

Exercise walk-through

Lethal Dose 50% (LD50) ■ 8.12

eXercise

You must be able to

- define **LD50** 半数致死量
- interpret LD50 values (lower = more toxic)
- compare the toxicity of substances

Method — What LD50 is

LD50 is the **dose that kills 50%** of a test population, usually given in mg of substance per kg of body weight (**mg/kg**). It measures a chemical's **acute toxicity**.

Method — Lower LD50 = more toxic

A **lower** LD50 means **less** substance is needed to be lethal, so it is **more toxic**. A **higher** LD50 means it takes more, so it is **less toxic**.

Method — A worked comparison

Substance A has $LD50 = 5 \text{ mg/kg}$; substance B has $LD50 = 500 \text{ mg/kg}$. **A is more toxic** — far less is needed to kill.

Method — Dose for a person

To estimate a lethal dose for a 70 kg person from $LD_{50} = 5 \text{ mg/kg}$: $5 \times 70 = 350 \text{ mg}$ (rough guide from animal data).

Practice 2.1 ■ 1 mark

Define LD50.

Solution 2.1

Worked steps

The dose that kills 50% of a test population **B1**.

Practice 2.2 ■ 1 mark

Does a lower or higher LD50 mean more toxic?

Solution 2.2

Method: Lower LD50 = more toxic

Worked steps

Lower **B1**.

Practice 2.3 ■ 1 mark

Substance X ($\text{LD}_{50} = 2 \text{ mg/kg}$) vs Y ($\text{LD}_{50} = 200 \text{ mg/kg}$): which is more toxic?

Solution 2.3

Worked steps

X ($\text{LD}_{50} = 2 \text{ mg/kg}$) **B1**.

Exam-style 3.1 ■ 1 mark

A chemical with a very low LD50 is

A very toxic

B not toxic

C a nutrient

D harmless

Solution 3.1

A very toxic



B not toxic

C a nutrient

D harmless

Worked steps

A — very toxic.

Exam-style 3.2 ■ 2 marks

Two pesticides have LD50 values of 10 mg/kg and 1000 mg/kg.

- (a) State which is more toxic, with a reason.
- (b) Estimate the lethal dose for a 60 kg person from the 10 mg/kg value.

Solution 3.2

Method: Dose for a person

Worked steps

(a) The 10 mg/kg pesticide — a lower LD50 means less is needed to be lethal, so it is more toxic **M1 A1**. (b) $10 \times 60 = 600$ mg **M1 A1**.

Exam-style 3.3 ■ 2 marks

Explain why LD50 is measured in mg per kg of body weight rather than just mg.

Solution 3.3

Method: What LD50 is

Worked steps

A larger animal needs more of a substance to be affected, so expressing the dose per kg of body weight makes toxicity comparable across different body sizes **M1** **A1**.