10.1 Resources and potable water

Name: _____ Class: _____ Date: _____ **Total: 34 marks**

KEY WORDS potable water • desalination • phytomining

Objective

Distinguish potable from pure water, describe treatment routes and (HT) alternative extraction. Original questions for spec statements 4.10.1.1–4.10.1.4.

1 Key knowledge and worked examples

- **Potable water** – safe to drink (low dissolved salts and microbes) but **not pure** – it still contains dissolved substances.
- **UK route**: choose a fresh source → **filter beds** → **sterilise** with chlorine, ozone or UV.
- **Desalination** (distillation or reverse osmosis) where fresh water is scarce – **energy-expensive**.
- **Sewage**: screening and grit removal → **sedimentation** (sludge + effluent) → then separate branches: **anaerobic digestion** of sludge; **aerobic biological** treatment of effluent.
- For comparable sources, suitable ground water usually needs less treatment than waste water; salt water needs salt removal. Source contamination and local conditions can change the comparison.
- **(HT)** Low-grade copper: **phytomining** – plants absorb the compounds, are burned to ash, metal extracted; **bioleaching** – bacteria make leachate solutions; then displace/extract the copper.

Worked example (3 marks). Explain why potable water is not pure water.

Pure water contains only water molecules; potable water is safe to drink but still has low levels of dissolved salts; and suitable treatment controls harmful microbes without removing all dissolved substances.

Resources and evidence. Finite ores/fossil fuels are not replaced on the time scale of use; renewable timber can regrow but is depleted if extraction exceeds regrowth. Sustainable development meets present needs without compromising future generations. Compare natural/agricultural/synthetic replacements using their actual lifetime, energy, land and waste, not the label alone.

RP8-style worked residue. A 25.0 cm^3 sample leaves 0.0500 g dry residue: $V = 0.0250\ dm^3$ and $c = 0.0500/0.0250 = 2.00\ g/dm^3$. Weigh the dry container and cooled residue, and heat/cool to constant mass to check drying. pH/residue/distillation assess different properties; written calculations do not certify supervised practical completion or drinking safety.

2 Practice

2.1 Name the three sterilising agents for potable water. [3]

2.2 Which step of sewage treatment produces the sludge? [1]

2.3 *(HT)* Name the two biological methods of extracting copper from low-grade ores. [2]

3 Exam-style questions

3.1 Describe how fresh water is made potable in the UK. [4]

3.2 A desert country has only sea water. Describe the two desalination methods and their shared drawback. [4]

3.3 *(HT)* Describe phytomining from planting to metal. [4]

3.4 A supplier calls timber renewable, but its forest loses 2000 tonnes of trees per year and regrows 1200 tonnes. Evaluate the claim about sustainable supply. Give one reason why replacing natural fibres with synthetic ones also needs evidence. [4]

3.5 In an RP8-style analysis, a 50.0 cm^3 water sample is evaporated in a container of mass 24.600 g. The cooled container and dry residue have constant mass 24.720 g. Calculate the residue concentration in g/dm^3. Explain why this does not establish that the water is safe to drink. [4]

3.6 Explain the different treatment routes for sludge and effluent after sedimentation. Why might industrial waste water need additional treatment before release? [4]

3.7 *(HT)* A bioleaching process produces copper sulfate solution. Explain how scrap iron can recover copper, give the balanced symbol equation, and identify two types of data needed to compare this route with mining. [4]