Exercise walk-through

8.3
Urban air pollution

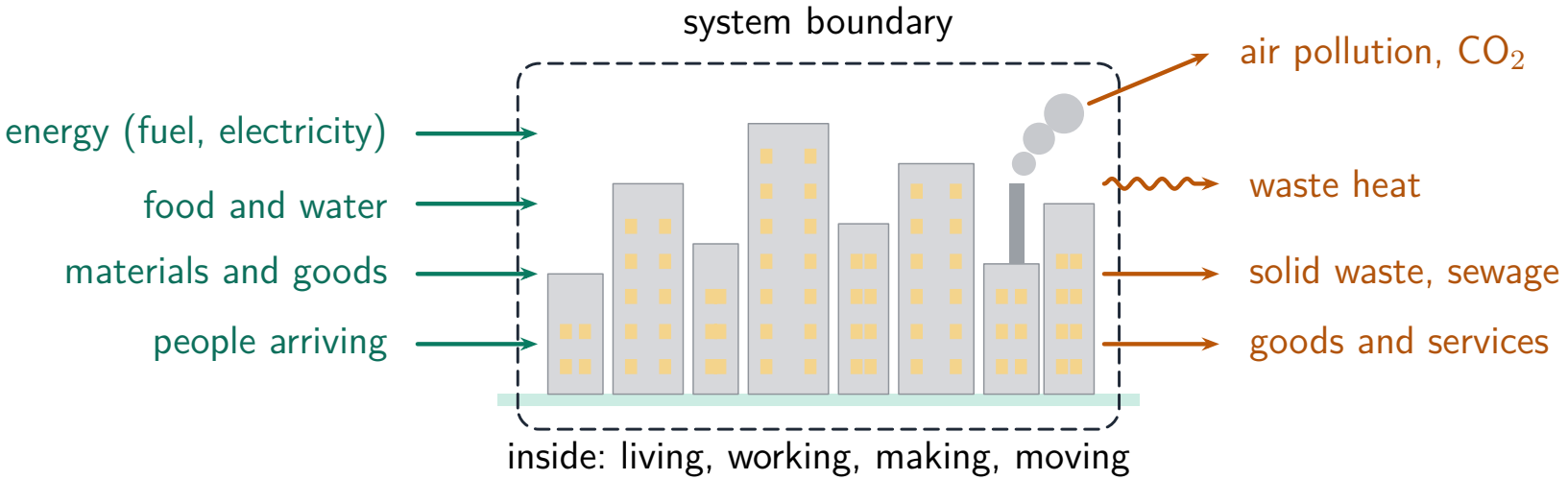
International Baccalaureate · IB Diploma · Environmental Systems and Societies · HL

A country that started to shrink

> Birth totals can rise in a year when the population still falls.

- China's population fell in 2022, 2023 and 2024.
- NBS 2024: 9.54 million births, 10.93 million deaths; births rose from 2023 while population fell.
- This unit: populations $\rightarrow$ cities $\rightarrow$ urban air.

A city as a system



Track matter, energy and people across the stated city boundary.

AHL: Stability and consequences

Mixing

An inversion suppresses vertical mixing; weak winds and topography can retain pollution.

A falling environmental temperature alone does not establish parcel buoyancy.

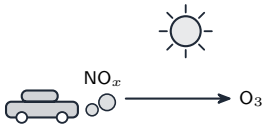
Effects and management

Eye/airway irritation, plant injury and rubber damage are direct effects.

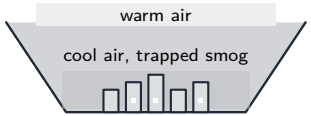
Healthcare costs, lost work and unequal exposure require source controls and protection.

Exercises 2.1·2.2

2.1 Distinguish between primary and secondary pollutants, giving **one** example of each. [2]

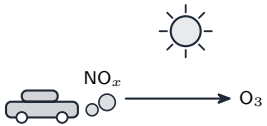


2.2 Explain how a temperature inversion traps air pollution in a city. [3]



Exercises 2.1·2.2

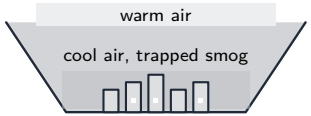
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2.1

primary: released directly from a source, e.g. NO_x, CO, SO_2, particulates from vehicles; secondary: formed in the air by reactions of primary pollutants, e.g. tropospheric ozone

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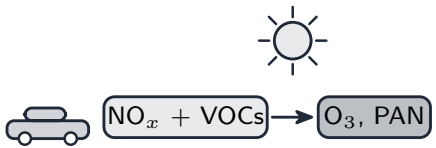
2.2

normally air cools with height, so warm polluted air rises and disperses; in an inversion a layer of warm air lies above cooler air near the ground; the cool, dense air cannot rise through it, so pollutants build up near the ground

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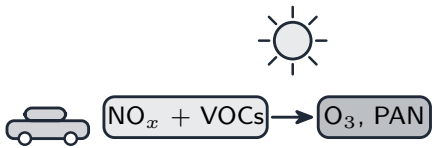
Exercise 2.3

2.3 Explain how photochemical smog forms. [3]



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2.3

vehicles release nitrogen oxides and volatile organic compounds; in strong sunlight these react together; they form secondary pollutants such as tropospheric ozone and PAN, which make a brown haze

Exercise 3.1 (a)

3.1 The graph shows the monthly mean $PM_{2.5}$ concentration in a northern city.

(a) Describe the pattern shown. [2]



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(a) highest in winter (December–February), lowest in summer (June–August); winter values are about three times the summer values

Exercise 3.1 (b)

3.1 The graph shows the monthly mean $PM_{2.5}$ concentration in a northern city.

(b) Suggest **two** reasons for the pattern. [2]

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(b) Suggest **two** reasons for the pattern. [2]

(b) more burning of coal and wood for heating in winter; more temperature inversions and calm air in winter trap pollution / more summer rain washes particles out

Exercise 3.2 (a)

3.2 A city plans a **low-emission zone**: older, more polluting vehicles must pay a daily charge to enter the centre.

(a) Outline **two** health effects of urban air pollution. [2]

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(a) any two: asthma and other breathing problems; heart disease and stroke; lung cancer; early death; eye irritation

Exercise 3.2 (b)

3.2 A city plans a **low-emission zone**: older, more polluting vehicles must pay a daily charge to enter the centre.

(b) Evaluate the low-emission zone. [3]



Exercise 3.2 (b)

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(b) Evaluate the low-emission zone. [3]



(b) strength: fewer old polluting vehicles in the centre, so less NO_x and particulates where most people are; limitation: poorer drivers and small businesses may pay most; traffic and pollution may move to roads outside the zone; judgement: effective when combined with better public transport and help to replace old vehicles