

Exercise walk-through

Photochemical Smog ■ 7.2

eXercise

You must be able to

- explain how **photochemical smog** 光化学烟雾 forms
- identify the role of **NO_x**, VOCs, and **sunlight**
- link smog to traffic and health

Method — How smog forms

Photochemical smog forms when **NO_x** and **VOCs** (volatile organic compounds) from vehicle exhaust react in **sunlight**, producing ground-level **ozone** (O₃) and other irritants.

Method — The key ingredients

- **NO_x** — from vehicle/industry combustion.
- **VOCs** — from fuels, solvents.
- **Sunlight** — drives the reaction (so smog is worst on **sunny, warm** days).

Method — Where and when

Smog is worst in **sunny cities with heavy traffic** (e.g. Los Angeles), peaking in the afternoon when sunlight is strongest.

Method — Health effects

Ground-level ozone irritates the lungs and eyes, worsening asthma and breathing problems.

Method — A worked link

Morning traffic emits NO_x and VOCs; midday sun drives reactions that build up ozone, so smog peaks in the afternoon.

Practice 2.1 ■ 2 marks

What two pollutants react to form photochemical smog?

Solution 2.1

Method: How smog forms

Worked steps

NO_x and VOCs **B1** **B1**.

Practice 2.2 ■ 1 mark

What drives the smog-forming reaction?

Solution 2.2

Method: The key ingredients

Worked steps

Sunlight **B1**.

Practice 2.3 ■ 1 mark

What harmful gas is a main component of smog?

Solution 2.3

Worked steps

Ground-level ozone (O_3) **B1**.

Exam-style 3.1 ■ 1 mark

Photochemical smog is worst on days that are

- A** cold and dark
- B** sunny and warm with heavy traffic
- C** rainy
- D** windy at night

Solution 3.1

Method: The key ingredients

- A cold and dark
- B sunny and warm with heavy traffic 
- C rainy
- D windy at night

Worked steps

B — sunny and warm with heavy traffic.

Exam-style 3.2 ■ 2 marks

A sunny city has heavy morning traffic.

- (a) Explain why smog peaks in the afternoon.
- (b) State one health effect of the ozone in smog.

Solution 3.2

Method: A worked link

Worked steps

(a) Morning traffic emits NO_x and VOCs; the midday sun drives reactions that build up ozone, so smog peaks in the afternoon **M1** **A1**. (b) It irritates the lungs/eyes and worsens asthma **B1**.

Exam-style 3.3 ■ 2 marks

Explain how reducing vehicle emissions would reduce photochemical smog.

Solution 3.3

Method: How smog forms

Worked steps

Fewer vehicle emissions mean less NO_x and VOCs available to react in sunlight, so less ozone/smog forms **M1** **A1**.