, *and* **AI maintenance**.
- **Impact on Research:**
  - *Assists in scientific fields like* **physics**, **chemistry**, **biology**, *and* **healthcare** *by speeding up problem-solving.*
  - *Generates formulas, analyses large datasets, and supports breakthroughs in various research fields.*

Access to OpenAI o1:

- **For Users:**
  - *Available to* **ChatGPT Plus** *and* **Team users** *through a model picker with weekly rate limits.*
  - *Limits: 30 messages for o1-preview, 50 for o1-mini.*
- **Future Availability:**
  - **ChatGPT Enterprise** *and* **Edu users** *will gain access next week.*
  - *OpenAI is working to increase message rates and optimize model selection based on queries.*

Ozone Pollution

Syllabus: GS-3: Environmental Pollution.

Context:

- *Ground-level ozone reduces the growth of tropical forests, preventing the capture of approximately* **290 million tonnes of carbon annually.**

Ozone: Dual Role

- **Stratospheric Ozone***: Protects the Earth by shielding from harmful ultraviolet (UV) radiation.*
- **Ground-Level Ozone***:*
    - *Formed from pollutants like nitrogen oxides in the presence of sunlight (from human activities such as urbanization, industrialization, and burning fossil fuels).*
    - *Harmful to human health and interferes with plant growth by limiting carbon dioxide absorption.*

Impact on Tropical Forests

- **New Growth Reduction***: Ground-level ozone reduces new yearly growth in tropical forests by* **5.1% on average***.*
    - **Regional Variations***: Stronger effects in some regions, such as Asia, where tropical forests lose* **10.9%** *of new growth.*
- **Carbon Sequestration***:*
    - *Tropical forests act as crucial* **carbon sinks***, capturing and storing carbon dioxide (CO_2).*
    - *Since 2000, ozone exposure has prevented the capture of* **290 million tonnes of carbon** *per year, leading to a cumulative loss of* **17% carbon removal** *by tropical forests.*

Future Implications

- **Increasing Ozone Concentrations***: Due to human activities and warming climates, ozone levels in tropical regions are expected to rise further, impacting areas designated for forest restoration—critical for climate change mitigation.*

Scientific Research and Findings

- *The research incorporated* **ozone susceptibility experiments** *on tropical tree species, with results fed into a* **computer model of global vegetation***.*

Conclusion

- *Air pollution, specifically ground-level ozone, plays a significant yet often overlooked role in limiting the carbon absorption capacity of tropical forests.*
- *Addressing air pollution could enhance the global carbon sequestration effort, particularly in regions undergoing forest restoration.*