NOVEMBER 2026

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Topic 1: Urban Cleanliness & Swachh Survekshan (10th Edition)

(Syllabus: GS Paper 2 – Governance; GS Paper 3 – Urbanization, Solid Waste Management)

Context & Key Highlights

- Survey Milestone: The Ministry of Housing and Urban Affairs (MoHUA) organized the 10th edition of Swachh Survekshan1. The survey has expanded from 73 cities in 2016 to 4,751 cities in 2025–26, incorporating feedback from 2.7 crore citizens2.
- Independent Assessor: The assessment is conducted by the Quality Council of India (QCI) across three core domains: service-level progress, certification, and citizen voice3.
- New Sub-Categories Introduced: For the first time, specialized geographic categories were instituted1:
    - Cleanest Riverfront Town: Rewa (Madhya Pradesh), followed by Bilaspur (Chhattisgarh) and Varanasi (Uttar Pradesh)4.
    - Cleanest Coastal Town: Puri (Odisha), followed by Alappuzha (Kerala) and Ratnagiri (Maharashtra)14.
    - Cleanest Himalayan City: Rudrapur (Uttarakhand), followed by Jammu and Shopian4.
    - Swachh Sheher Jodi (Mentor–Mentee Model): Pairs the best-performing city in each State with its lowest-ranked counterpart to foster peer-led capacity building14. Top pairs: Ahmedabad and Sanand (1st), Indore and Depalpur (2nd), and Tirupati and Kuppam (3rd)4.

Major Population-Wise Rankings

- Super Swachh League: Reserved for past winners to allow emerging cities to compete for top spots5. Navi Mumbai ranked first, followed by Surat and Vijayawada6. (Indore topped the league in the previous edition after winning cleanest city for eight consecutive years)6.
- Cities with Population > 10 Lakh: Visakhapatnam bagged 1st rank, followed by Jabalpur and Lucknow16.
- Cities with Population 3 Lakh to 10 Lakh: Ujjain secured 1st rank, followed by Chandigarh and Guntur6.

- Cities with Population 50,000 to 3 Lakh: Dewas secured 1st rank, followed by New Delhi Municipal Council (NDMC) and Sagar6.

Challenges & Policy Gaps

- Relative vs. Absolute Metric: Rankings demonstrate relative standing among peers rather than 100% scientific processing of generated waste7.
- Wide Disparities: The stark divide between top cities and laggards within the same State necessitates targeted technical and financial handholding7.

Topic 2: Remediation of Legacy Landfills & SBM-U 2.0

(Syllabus: GS Paper 3 – Environmental Pollution, Solid Waste Management)

Context & Timeline Extension

- Target Revision: The MoHUA extended the deadline to remediate all legacy dumpsites across Indian cities from October 2026 (the original 5-year culmination of Swachh Bharat Mission Urban 2.0 launched in 2021) to December 20278more_horiz. While SBM-U 2.0 itself has been extended to March 2027, the remediation target extends nine months beyond the mission tenure, leaving post-mission financing and monitoring unclear8more_horiz.

Progress & Backlog Metrics

- Total Legacy Waste: 2,607 dumpsites on the national dashboard initially held 3,135 lakh tonnes of waste spread over 15,545 acres1012.
- Remediation Status:
    - 1,402 sites have been fully remediated; 1,057 sites have ongoing work; 148 sites show zero progress1012.
    - Overall, 64% of waste volume has been processed and 70% of land reclaimed12.
    - A backlog of 1,139 lakh tonnes across 4,632 acres remains12.
- Dumpsite Remediation Accelerator Programme: Launched by MoHUA to focus intensively on 214 mega-sites that concentrate 80% of the remaining unremediated waste13.

Hotspots & Structural Challenges

- Mega Dumpsites:
    - *Bhalswa (Delhi):* Fresh municipal waste continues to enter the site alongside legacy biomining, diluting reclaimed area gains1213.
    - *Okhla & Ghazipur (Delhi):* Okhla is nearing clearance, whereas Ghazipur requires at least another year13.
    - *Deonar (Mumbai):* Recognized as one of Asia's oldest and largest landfills, where waste clearance trials have only recently begun13.
- Key Challenge: The failure of urban local bodies (ULBs) to achieve 100% source segregation and daily fresh-waste processing results in active dumping on land under remediation1113.

Topic 3: Air Quality Monitoring & Green Crackers Efficacy

(Syllabus: GS Paper 3 – Environmental Pollution & Health, Scientific Interventions)

CAAQMS Network & Peak Episode Vulnerabilities

- Festival Spike: An analysis of Central Pollution Control Board (CPCB) Continuous Ambient Air Quality Monitoring Stations (CAAQMS) revealed that stations reporting ‘severe’ PM2.5 levels (≥ 250 µg/m³) surged from 96 stations pre-Deepavali to 375 stations during the festival (accounting for nearly 70% of reporting stations)1415.
- Geographic Spread: All 59 CAAQMS stations in Delhi reported 'severe' peaks16. Over two-thirds of stations in Maharashtra, Uttar Pradesh, Rajasthan, Haryana, Madhya Pradesh, Gujarat, and Andhra Pradesh also breached severe thresholds16.
- Data Blind-Spots: Out of 634 CPCB stations, only 571 were live during the festival15. More critically, CPCB particulate matter analyzers are calibrated to an upper threshold of 1,000 µg/m³, automatically censoring readings above this limit as "data gaps"17. Many monitors stopped reporting well before reaching this ceiling (at ≤ 500 µg/m³), obscuring true community peak exposure17. In Tamil Nadu, only 9 of 37 stations reported PM2.5 during the festival17.

Scrutiny of 'Green Crackers'

- Development & Norms: Developed by CSIR-NEERI (National Environmental Engineering Research Institute) to reduce particulate matter emissions by approximately 30% relative to conventional formulations18.
- Judicial Mandate: Permitted by the Supreme Court in *Arjun Gopal v. Union of India (2018)*18.
- Empirical Reality: Real-time data across Delhi, Mumbai, and Kolkata shows no reduction in Sulphur Dioxide (SO_2) levels over the past five years during Deepavali, revealing persistent gaps in testing, market regulation, and field enforcement of conventional fireworks1920.

Topic 4: Farm Fires – Active Fire Counts vs. Burnt Area Measurement *(Syllabus: GS Paper 3 – Air Pollution, Remote Sensing & Agriculture)*

The Measurement Paradox

- Active Fire Counts vs. Burnt Area: Active fire counts rely on thermal anomalies detected when polar-orbiting satellites make orbital passes, measuring only momentary burning2122. In contrast, burnt area mapping detects spectral burn scars on the ground post-event via infrared imagery, capturing the full cumulative extent2123.
- Judicial Intervention: In November 2024, the Supreme Court directed the Commission for Air Quality Management (CAQM) to focus on burnt area as the definitive metric, observing that fire counts do not represent the true extent of farm fires24.

Divergent Field Trends (2024–2025)

- Haryana: Active satellite fire detections fell by more than 50% (from 1,406 to 662), yet cumulative burnt area expanded by nearly 25% (from 7,117 sq km to 8,812 sq km)2225.
- Punjab: Fire counts halved (10,909 to 5,114), but burnt area saw only a marginal decline of ~15% (23,262 sq km to 19,757 sq km)2226.
- Shift in Burning Behavior: Over 90% of large fires were lit after 3:00 PM, deliberately scheduled after the afternoon overpass of polar satellites22.

Geostationary sensors confirmed a structural shift of peak burning toward late afternoon and evening22.

Methodological & Institutional Impasse

- Algorithm Limitations: The European Space Agency's Sentinel-2 satellite (5-day revisit cycle) uses infrared sensors to identify burn scars23. However, mixed field mosaics (standing crops, harvested stubble, and burnt soil) cause satellite models to confuse dry residue with burn scars23. CAQM field validation failed to corroborate over 50% of satellite-detected fires23.
- Institutional Fragment: While CAQM formed an NRSC expert committee in January 2024, the Indian Agricultural Research Institute (IARI) maintains that burnt area mapping remains unstandardized and unverified, leaving India without an authenticated baseline metric24more_horiz.

Topic 5: Global Carbon Budget & India's Transition Constraints

(Syllabus: GS Paper 3 – Climate Change, Renewable Energy Integration)

Global Carbon Trends

- Study Overview: Produced annually by the University of Exeter-led consortium and released at COP31 in Antalya, Turkey2930.
- Fossil Emission Dip: Projects a marginal decline in global fossil fuel emissions, driven by energy shocks from the Iran war and accelerated solar/wind deployment2930. Emissions in China (down ~1%), the US, the EU, and Japan are projected to fall30.
- Total Emissions Rise: Despite lower fossil combustion, total global CO_2 emissions are projected to climb from 42.8 billion tonnes to 43.3 billion tonnes, driven by deforestation and Super El Niño-induced peatland fires in Southeast Asia31.

India's Decarbonization Bottlenecks

- Emissions Outlier: India's fossil fuel emissions are estimated to rise by > 4%, driven by surging base-load power demand dominated by coal29more_horiz.
- The "Integration Paradox": Rapid expansion of installed renewable capacity is constrained by:

1. *Storage Deficits:* Insufficient grid-scale battery storage and pumped-storage hydropower result in the curtailment and loss of midday solar and wind surpluses3334.
2. *Discom Financial Distress:* Prolonged financial deficits among State power distribution companies (discoms) prevent necessary capital investments in sub-station and grid modernization3435.

Topic 6: Climate Finance & Turning COP Commitments into Capital
(Syllabus: GS Paper 3 – Environmental Economics, International Climate Negotiations)
COP31 & The Financing Architecture

- The "Implementation COP": COP31 is framed around bridging the gap between national pledges and actual deployed capital3637.
- New Collective Quantified Goal (NCQG): Formulated at COP29 to replace the expired 2009 target of $100 billion/year3839. NCQG mandates developed countries to mobilize at least $300 billion annually by 2035, anchored within a broader ambition of $1.3 trillion per year3840. Developing nations, including India, have criticized this quantum as severely inadequate41.

Barriers to Private Capital Mobilization

- Risk Perception vs. Actual Risk: Credit rating agencies systematically overestimate emerging market risks; empirical data from the ICC Trade Register demonstrates consistently low default rates in trade and supply chain finance40.
- MDB Catalytic Mobilization Deficit: Multilateral Development Banks (MDBs) generate inadequate private co-investment per public dollar deployed4042.
- Adaptation Disadvantage: Adaptation and resilience projects rarely yield direct commercial financial returns, leaving them heavily dependent on concessional public finance3841.
- Trade Integration & Green Protectionism: International trade accounts for up to 30% of global emissions43. Unilateral carbon border adjustment measures, enacted without developing country participation, risk evolving into non-tariff trade barriers43.

Topic 7: Fertilizer Subsidy Dynamics & Fiscal Overruns

(Syllabus: GS Paper 3 – Farm Subsidies, Food Security & Fiscal Policy)

Subsidy Architecture

- Urea: Sold at a statutory administered Maximum Retail Price (MRP), with the Centre absorbing the difference as subsidy; domestic production costs depend directly on Liquefied Natural Gas (LNG) prices44.
- Nutrient Based Subsidy (NBS): Governs Phosphatic and Potassic (P&K) fertilizers (e.g., Di-ammonium Phosphate - DAP). The Cabinet approves per-kilogram subsidy rates for four nutrients: Nitrogen (N), Phosphorus (P), Potash (K), and Sulphur (S) on a seasonal basis (Kharif and Rabi)4445.

Current Fiscal Divergence

- Budgetary Outlay vs. Reality: The Union Budget 2026–27 allocated ₹54,000 crore for P&K subsidies (reducing total fertilizer outgo to ₹1.71 lakh crore based on assumed price moderation)45more_horiz.
- Mid-Year Surge: The Cabinet approved a Rabi P&K subsidy of ₹62,370.02 crore (a 64% increase over the previous Rabi season's ₹37,952 crore)4546. Adding the Kharif outgo of ₹41,533.81 crore, the P&K bill alone crossed ₹1.03 lakh crore, pushing total fertilizer outgo toward ₹3.0 to ₹3.50 lakh crore45more_horiz.
- Geopolitical Catalyst: Armed conflict in West Asia and shipping threats around the Strait of Hormuz caused global price spikes in LNG, imported urea, and rock phosphate/DAP4748.
- Fixed Farmer Pricing: The Centre insulated farmers by fixing the DAP retail price at ₹1,350 per bag, fully absorbing external price shocks into the fiscal deficit (projected to add up to 0.3% of GDP)4648.

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Topic 8: Gravitational-Wave Astronomy Enters the Statistical Era

(Syllabus: GS Paper 3 – Science & Technology, Space & Fundamental Physics)

Transition to Population Studies

- Catalogue Milestone: The international detector collaboration released a catalog containing 390 candidate events (a 70% increase over the previous release, adding 161 new candidate black hole mergers)4950.
- The "Statistical Era": Astronomy has transitioned from detecting isolated mergers to analyzing population demographics, mass spectrums, and spin distributions4951.
- Validation of General Relativity: Analysis of 168 merger signals (including the benchmark event GW250114) confirmed that the ringdown phase (fading gravitational waves as the merged entity settles) matched Einstein's field equations5152.

Key Astrophysical Discoveries

- Mass Clusters & Formation: Black holes around 10 solar masses appear far more frequently than expected, while those around 35 solar masses consistently merge with equal-mass companions52. Only ~15% exhibit rapid spin, indicating diverse evolutionary paths (e.g., isolated binaries, dynamical capture in star clusters, and hierarchical repeat mergers)52.
- Pair-Instability Supernova Mass Gap: Extremely massive stars undergo runaway core fusion when high-energy photons convert into electron-positron pairs, causing total explosive disruption without leaving a remnant; this creates a deficit of black holes with masses starting around 44 solar masses52.
- Hubble Constant Estimation: Gravitational wave "standard sirens" coupled with electromagnetic redshift yield an expansion rate of 71 km/s/Mpc53.

Future Observatories & India's Strategic Role

- LIGO-India (Aundha, Hingoli District, Maharashtra): Scheduled to begin operations in 2030 as the world's sixth gravitational wave detector (joining LIGO Hanford, LIGO Livingston, Virgo in Italy, KAGRA in Japan, and GEO600 in Germany)51more_horiz.

- Triangulation Advantage: The existing northern-hemisphere baseline limits sky localization5355. Adding LIGO-India creates an extended geographical baseline, cutting source sky localization uncertainty by 40% and enabling rapid electromagnetic follow-up by optical/radio telescopes5356.
- Space-Based Detection (LISA): Joint ESA-NASA mission of three spacecraft orbiting the Sun to detect lower-frequency gravitational waves inaccessible to terrestrial interferometers53.

UPSC-Style Practice MCQs

Question 1
With reference to the Swachh Survekshan awards, consider the following statements:

1. Visakhapatnam was awarded the cleanest city among urban areas with a population exceeding 10 lakh.
2. The "Super Swachh League" category was introduced to allow past winning cities to mentor newly participating urban local bodies.
3. Rewa in Madhya Pradesh was adjudged the cleanest riverfront town.

Which of the statements given above is/are correct? (a) 1 and 2 only (b) 1 and 3 only (c) 3 only (d) 1, 2, and 3

Question 2
Under the Swachh Survekshan framework, the newly introduced "Swachh Sheher Jodi" initiative is aimed at: (a) Pairing coastal cities with riverfront towns to exchange solid waste management techniques. (b) Linking the best-performing city of each State with its lowest-performing counterpart for peer mentoring. (c) Creating twin-city partnerships between Indian municipal corporations and international clean cities. (d) Twinning capital cities with surrounding industrial satellite towns to control hazardous industrial effluents.

Question 3
Consider the following statements regarding the Swachh Bharat Mission Urban 2.0 (SBM-U 2.0) and legacy landfill remediation:

1. SBM-U 2.0 was originally launched with the objective of remediating all urban legacy dumpsites within a five-year period ending in October 2026.
2. The revised target to achieve complete legacy landfill remediation has been extended to December 2027, which lies beyond the extended tenure of the Mission itself.
3. The Dumpsite Remediation Accelerator Programme focuses specifically on 214 dumpsites that hold 80% of the country's unremediated legacy waste.

Which of the statements given above are correct? (a) 1 and 2 only (b) 2 and 3 only (c) 1 and 3 only (d) 1, 2, and 3

Question 4
Consider the following landfill sites:

1. Deonar
2. Bhalswa
3. Ghazipur

Which of the above are located in Delhi? (a) 1 and 2 only (b) 2 and 3 only (c) 1 and 3 only (d) 1, 2, and 3

Question 5
With reference to Ambient Air Quality Monitoring in India, consider the following statements:

1. Under CPCB standards, an ambient hourly PM2.5 concentration of 250 micrograms per cubic metre or above is categorized as 'severe'.
2. The continuous ambient air quality analyzers deployed by CPCB are configured to record pollutant values without any upper measurement ceiling.
3. Data recorded by CAAQMS stations during extreme pollution spikes is never excluded or flagged as data gaps by automated validation algorithms.

Which of the statements given above is/are correct? (a) 1 only (b) 1 and 2 only (c) 2 and 3 only (d) None of the above

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Question 6
With reference to "Green Crackers" in India, consider the following statements:

1. They were developed by the National Environmental Engineering Research Institute (CSIR-NEERI).
2. They are formulated to reduce particulate matter emissions by approximately 30% compared to conventional firecrackers.
3. In the *Arjun Gopal v. Union of India (2018)* case, the Supreme Court placed a blanket ban on all types of firecrackers, including green crackers.

Which of the statements given above is/are correct? (a) 1 and 2 only (b) 2 and 3 only (c) 1 only (d) 1, 2, and 3

Question 7
In the context of agricultural stubble burning monitoring in northern India, consider the following statements:

1. Active fire counts captured by polar-orbiting satellites measure the cumulative seasonal area of burnt land.
2. Burnt area mapping using infrared sensors on satellites can detect burn scars irrespective of whether a satellite passed overhead at the exact moment of combustion.
3. Satellite observations indicate that over 90% of large farm fire events occur after 3:00 PM, avoiding the overpass times of traditional polar-orbiting satellites.

Which of the statements given above is/are correct? (a) 1 and 2 only (b) 2 and 3 only (c) 1 and 3 only (d) 1, 2, and 3

Question 8
Consider the following statements regarding the measurement of paddy residue burning:

1. In Haryana, during 2024–2025, active fire counts decreased while the total burnt area increased.
2. The European Space Agency's Sentinel-2 satellite has a 24-hour daily revisit time over northern India to map fire scars.

3. The Commission for Air Quality Management (CAQM) has officially notified and fully operationalized a standardized burnt area protocol developed by IARI.

Which of the statements given above is/are correct? (a) 1 only (b) 1 and 2 only (c) 2 and 3 only (d) 1, 2, and 3

Question 9
With reference to the Global Carbon Budget, consider the following statements:

1. The annual Global Carbon Budget assessment is led by an international research team anchored at the University of Exeter.
2. Temporary reductions in fossil fuel emissions caused by geopolitical energy shocks indicate that global emissions have structurally peaked.
3. Severe dry conditions linked to a Super El Niño elevate the risk of peat fires, which release carbon stored in organic soils.

Which of the statements given above is/are correct? (a) 1 and 2 only (b) 2 and 3 only (c) 1 and 3 only (d) 1, 2, and 3

Question 10
Which of the following factors act as critical structural impediments to India's optimal utilization of its installed renewable energy capacity?

1. Inadequate utility-scale battery and pumped-hydro energy storage systems.
2. Persistent financial distress and balance-sheet losses among power distribution companies (discoms).
3. The absence of base-load coal-fired power plants in the national grid.

Select the correct answer using the code given below: (a) 1 and 2 only (b) 2 and 3 only (c) 1 and 3 only (d) 1, 2, and 3

Question 11
With reference to international climate finance negotiations, consider the following statements:

1. The New Collective Quantified Goal (NCQG) on climate finance was established at COP29 to replace the previous $100 billion annual target.
2. The NCQG sets a commitment of at least $300 billion annually by 2035 for developed nations, within an overall ambition of mobilizing $1.3 trillion per year.
3. The International Chamber of Commerce (ICC) Trade Register indicates that emerging market green infrastructure loans suffer from exceptionally high historical default rates.

Which of the statements given above is/are correct? (a) 1 only (b) 1 and 2 only (c) 2 and 3 only (d) 1, 2, and 3

Question 12
Under the Nutrient Based Subsidy (NBS) regime in India, the Central Government fixes annual or seasonal subsidy rates for which of the following nutrients?

1. Nitrogen (N)
2. Phosphorus (P)
3. Potash (K)
4. Sulphur (S)

Select the correct answer using the code given below: (a) 1, 2, and 3 only (b) 2 and 3 only (c) 1, 2, 3, and 4 (d) 2, 3, and 4 only

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Question 13
With reference to chemical fertilizer subsidies and pricing in India, consider the following statements:

1. Urea pricing is governed under the Nutrient Based Subsidy (NBS) policy.
2. Liquefied Natural Gas (LNG) is the primary feedstock used in the manufacturing of urea.
3. The retail price of Di-ammonium Phosphate (DAP) is completely deregulated and fluctuates freely on a daily basis with international spot prices.

Which of the statements given above is/are correct? (a) 1 and 3 only (b) 2 only (c) 2 and 3 only (d) 1, 2, and 3

Question 14
Consider the following pairs of Gravitational Wave Observatories and their locations:

1. Virgo : Italy
2. KAGRA : Japan
3. LIGO-India : Hingoli, Maharashtra
4. LISA : Atacama Desert, Chile

How many of the above pairs are correctly matched? (a) Only one (b) Only two (c) Only three (d) All four

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Question 15
With reference to Gravitational-Wave astronomy, consider the following statements:

1. The "ringdown" phase of a gravitational wave signal corresponds to the fading waves emitted as a newly merged black hole settles into equilibrium.
2. In pair-instability supernovas, extremely massive stars blow apart completely due to electron-positron pair creation, leaving a deficit of black holes above ~44 solar masses.
3. Constructing LIGO-India improves the geographical baseline of the global detector network, significantly reducing the sky area of uncertainty for source localization.

Which of the statements given above are correct? (a) 1 and 2 only (b) 2 and 3 only (c) 1 and 3 only (d) 1, 2, and 3

Part 3: Answer Key & Explanations

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Answer Key

Q. No.	Answer	Q. No.	Answer	Q. No.	Answer
1	(b)	6	(a)	11	(b)
2	(b)	7	(b)	12	(c)
3	(d)	8	(a)	13	(b)
4	(b)	9	(c)	14	(c)
5	(a)	10	(a)	15	(d)

Detailed Explanations

Q1. Correct Answer: (b)

- Statement 1 is correct: Visakhapatnam was adjudged the cleanest city among cities with a population above 10 lakh in the 10th edition of Swachh Survekshan16.
- Statement 2 is incorrect: The "Super Swachh League" is a separate competition category specifically created for past winning cities so they do not crowd out new competitors in the standard population categories5. The peer mentoring initiative is called "Swachh Sheher Jodi"14.
- Statement 3 is correct: Rewa (Madhya Pradesh) won 1st place in the newly created Cleanest Riverfront Town category4.

Q2. Correct Answer: (b)

- Explanation: The "Swachh Sheher Jodi" award pairs each State's best-performing city with its worst-performing city in a mentor–mentee partnership to improve urban sanitation (e.g., Ahmedabad paired with Sanand)14.

Q3. Correct Answer: (d)

- Statement 1 is correct: SBM-U 2.0 was launched in 2021 with a 5-year mandate to clear all legacy landfills by 1 October 2026910.
- Statement 2 is correct: The target has been shifted to December 2027, which is nine months after the extended tenure of SBM-U 2.0 itself (extended up to March 2027)810.

- Statement 3 is correct: MoHUA launched the Dumpsite Remediation Accelerator Programme targeting 214 high-priority sites holding 80% of India's remaining legacy waste13.

Q4. Correct Answer: (b)

- Explanation: Bhalswa, Ghazipur, and Okhla are prominent legacy landfill sites in Delhi1213. Deonar is located in Mumbai, Maharashtra, and is recognized as one of Asia's oldest and largest landfills13.

Q5. Correct Answer: (a)

- Statement 1 is correct: Under CPCB guidelines, a continuous PM2.5 reading of 250 micrograms per cubic metre ($\mu\text{g/m}^3$) or higher falls under the 'severe' category15.
- Statements 2 and 3 are incorrect: CPCB particulate matter analyzers are calibrated to a maximum measurement range of 1,000 $\mu\text{g/m}^3$17. Automated data checks treat values outside that range as invalid, appearing as "data gaps" during extreme pollution episodes17.

Q6. Correct Answer: (a)

- Statements 1 and 2 are correct: Green crackers were designed by CSIR-NEERI and achieve a ~30% reduction in particulate matter compared to conventional crackers18.
- Statement 3 is incorrect: In *Arjun Gopal v. Union of India (2018)*, the Supreme Court did not place a blanket ban; it explicitly permitted the sale and use of green and reduced-emission crackers while banning toxic conventional formulations18.

Q7. Correct Answer: (b)

- Statement 1 is incorrect: Active fire counts record instantaneous thermal anomalies only when a satellite passes overhead; they do not measure the total land area burnt21. Burnt area mapping captures the cumulative extent of damaged farmland21.
- Statement 2 is correct: Burnt area mapping identifies spectral burn scars left on the land after fire events, capturing small or short-duration fires that satellites miss during overpasses21.

- Statement 3 is correct: Data reveals that >90% of large fires are lit after 3:00 PM, bypassing the scheduled daytime overpass hours of sun-synchronous polar-orbiting satellites22.

Q8. Correct Answer: (a)

- Statement 1 is correct: In Haryana (2024 to 2025), active fire count detections fell from 1,406 to 662 (more than halved), whereas burnt area expanded from 7,117 sq km to 8,812 sq km (nearly 25% increase)2225.
- Statement 2 is incorrect: ESA's Sentinel-2 constellation has a revisit frequency of 5 days, not 24 hours23.
- Statement 3 is incorrect: A finalized burnt area protocol has not yet been notified by CAQM; IARI has stated that methodology and validation remain unstandardized and research-grade2427.

Q9. Correct Answer: (c)

- Statement 1 is correct: The annual Global Carbon Budget is led by a scientific consortium coordinated by the University of Exeter30.
- Statement 2 is incorrect: Past dips in fossil emissions caused by geopolitical shocks or recessions (e.g., 1992, 1998, 2009, 2020) were transient single-year events that reversed once supplies and demand normalized30more_horiz.
- Statement 3 is correct: Severe drought and temperature conditions during Super El Niño events increase peatland fire occurrences, releasing substantial carbon from underground peat soil deposits31.

Q10. Correct Answer: (a)

- Statements 1 and 2 are correct: The lack of utility-scale storage systems (battery and pumped-hydro) leads to the curtailment of renewable power generated during peak solar/wind periods3334. Furthermore, poor discom finances prevent necessary capital investments in grid upgrades34.
- Statement 3 is incorrect: The continued presence of coal-fired generation provides essential base-load power, but it is not an impediment to renewable capacity absorption; rather, inadequate grid flexibility and storage prevent coal substitution3334.

Q11. Correct Answer: (b)

- Statements 1 and 2 are correct: Adopted at COP29, the NCQG replaces the 2009 $100 billion/year pledge, committing developed countries to mobilize at least $300 billion annually by 2035 within an overarching $1.3 trillion ambition38more_horiz.
- Statement 3 is incorrect: Empirical performance data from the ICC Trade Register demonstrates consistently low default rates in emerging market trade and supply chain finance, contradicting inflated risk perceptions held by rating agencies40.

Q12. Correct Answer: (c)

- Explanation: Under the Nutrient Based Subsidy (NBS) scheme for P&K fertilizers, the government determines fixed per-kg subsidy rates across all four primary and secondary nutrients: Nitrogen (N), Phosphorus (P), Potash (K), and Sulphur (S)44.

Q13. Correct Answer: (b)

- Statement 1 is incorrect: Urea is excluded from the NBS scheme and is administered under a separate statutory pricing and subsidy regime44.
- Statement 2 is correct: Liquefied Natural Gas (LNG) is the critical feedstock used to synthesize ammonia for urea production, tying domestic costs directly to international gas prices44.
- Statement 3 is incorrect: DAP is subsidized under NBS with special provisions to protect farmers, keeping the retail price fixed at ₹1,350 per bag rather than fluctuating freely4446.

Q14. Correct Answer: (c)

- Pair 1 is correctly matched: Virgo is located near Pisa, Italy51.
- Pair 2 is correctly matched: KAGRA is an underground cryogenic interferometer in Japan51.
- Pair 3 is correctly matched: LIGO-India is being constructed in Aundha, Hingoli district, Maharashtra53.

- Pair 4 is incorrectly matched: LISA (Laser Interferometer Space Antenna) is a joint space-borne mission by ESA and NASA consisting of three spacecraft orbiting the Sun, not a terrestrial observatory in Chile53.

Q15. Correct Answer: (d)

- Statement 1 is correct: The ringdown represents the final phase where the distorted single black hole settles into a stable Kerr state, emitting exponentially damped gravitational radiation5152.
- Statement 2 is correct: In pair-instability supernova phenomena, pair production causes core pressure drops that lead to total catastrophic disruption, leaving an astrophysical mass gap with a scarcity of remnant black holes beginning around 44 solar masses52.
- Statement 3 is correct: Adding LIGO-India expands the detector network's geographic baselines, cutting sky localization uncertainty by roughly 40%53.
