

Exercise walk-through

8.11

Sewage Treatment

AP Environmental Science

The pathogens the exam names, and how each travels

dysentery

bacterial – untreated sewage in streams and rivers

plague

bacterial – an infected flea's bite, or infected fluids

tuberculosis

bacterial – breathing in an infected person's bacteria

malariaparasitic – an infected **mosquito** ; sub-Saharan Africa**West Nile / Zika**

viral – an infected mosquito again; Zika also passes sexually

SARS / MERS

viral – infected fluids; MERS crosses from animals

Poverty deepens all of it: low-income areas often lack sanitary waste disposal and clean water in the first place.

Exam tips

- Trace **eutrophication** step by step: nutrient runoff → algal bloom → decay → oxygen depletion → fish die.
- **Bioaccumulation** builds up in one organism; **biomagnification** increases up the food chain, so top predators are hit hardest.
- Read an **LD50**: a **lower** value means **more** toxic; multiply by body mass for a lethal dose.
- Order the waste hierarchy **reduce** > **reuse** > **recycle**, and the stages of sewage treatment.
- Link pathogens to contaminated water and to clean-water/sanitation defences.

Worked example – reading a BOD result

A river below a sewage outfall has high BOD and almost no fish. Explain the link.

- BOD = the oxygen **decomposer bacteria** use to break down organic waste.
- Sewage feeds the bacteria $\Rightarrow$ they multiply and **respire hard**.
- Dissolved oxygen **crashes** $\Rightarrow$ fish suffocate and only tolerant species survive.
- Further downstream the waste runs out $\Rightarrow$ oxygen recovers $\Rightarrow$ **a classic oxygen sag curve**.

High BOD = dirty water: it means a big oxygen demand, not a lot of oxygen. Fish die of **suffocation**, not poisoning.

Exercises 2.1-2.3

2.1 What does primary treatment remove?

[1]

2.2 What does secondary treatment use to break down organic matter?

[1]

2.3 What does tertiary treatment remove?

[1]

Exercises 2.1-2.3

2.1 What does primary treatment remove? [1]

2.1

- Solids (by settling/screening)
-

2.2 What does secondary treatment use to break down organic matter? [1]

2.2

- Bacteria (biological breakdown)
-

2.3 What does tertiary treatment remove? [1]

2.3

- Nutrients (nitrogen, phosphorus) and pathogens (disinfection)

Exercise 3.1

3.1 Bacteria are used to break down dissolved organic matter in

[1]

☐

A primary treatment

B secondary treatment

C tertiary treatment

D no treatment

Exercise 3.1

3.1 Bacteria are used to break down dissolved organic matter in

[1]

☐

A primary treatment

B secondary treatment

C tertiary treatment

D no treatment

3.1 B

- secondary treatment

Exercise 3.2 (a)

3.2 A treatment plant processes sewage before releasing water to a river.

(a) Name the three treatment stages in order.

[3]

Exercise 3.2 (a)

3.2 A treatment plant processes sewage before releasing water to a river.

(a) Name the three treatment stages in order.

[3]

(a)

- Primary, secondary, tertiary

Exercise 3.2 (b)

3.2 A treatment plant processes sewage before releasing water to a river.

(b) Explain why releasing untreated sewage would harm the river.

[2]

Exercise 3.2 (b)

3.2 A treatment plant processes sewage before releasing water to a river.

(b) Explain why releasing untreated sewage would harm the river. [2]

(b)

- Untreated sewage adds nutrients (eutrophication), pathogens (disease), and oxygen-demanding matter, harming aquatic life and human health

Exercise 3.3

3.3 Explain why tertiary treatment is important for preventing eutrophication. [2]

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3.3

- Tertiary treatment removes the nitrogen and phosphorus that would otherwise fertilize algae, preventing algal blooms and eutrophication downstream