



PART 1

Read the text below and answer questions 1–13.

THE SCIENCE OF NIGHT-SKY-FRIENDLY CITIES

A

For most of human history, darkness was not an urban defect but a shared civic condition: an unpriced public resource that anchored calendars, enabled navigation, and supplied the raw material for cosmology and scientific inference. In contemporary cities, however, the night sky has been progressively overwritten by a persistent halo of artificial brightness. What is often mourned as a cultural or aesthetic loss is increasingly framed, in empirical research, as a systemic externality. Excessive nocturnal illumination carries costs that reach beyond astronomy, shaping energy demand, altering wildlife behaviour, and subtly changing how streets are engineered and experienced. In this sense, the disappearance of stars is not simply symbolic; it is diagnostic of a wider transformation in how urban services are deployed.

B

The rapid expansion of urban lighting in the twentieth century reflected a seemingly self-evident logic: brighter streets would be safer streets. As electric grids became cheaper and municipalities sought measurable reductions in accidents and crime, illumination was treated as a straightforward tool of risk management. Yet the evidence has proved counter-intuitive. Comparative studies between neighbourhoods with different lighting levels have produced mixed results, in part because “more light” is not a single intervention but a bundle of variables: intensity, colour spectrum, beam direction, and uniformity. A poorly designed lamp can improve visibility at one point while creating glare, harsh contrast, and deep shadow elsewhere, thereby complicating perception and undermining the very security the policy aimed to deliver. The assumption that brightness monotonically increases safety is therefore empirically unstable.

C

Much of the difficulty lies not in the presence of light but in its spatial misallocation. Engineers use the term uplight to describe illumination that escapes above the horizontal plane, typically because fixtures are unshielded, tilted, or designed to spill light beyond their intended target. Once emitted into the atmosphere, this light does not travel innocently; it interacts with aerosols, water vapour, and particulate matter, scattering in a way that expands its footprint. Through processes akin to Rayleigh scattering, even modest uplight can contribute to skyglow that spreads well beyond its origin. This is why a town



that has installed relatively few lamps may still lose a dark sky if it sits near a bright commercial corridor or a heavily lit arterial road: the glow is regional, not merely local.

D

The shift from older sodium lamps to white LEDs illustrates how technological upgrades can generate unintended consequences. LEDs are efficient and long-lasting, and their controllability makes them attractive to urban planners. However, many “white” LEDs contain a pronounced blue component. Blue-rich light scatters more readily in the atmosphere, intensifying skyglow in ways that can be disproportionate to the apparent increase in ground-level brightness. More importantly, blue wavelengths have a strong biological salience. Human circadian rhythms rely on natural fluctuations in light to regulate sleep and alertness; blue-heavy exposure at night can suppress melatonin and disrupt these cycles. For this reason, some guidelines recommend warmer colour temperatures for outdoor lighting, especially in residential contexts where physiological recovery is a priority.

E

The ecological ramifications extend beyond humans and can be amplified through trophic cascades. Nocturnal insects commonly use moonlight and starlight for orientation, and intense lamps can trap them in repetitive flight loops around a fixture until exhaustion or predation intervenes. When insect behaviour changes, the effects propagate upward: birds and bats that depend on insects may experience altered feeding patterns, while predators that exploit illuminated zones may gain an artificial advantage. Even plants can be affected if persistent light modifies flowering schedules and seasonal cues. Notably, these impacts are often spatially concentrated near particular corridors—waterfront promenades, sports facilities, and major intersections—rather than evenly distributed across a city, which complicates both measurement and governance.

F

Responses are increasingly guided by the principle that lighting should be a targeted service rather than a blanket. A foundational intervention is shielding: fully shielded luminaires direct illumination downward, limiting uplight and reducing glare. Complementing this is adaptive lighting, in which lamps dim during low-activity hours and brighten when sensors detect movement. Early pilots suggest that such systems can reduce energy use while preserving practical visibility, although calibration is essential to avoid abrupt changes that could distract drivers or pedestrians. Governance is equally decisive. Street lighting may be fragmented across transport agencies, utilities, private developers, and building managers, each operating under different incentives. Some municipalities therefore employ lighting masterplans that set measurable standards—



limits on glare, permitted colour ranges, and maximum uplight—and apply them across both public and private installations to prevent one actor’s floodlights from negating another’s careful retrofit.

G

Yet technical optimisation alone cannot secure legitimacy, because darkness also has a social meaning. In districts that have historically received fewer services, residents may interpret dimmer streets as neglect, even if the redesign improves visibility by reducing glare. If reforms are framed purely as environmental restraint, they can trigger resistance and exacerbate distrust. Programmes that succeed tend to combine infrastructural upgrades with consultation and explanation: shielding can improve facial recognition by reducing blinding contrast; warmer light can feel more comfortable without being brighter; and precision lighting can increase safety by making visual information more reliable rather than merely more intense. The emerging consensus is that night-sky-friendly cities are not defined by “less light” but by better light—used only when needed, directed with discipline, and aligned with both ecological constraints and social expectations.

Questions 1–5

Choose the correct heading for each paragraph.

List of Headings

- i Insects as the starting point of wider disruption
- ii Defining “better light” for cities
- iii Mixed evidence behind a simple assumption
- iv Splitting responsibility across agencies
- v A technology change with unintended consequences
- vi Why citizens may oppose darker streets
- vii How scattered light creates a regional glow
- viii Lighting as a targeted service rather than a blanket
- ix A public resource that quietly disappeared
- x The future of adaptive systems

1 Paragraph A

2 Paragraph B



3 Paragraph C

4 Paragraph D

5 Paragraph E

Questions 6–9

Choose **TRUE** if the statement agrees with the information given in the text, choose **FALSE** if the statement contradicts the information, or choose **NOT GIVEN** if there is no information on this.

6 The passage suggests that increasing street lighting consistently reduces both traffic accidents and crime.

7 The passage indicates that a small town can still suffer skyglow even if the brightest lamps are located in a nearby district.

8 The passage states that blue-rich light scatters less readily in the atmosphere than warmer light.

9 The passage claims that “lighting masterplans” are legally required in all municipalities that upgrade to LEDs.

Questions 10–13

Complete the summary below. Choose **ONE WORD ONLY** from the text for each answer.

The impact of urban lighting design

Many negative effects of city lighting depend on design choices. Unshielded fixtures increase **10**, which then scatters to create widespread brightness. Switching to white LEDs can add a stronger **11** component, potentially affecting sleep patterns. In ecological terms, intense lamps can trap **12** and change food chains. To reduce these harms, fully shielded **13** can direct illumination downward, while adaptive systems dim lights during quiet periods.

Answer Key

1. ix
2. iii
3. vii
4. v



5. i
6. FALSE
7. TRUE
8. FALSE
9. NOT GIVEN
10. uplight
11. blue
12. insects
13. luminaires