GEOGRAPHY

Volcanic Vortex Rings Over Mount Etna, Italy

Mount Etna Smoke: Mount Etna, the largest volcano in Europe, has been sending up almost perfect rings of smoke into the air.

The Mount Etna Smoke rings are a rare phenomenon that scientists refer to as volcanic vortex rings, which are produced roughly in the same way as the smoke rings that some cigarette smokers are able to blow out of their mouths.

About Mount Etna

- Geographical Location: Mount Etna is on the east coast of Sicily, (Italy) which is the largest island in the Mediterranean Sea. Its strategic location influences both local climate and agricultural practices due to its volcanic ash contributing to fertile soil.
- Physical Features: The summit of Mount Etna features five main craters which are the primary sources of its frequent eruptions.
- Additionally, the mountain is dotted with over 300 vents that vary in size. These vents are scattered along its slopes and contribute to both summit and flank eruptions.
- Eruption Episodes: Mount Etna is one of the most continuously active volcanoes in the world, with an eruptive history that dates back over 500,000 years. The volcano has experienced numerous eruptive events since 1600, including:
- Summit Eruptions: Notable summit eruptions occurred in 2006, 2007-08, twice in 2012, 2018, and most recently in 2021.
- Flank Eruptions: Significant flank eruptions took place in 2001, 2002-03, 2004-05, and 2008-09.
- World Heritage Site: Mount Etna has been designated a World Heritage Site since 2013. According to UNESCO, the volcano's eruptive history can be traced back 500,000 years, out of which 2,700 years of this activity has been documented.

Distribution of Volcanoes Around the World

There are about 500 volcanoes in the world. Most of these volcanoes are found in three well defined belts.

The Circum-Pacific Belt:

Circum-Pacific region has the greatest concentration of volcanoes, that is why it is called 'Pacific Ring of Fire'.

It is a horseshoe-shaped zone encircling the Pacific Ocean.

This ring extends along the Andes mountains of South America to Alaska and from the Aleutian Islands to Japan, Philippines, Indonesia to New Zealand.

Major Volcanoes: Mount St. Helena, Mauna Loa,Mount Ruapehu, Mount Krakatoa, Mount Fuji.

The Mid-World Mountain Belt:

The Mid-world mountain belt occupies the second position with regard to the numbers of volcanoes.

It runs from Alps in Europe to Asia Minor and crossing through Himalayan region joins the Circum-Pacific belt

Major Volcanoes Mt. Stromboli , Mt. Vesuvius , Mt. Karakoram

India's only active volcano is located in Barren island of Andaman, which is also the only confirmed active volcano in South Asia

The African Rift Valley Belt:

The African Rift Valley region ranks third. Most of the volcanoes are extinct here.

Mt. Cameroon is the only active volcano which is situated in Central West Africa.

Other Volcanoes: Mount Kilimanjaro, Mount Kenya, Mount Longonot

About Volcanic Vortex Rings

Volcanic vortex rings are circular loops of gasses, predominantly water vapor, that are expelled into the air in a ring-like formation through a vent in the crater.The vent that has opened up in Mount Etna's crater is almost perfectly circular, thus the rings that have been seen above it are also circular.

These rings can remain in the air for up to 10 minutes, but tend to disintegrate quickly if conditions are windy and turbulent.

Formation of Volcanic Vortex Rings:

Rapid Gas Emission: The formation involves rapid ejection of gas through a narrow circular conduit in a volcano's crater. This rapid expulsion is the initial trigger for the development of the vortex ring.

Pressure and Motion Dynamics: Similar to dolphins blowing bubble rings, the volcanic gasses are compressed and pushed through the vent, which creates a high-pressure pulse that molds the gas into a circular vortex.

Stabilization and Travel: Once formed, the cohesive forces within the gas maintain the ring's structure, allowing it to rise intact through the atmosphere unless disrupted by external forces like wind.

Significance of Volcanic Vortex Rings:

Research Value: Studying volcanic vortex rings helps scientists understand eruption dynamics and plume behavior, which are critical for predicting ash dispersion and assessing aviation risks.

1

Environmental Impact: Understanding these rings also aids in evaluating the environmental impact of the ash and gasses released during eruptions, which can affect air quality and climate.

Volcanic vortex rings have been observed at volcanoes such as Redoubt in Alaska, Tungurahua in Ecuador, Pacaya in Guatemala, Eyjafjallajökull and Hekla in Iceland, Stromboli in Italy, Aso and Sakurajima in Japan, Yasur in Vanuatu, Whakaari in New Zealand etc.

Mt Etna is well known for producing Volcanic Vortex rings. It was found that Mt Etna produced dozens of gas rings every day last year too.

Positive Consequences of Volcanic Eruptions

Climatic Benefits:
1. Solar Radiation Cooling: Volcanic particles can shade incoming solar radiation, causing temporary cooling effects on the planet that may last from months to years.
2. Agricultural and Ecological Benefits:
3. Soil Fertility: The breakdown of some types of volcanic ash and lava contributes to soil rich in nutrients, enhancing land for crops and forest growth.
4. Creation of New Landforms: Volcanoes form islands, plateaus, and mountains, which can be rich in minerals and fertile soils.

Economic and Geothermal Advantages:
1. Mineral Resources: Volcanic activity brings valuable mineral resources to the surface, including metallic ores and diamonds.
2. Geothermal Energy: Regions with volcanic activity often have potential for geothermal power generation, tapping into the Earth's internal heat.
3. Tourism and Recreation: Volcanic landscapes attract tourists, benefiting local economies and sometimes leading to the establishment of national parks centered around volcanic features.

Negative consequences of volcanic eruptions

Environmental and Climatic Hazards:
- Stratospheric Ash: Volcanic ashes can remain in the stratosphere for 2-5 years, where they participate in chemical reactions that destroy ozone molecules.
- Greenhouse Gasses: Eruptions release large amounts of greenhouse gases like carbon dioxide and water vapor, contributing to global warming.
- Loss of Flora and Fauna: Lava flows can destroy entire ecosystems, killing plants and animals which serve as carbon sinks.

Human and Structural Damage:
- Physical Destruction: Advancing lava can engulf cities and landscapes, while pyroclastic materials like cinders and volcanic bombs can cause fatalities and injuries.
- Volcanic Earthquakes and Mudflows: Associated seismic activity and lahars (mudflows of volcanic ash mixed with water) can devastate nearby areas.
- Health Risks: Eruptions can cause respiratory illnesses, burns, and injuries due to falls, while ash can lead to hazardous driving conditions and deteriorate water quality.

Economic Impacts:
1. Agricultural Disruption: Ash fall can damage crops and reduce periods of rain, negatively impacting agricultural productivity.
2. Tsunamis: In coastal regions, underwater volcanic activity can trigger tsunamis, causing extensive damage.

SCIENCE AND TECHNOLOGY

Potential impacts of AI: The future of work in the AI era

The article discusses how artificial intelligence (AI) might lead to job losses across all sectors, increasing productivity but potentially making human labor less valuable. It explores scenarios where AI could either lead to great wealth disparity or universal basic income, enhancing overall welfare.

Response of society to increased wealth from AI

There are two main predictions:

Apocalyptic Scenario: In this prediction, AI leads to a significant loss of jobs across various sectors, concentrating wealth in the hands of a few. The resulting inequality could deepen, with most of the wealth and productive surpluses being controlled by a small capital-owning class.

Utopian Scenario: Conversely, the same increase in productivity from AI could result in the wealthy being compelled to share their fortunes. This could be through mechanisms like a universal basic income, ensuring that everyone benefits from the AI-driven economic gains and possibly realizing a Marxist vision of society where all enjoy wealth and freedom.

potential impacts of AI

2

- **Job Displacement Across Sectors:** AI could replace a wide range of jobs, from low-wage positions like truck drivers and cashiers to high-paying roles such as doctors, software programmers, and airline pilots. This broad impact highlights the extensive reach of AI in the job market.
- **Increased Productivity and Economic Inequality:** AI may boost overall productivity but could also concentrate wealth significantly. In one scenario, a small, capital-owning class might monopolize these gains, exacerbating inequality.
- **Psychological and Social Effects:** As AI potentially eliminates the need for human labor, people might struggle with the loss of purpose and identity that work provides. This could lead to increased rates of depression, anxiety, and other mental health issues, as well as social consequences like substance abuse and higher suicide rates.
- **Challenge of Redistribution:** In a more optimistic scenario, the massive wealth generated by AI could be redistributed through mechanisms like universal basic income, suggesting a potential solution to the disparities created by AI-driven productivity.

What should be done?

Taxing AI: Imposing higher taxes on AI profits to fund social welfare programs, although this might not be sufficient to counteract the job losses.

Government Intervention: Using government resources to ensure AI complements human labor, as suggested by economist David Autor, but this might delay the inevitable rather than solve the problem.

PRELIM FACT

1.Prerana Program

Recently, the Secretary of the Department of School Education and Literacy (DoSEL) addressed the first alumni meeting of the Prerana Program.

1. About: Prerana is an experiential and inspirational learning program for students with the best-in-class technology where heritage meets innovation.

2. Launched by: Department of School Education & Literacy, Ministry of Education, Government of India

3. Aim: To offer a meaningful, unique, and inspiring experience to all participants and empowering them with leadership qualities.

4. Salient Features of the programme:

a) It is a week-long residential program for selected students of class IX to XII.

b) PRERANA started in the pilot phase from January to February 2024 in the Vernacular school at Vadnagar, Mehsana, Gujarat. The 6th batch will start from 15th April 2024.

c) In this phase, the Prerana program has been held for five batches of 20 participants each from five states and one Union Territory.

d) Prerana combines experiential learning with cutting-edge technology, bridging traditional heritage with modern innovation.

e) The curriculum is built around nine core values: Dignity and Humility, Valor and Courage, Hard Work and Dedication, Compassion and Service, Diversity and Unity, Integrity and Purity, Innovation and Curiosity, Faith and Trust, and Freedom and Responsibility.

f) These themes aim to instill a deep respect for India's diverse culture and promote the philosophy of "Vasudhaiva Kutumbakam" (the world is one family).

g) The day-wise program includes yoga, mindfulness, and meditation, alongside thematic experiential learning and engaging hands-on activities.

Evening activities will include visits to ancient and heritage sites, inspirational film screenings, mission life creative activities, talent shows etc. ensuring a holistic learning approach.

2. Novel hydrogel removes microplastics from water

Researchers at the Indian Institute of Science (IISc) have developed a sustainable hydrogel specifically designed to tackle the menace of microplastics in water.

1) The hydrogel utilizes a complex interpenetrating polymer network (IPN) architecture composed of chitosan, polyvinyl alcohol, and polyaniline.

2) This structure is infused with nanoclusters of copper substitute polyoxometalate (Cu-POM), which act as catalysts under UV light irradiation to degrade microplastics.

3) The synergistic effect of the polymers intertwined with the catalytic nanoclusters enhances the hydrogel's stability across various temperatures and also enables it to adsorb and degrade large quantities of microplastics efficiently.

4) This hydrogel efficiently removes about 95% and 93% of two different types of microplastics in water, highlighting its potential as a significant solution in water purification technologies.

5) The hydrogel could last for up to five cycles of microplastic removal without significant loss of efficacy.

6) This hydrogel can also be converted into carbon nanomaterials that are capable of extracting heavy metals, such as hexavalent chromium, from contaminated water.

3

About Microplastic

1. Microplastics are small plastic particles in the environment that are generally smaller than 1 mm to the 1 micrometer range. Microplastics can be formed by fragmentation of large plastic waste material.

2. Danger of Microplastics to humanity and overall biodiversity:

a) Microplastics pass the filtration and treatment processes for wastewater resulting in significant global impacts on wildlife from marine environment pollution.

b) Microplastics kill biodiversity and other organisms' fish before they reach reproductive age. It lead to stunted growth and behaviour change in some organisms.

c) Large amounts of plastic are not recycled and end up in landfills, posing a threat to human health.

d) The durable properties of plastics make them persistent and slow to degrade in the environment entering the food chains. It holds the potential for both bioaccumulation and biomagnification.

3. World Cybercrime Index

Recently, an international team of researchers has compiled the 'World Cybercrime Index'.

World Cybercrime Index

1. The 'World Cybercrime Index' identifies the globe's key cybercrime hotspots by ranking the most significant sources of cybercrime at a national level.

2. The index was developed through a collaborative effort between the University of Oxford and UNSW Canberra.

3. It is based on data collected from a survey involving 92 top global experts in cybercrime, who specialize in intelligence and investigations related to cyber activities.

4. It ranks roughly 100 countries and identifies key hotspots according to various categories of cybercrime.

5. The five major categories of cybercrime assessed by the study were technical products/services, attacks and extortion, Data/identity theft, Scams, cashing out/money laundering.

6. Key findings from the World Cybercrime Index:

a) Russia tops the list with the highest cybercriminal threat, followed by Ukraine, China, the USA, Nigeria, and Romania.

b) The United Kingdom (UK) ranks at number eight in terms of cybercrime threat.

c) India was ranked 10th in cybercrime, mostly involving scams that trick people into making advance payments.

d) The study indicated that certain types of cybercrime were linked to specific countries. For ex- the U.S.A was predominantly connected with data and identity theft crimes, whereas crimes involving technical products or services frequently traced back to China.

e) The study also found that countries that are cybercrime hubs "specialise" in particular categories. For ex- Russia and Ukraine are highly technical cybercrime hubs, whereas Nigerian cybercriminals are engaged in less technical forms of cybercrime.

f) The worldwide economic impact of cybercrime is projected to significantly increase over the next four years, escalating from \$9.22 trillion in 2024 to \$13.82 trillion by 2028.

4. Web3

- Web3.0 is decentralized,privacy-oriented block chain driven and crypto asset friendly. It is also known as semantic web. It allows more intelligent,context aware and personalized interactions between human and computers.

- India's share of Web3 developers globally has surged from 3% in 2018 to 12% in 2023, leading among emerging markets, states a report by Hashed Emergent.

- The ecosystem is young, with over 50% of developers joining in the past two years, and female participation has risen from 3% to 14% in five years. The country has a thriving Web3 sector with 1,000 startups and received \$250 million in investment in 2023, mainly in finance, entertainment, and infrastructure subsectors.

5. Financial Services Institutions Bureau (FSIB)

The Financial Services Institutions Bureau (FSIB) has recommended Manoj Mittal, currently the Managing Director of IFCI, as the new Chairman and Managing Director of the Small Industries Development Bank of India (SIDBI).

Additionally, Sanjay Shukla has been selected as the Managing Director of the National Housing Bank (NHB)

About FSIB:

- Constituted in 2022 under Department of Financial Services (Ministry of Finance), by Central Government replacing Bank Board Bureau.

- The Financial Services Institutions Bureau (FSIB) is an organization responsible for selecting directors for state-owned banks and financial institutions in India.

- It acts as a head-hunter, identifying and recommending suitable candidates for leadership positions within the financial sector.

4

ANSWER WRITTING

Q. Discuss the significance of the One Health approach in the context of India's public health system and how it can be incorporated effectively to address the risk of Pandemics.

The One Health approach has emerged as a pivotal paradigm in addressing the intricate challenges of public health, particularly in mitigating the risk of pandemics. This integrative strategy recognizes the interconnectivity between human, animal, and environmental health, emphasizing the necessity for a collaborative response to health threats. In the context of India, with its dense population and rich biodiversity, the implementation of the One Health approach is both a necessity and a challenge.

Significance of the One Health Approach

- **Zoonotic Diseases and Public Health**
  o Zoonotic diseases, which comprise approximately 60% of known infectious diseases in humans and 75% of emerging infectious diseases, highlight the critical role of the One Health approach.
  o The interconnectedness of human, animal, and environmental health necessitates an integrated response to these diseases.
- **Antimicrobial Resistance (AMR)**
  o The extensive and irrational use of antibiotics, particularly in the livestock sector, has led to the emergence of antibiotic-resistant pathogens.
  o This issue underlines the importance of the One Health approach in tackling AMR by fostering responsible antibiotic use across sectors.
- **Environmental Health and Biodiversity**
  o Environmental health threats and the loss of biodiversity are increasingly recognized as factors influencing human and animal health.
  o The One Health approach advocates for environmental preservation as a fundamental aspect of health security.

Operationalizing One Health in India

- **Government Initiatives and Frameworks**
  o India's efforts in operationalizing the One Health approach are evident through the establishment of the National Institute for One Health and the Roadmap to Combat Zoonoses in India (RCZI).
  o These initiatives underscore the government's commitment to integrating human, animal, and environmental health considerations into its public health strategies.
- **Challenges and Opportunities**
  o While India has made strides in embracing the One Health concept, several challenges remain, including the need for improved cross-sector convergence, enhanced laboratory capacities, and integrated disease surveillance systems.
  o However, these challenges also present opportunities for strengthening India's health infrastructure and fostering collaboration among stakeholders.
- **Collaborative Research and Capacity Building**
  o The promotion of collaborative research and capacity building within the One Health framework is crucial for generating evidence-based solutions to zoonotic diseases and AMR.
  o Such efforts can guide policy and practice to better address these health threats.

The One Health approach offers a comprehensive strategy for enhancing pandemic preparedness and response in India, addressing the multifaceted challenges at the human-animal-environment interface. Its successful implementation hinges on fostering cross-sectoral collaboration, building robust health surveillance systems, and ensuring sustainable environmental practices. By integrating these components, India can build a resilient public health system capable of confronting the complexities of emerging health threats in an interconnected world. The journey towards a fully operational One Health framework in India is fraught with challenges, but it also offers a beacon of hope for a healthier, more sustainable future.

MCQs

1. Consider the following statements with reference to Volcanism:
1. The explosive volcanic eruptions largely depend upon the temperature of the magma.
2. Lava domes are formed when the viscosity of the magma is very low.
3. Volcanic Vortex rings are generated when water vapour is released rapidly through a vent in the crater.
How many of the above statements are correct?
(a) Only one
(b) Only two
(c) All three
(d) None

2. 2. With reference to Spyware, consider the following statements:
1. A spyware aims at disrupting, damaging, or gaining unauthorised access to a system or network.
2. The mercenary spywares is characterised by substantial investment and short lifespan.

3. Pegasus spyware was designed to access any smartphone through zero-click vulnerabilities.
How many of the above statements is/are correct?
(a) Only one
(b) Only two
(c) All three
(d) None

3. Piezoelectric bone conduction is a medical procedure to treat:
(a) Brain haemorrhage
(b) Dental infections
(c) Hearing anomalies
(d) Colour blindness

4. Consider the Following Statements regarding Right to Privacy
1. The right to privacy is protected as an intrinsic part of the right to life and personal liberty under Article 21 of the Constitution.
2. The right may be restricted only by state action for the purpose of National Security, Public Order and Sovereignty of the Nation.
Which of the statements given above is/are incorrect?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

5. The Annual Status of Education Report (ASER) 2023 report is titled "Beyond Basics." What does this title likely refer to?
(a) Advanced scientific concepts
(b) Vocational training skills
(c) Early childhood education
(d) Teacher training programs

6. With reference to the Telecommunications Act, 2023, consider the following statements:
1. It introduced the concept of setting up multiple regulatory sandboxes (RS) to foster innovation within the telecom sector.
2. These sandboxes provide regulated access to network and customer resources for testing new products, services, processes, and business models.
3. Both Indian nationals and foreign entities are eligible to participate in these regulatory sandboxes.
How many of the statements given above are correct?

(a) Only one
(b) Only two
(c) All three
(d) None

7. Consider the following:
1. Manufacturing
2. Mining
3. Electricity
4. Agriculture
How many of the above sectors are included in the Index of Industrial Production (IIP) calculation?
(a) Only one
(b) Only two
(c) Only three
(d) All four

8. Which organization releases the Global Financial Stability Report?
(a) International Monetary Fund (IMF)
(b) World Bank
(c) Organisation for Economic Co-operation and Development (OECD)
(d) Bank for International Settlements (BIS)

9. Consider the following statements:
1. It is a government body set up under the Department of Financial Services (DFS), Ministry of Finance.
2. It recommends the selection of heads for Public Sector Banks.
3. It helps the Public Sector Banks in developing strategies and capital raising plans.
How many of the above statements about the Financial Services Institution Bureau (FSIB) is/are correct?
(a) Only one
(b) Only two
(c) All three
(d) None

10. Which of the following best describes Web3?
(a) A new version of the World Wide Web that focuses on user-generated content and social media platforms.
(b) An upgrade to Web2 that aims to improve website loading speeds and user experience.
(c) A decentralized internet where users have more control over their data and interactions using blockchain technology.
(d) A design framework for creating visually appealing and interactive websites.

6