PART 3

Read the text below and answer questions 27–40.

THE SCIENCE AND POLITICS OF URBAN NOISE

Urban noise is routinely framed as a minor annoyance—an unavoidable accompaniment to mobility and economic life—yet a growing body of environmental epidemiology treats it as a pollutant in its own right. The shift is partly conceptual: noise is not merely "sound," but an exposure that can be chronic, unevenly distributed, and biologically consequential, much like air pollution. International health authorities have attempted to translate this evidence into recommended limits, and policy debates increasingly reference guideline thresholds intended to reduce the burden of disease attributable to transport and neighbourhood soundscapes. The political difficulty is that noise is invisible and culturally normalised; a city can "feel" functional while still imposing an acoustic load that accumulates quietly across years.

The epidemiological case for noise as a health hazard rests on more than complaint surveys. Large population studies have associated long-term exposure—especially at night—with increased risks of cardiovascular pathology, including hypertension and other markers of vascular strain. The central mechanism is not primarily cochlear injury, but activation of the autonomic nervous system. Even when individuals do not report being disturbed, acoustic events can trigger sympathetic arousal, elevating heart rate and blood pressure. The physiology resembles a chronic, low-level version of the body's alarm response: repeated "fight-or-flight" signals promote hormonal cascades that, over time, are hypothesised to contribute to oxidative stress, endothelial dysfunction, and inflammatory pathways implicated in cardiovascular disease. In this sense, the hazard is less about loudness per se than about repeated biological mobilisation under conditions where recovery is incomplete.

This is closely related to the logic of the General Adaptation Syndrome, which distinguishes between acute stress responses and the longer-term consequences of repeated exposure. In the short term, a sudden sound—an accelerating motorcycle, a passing train, an aircraft event—provokes a patterned response involving the sympathetic nervous system and associated endocrine signalling. In the long term, the concern is cumulative: if the body repeatedly "prepares for threat" in the absence of genuine danger, the regulatory systems governing blood pressure, metabolic control, and vascular repair may shift toward maladaptive equilibrium. Crucially, these processes can occur below the level of conscious appraisal. Individuals may become subjectively accustomed to noise, reporting lower annoyance, while physiological reactivity persists. This helps explain why

public policy that relies heavily on complaint rates may underestimate risk in communities that have normalised exposure.

Noise also exerts cognitive effects that are not captured by a simple stress narrative. In school settings, researchers describe an “Irrelevant Sound Effect,” whereby background sound competes for cognitive resources even when children try to ignore it. The mechanism is partly linguistic: noise reduces speech intelligibility, obscuring consonants and degrading the acoustic cues needed to parse complex sentences. Yet the impact extends further. When the classroom environment demands greater effort merely to decode speech, fewer cognitive resources remain for working memory, comprehension, and the consolidation of new material. Over time, this can manifest as slower reading development and weaker performance on tasks that depend on sustained attention. Importantly, these effects are not limited to extreme loudness; intermittent intrusions, unpredictable peaks, and reverberant rooms can produce disproportionate disruption because they repeatedly break concentration and force re-orientation.

Sleep is often treated as the most sensitive exposure window because it is both biologically restorative and vulnerable to fragmentation. Here, the distinction between sleep duration and sleep architecture becomes essential. A person may spend enough hours in bed and still experience degraded recovery if acoustic events repeatedly trigger cortical arousal—brief activations of the brain’s alerting systems that do not necessarily produce full awakening. These micro-arousals can fragment sleep cycles and reduce time spent in deep sleep and REM phases, which are linked to memory processing, emotional regulation, and physiological repair. The sleeper may remain unaware of the disruption, yet experience daytime fatigue, mood volatility, and reduced performance. This is one reason why night-time sound events, even when short, can be more damaging than daytime exposure of similar average intensity: they interfere with a biological process that depends on continuity rather than mere total minutes.

A major complication is measurement. Regulatory systems often depend on summary indicators, including energy-averaged metrics such as LAeq, which compress many hours into a single value using decibel weighting that approximates human hearing sensitivity. These metrics are useful for mapping broad exposure patterns, but they can obscure the role of intermittent peak events—exactly the events most likely to produce cortical arousal at night. A neighbourhood might meet an average threshold while still experiencing frequent high-intensity intrusions from late trains or sporadic freight movements. Furthermore, annoyance is psychoacoustic as well as social: perception varies with pitch, temporal pattern, predictability, and context. A short, sharp event may be experienced as more disruptive than a higher continuous hum, and identical measured levels can

generate different responses depending on whether residents view the source as legitimate, controllable, or imposed. The result is a persistent gap between what is easily measurable and what is biologically and socially salient.

Noise also has an environmental justice dimension. Exposure is rarely distributed randomly. Lower-income communities often function as acoustic buffers for wealthier zones, because they are more likely to be located near highways, rail corridors, airports, and industrial activity. These residents may also have fewer options to mitigate exposure through building upgrades, bedroom relocation, or political mobilisation. Thus noise operates as a form of unequal urban burden: the disutility of mobility is concentrated where land is cheaper and political voice is weaker. This is not simply an ethical concern; it also affects the reliability of policy signals. When the most exposed groups have the least capacity to lobby, noise can remain politically under-prioritised even when epidemiological evidence indicates substantial population-level harm.

Mitigation is commonly described through a hierarchy: address the source first, then the transmission path, and finally the receiver. Source measures include speed reduction, smoother traffic flow, and quieter road surfaces. Electrification is often assumed to solve the problem, yet it illustrates a policy paradox. Electric vehicles reduce engine noise at low speeds, but at higher speeds tyre–road interaction dominates, meaning the acoustic benefits taper off precisely on major roads where exposure burdens are greatest. Path measures—barriers, berms, and building placement that creates quiet courtyards—can be effective but require space and may shift sound elsewhere. Receiver measures, such as high-performance glazing and façade sealing, can protect indoor sleep, but they do little for outdoor public space and can entrench inequality if only affluent households can afford upgrades. Consequently, governance matters: without coordinated transport planning, housing standards, land-use policy, and credible enforcement, technical measures alone tend to deliver partial and uneven gains.

Overall, the science and politics of urban noise suggest that treating it as a private irritation is a category error. Epidemiological evidence indicates that chronic exposure can contribute to cardiovascular risk and cognitive impairment through mechanisms that operate even when individuals feel “used to” their environment. Meanwhile, policy failure often arises from measurement shortcuts, fragmented responsibilities across agencies, and an under-appreciation of equity. The most defensible conclusion is not that cities must become silent, but that they should pursue a healthier acoustic environment through governance that aligns measurement with biological realities, prioritises prevention over after-the-fact insulation, and addresses the distribution of exposure as a matter of public health.

Questions 27–31

Choose **YES** if the statement agrees with the claims of the writer, choose **NO** if the statement contradicts the claims of the writer, or choose **NOT GIVEN** if it is impossible to say what the writer thinks about this.

27 The writer suggests that urban noise should be treated as a pollutant comparable to air quality rather than merely an annoyance.

28 The writer claims that people's self-reported annoyance levels are a reliable guide to whether physiological harm is occurring.

29 The writer implies that noise can fragment sleep through cortical arousal even when people do not fully wake up.

30 The writer argues that LAeq-style averages can conceal intermittent peak events that may be especially disruptive at night.

31 The writer states that one specific country currently has the world's most effective legal framework for urban noise control.

Questions 32–35

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

Health effects and noise measurement

Long-term exposure to noise has been associated with cardiovascular problems such as **32** ..... . In classrooms, understanding spoken language can become harder when background noise obscures speech sounds such as **33** ..... . At night, repeated disruption may reduce the amount of time spent in deep sleep and **34** ..... phases. Regulators often summarise exposure with an energy-averaged measure such as **35** ....., although a single value may fail to represent disruptive changes in sound levels.

Questions 36–40

Select the correct answer.

36 According to the opening paragraph, why can urban noise be politically difficult to address?

A Most exposure occurs only during temporary disruptions to transport systems.
B A city may appear to function normally even while the effects of repeated exposure build up over time.

C Health authorities have been unable to establish any recommended exposure levels.
D The main sources of urban noise generally fall outside the control of public authorities.

37 Why can adequate time in bed still fail to provide proper recovery?

A Noise may shorten the total number of hours a person remains asleep each night.
B People who hear sounds during sleep are repeatedly prevented from entering any restorative stage.
C Brief alerting responses can disturb the structure of sleep without causing complete awakening.
D Daytime tiredness caused by noise can itself alter the sequence of later sleep stages.

38 What limitation of LAeq does the passage emphasise?

A It gives excessive importance to brief peaks while giving too little weight to continuous background sound.
B Similar average readings can conceal substantial differences in the frequency of short, intense noise events.
C Its decibel weighting makes it unsuitable for comparing outdoor environments with one another.
D Its value changes according to whether residents consider a particular noise source acceptable.

39 Why may replacing conventional vehicles with electric ones produce smaller noise reductions than expected on major roads?

A Quieter motors provide their greatest benefit only when vehicles are travelling at high speeds.
B The advantage of reducing engine sound diminishes as tyre–road noise becomes more important at higher speeds.
C Electric vehicles reduce indoor noise but have little effect on sound experienced in outdoor spaces.
D Their tyres generate more continuous sound in order to compensate for the absence of engine noise.

40 Which statement best represents the writer’s overall view of urban noise policy?

A Standardised acoustic measurements should remain the main basis for regulation because individual reactions vary widely.
B Technical source controls should take priority over housing and land-use measures because they produce more consistent results.
C Effective policy should combine better measurement, preventive planning, and attention

to how exposure is distributed across communities.
D Since complete urban quiet is unrealistic, authorities should concentrate mainly on the residents who report the greatest annoyance.

Answer Key

27. YES
28. NO
29. YES
30. YES
31. NOT GIVEN
32. hypertension
33. consonants
34. REM
35. LAeq
36. B
37. C
38. B
39. B
40. C