

**AP® ENVIRONMENTAL SCIENCE
1999 SCORING GUIDELINES**

Question 1

Part a (Max 5 points): 1 point to be awarded for each abiotic test linked with a description of what it measures; for example the nitrate test measures the concentration of nitrates (maximum 3 tests). For each parameter an additional point to be awarded for an "impact" statement that links it to a specific effect on organisms. For example increased nitrate levels can lead to algal blooms and ultimately lower dissolved oxygen levels. No credit was given for stating an organism can only survive in a specific range of nitrates. Statements so general they could apply to numerous water quality tests were not accepted.

1 point	Water Quality Test Information	Amount of dissolved oxygen	Required for aerobic respiration (decomposition)
1 point	Heavy Metals e.g. lead, mercury, cadmium	Level of the metal	Increased conc Decreased reproductive rates Bioaccumulation leads to stress Accumulation on gills of fish can cause deformities
	Carbon Dioxide	Amount of carbon dioxide	Increased CO ₂ -> Decreased pH Decreased CO ₂ -> Decreased photosynthesis
	Nitrate (NO ₃ ⁻) (N) Nitrites (NO ₂ ⁻) Phosphates (PO ₄ ³⁻) (P)	Level of nitrates Level of nitrites Level of phosphates	Increased nitrates and phosphates; -> Increased algae growth; algal bloom...->...blocked sunlight; decomposition -> Decreased dissolved oxygen
	Salinity	Level of total salts	Maintenance of osmotic pressure; Increased salinity -> Decreased DO and Decreased viability of eggs and larvae Oxidized to NO ₃ ⁻ and can lead to algal blooms
	Ammonia	Level of NH ₃	
	Other macro or Micro nutrients (K,S)	Level of nutrient	Increased nutrient -> Increased plant growth... food chain impact
	Chlorine	Level of chlorine	Increased chlorine interferes with hatching, embryo development, and reproduction Chlorinated hydrocarbons formed... some toxic
	Selenium	Amount of selenium	Increased selenium; -> Increased birth defects (birds w/no eyes)
	Hardness	Amount of Ca or Mg	Increased Ca/Mg -> Increased solubility of heavy metals Increased Ca/Mg -> Increased buffering capacity
	Conductivity Turbidity (Secchi disk) Suspended Solids	Amount of suspended solids (TDS), light penetration	Increased TDS -> Increased mortality of fish eggs and juveniles Decreased photosynthesis due to light penetration Increased temperature

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Question 1 (cont.)

pH	Biological Oxygen Demand (BOD) Chemical Oxygen Demand (COD)	Amount of oxygen needed Increased BOD -> Decreased dissolved oxygen levels, DO required for respiration	Decreased pH -> Increased solubility of heavy metals, Relative acid/base level Increased mortality of eggs and juveniles, Increased decalcification of bones, plant cuticle damage, Increased stress with pH changes
	Alkalinity	Measure of buffering capacity Acid Neutralizing Capacity (ANC) Increased ANC -> Increased egg & fry survival	Increased alkalinity -> Increased CO ₂ & inorganic nutrients - photosynthesis Increased ANC -> Increased egg & fry survival
Temperature		Increased temp -> Increased rate of metabolism, Increased sensitivity to toxic waste and disease, Decrease in DO, Increased biological stress	
Color	Dissolved and suspended matter	May decrease light penetration	
Odor	Presence of chlorine, H ₂ S, sewage, etc. synthetic organics	Specific to smell	presence of pesticides, aromatics, petroleum specific to compound

Part b (Max 4 points)

- Hypothesis (1 pt) - States a specific, testable explanation for the distribution of insect larvae.
- Variable (1 pt) - Identifies one, specific independent variable

Not accepted as too general: chemicals, pollutants, chemicals, toxin(s), pesticides, a factor

Accepted: pesticide, fungicide, herbicide

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Question 1 (cont.)

3. (Internal Max 3 points)
- Procedures - Outlines experimental procedures for:
(1 pt) manipulates the independent variable
(1 pt control group(s) present.
Data (1 pt) - Describes quantifiable data related to the
dependent variable (number of larvae, size, movement, mortality).
Elaboration (1 pt) - repeated trials, description of how other variables are controlled, etc
4. Results/Discussion (1 pt) - Connection of the data collected to the larvae
distribution in the two ponds

Part c (Max 3 points)

Definition of indicator species (1 pt) - Species whose presence or absence serves as an
early warning sign of environmental change or degradation of a natural community.
Example (1 pt) - Specific example of an indicator species

"Use" (1 pt) - Species is linked to a specific environmental change (activity, community,
physical property).

One point to be awarded if an atypical indicator species is used and an environmental
change is indicated. Example: An algal bloom indicates an increased level of phosphates.

Indicator Species:

Accepted: songbirds, amphibians (frogs, salamanders, toads), trout, benthic invertebrates
(mayfly, caddisfly, riffle beetle, dobson fly larvae) water bird, *E. coli* (fecal wastes), shell
fish (issues analyzed for pesticides, heavy metals), top level consumers (northern spotted
owl, wolf, bear, mountain lion, great hornbill), *Elodea*, *Ceratophyllum*, cel grass,
alligator, lichen, dinoflagellates, fathead minnow, salmon, oysters, water penny, water
pollution tolerant organisms (sludge worms, aquatic worms, midge larvae, tubifex
worms, pouch snails, blood midges). Note: "use" point was only awarded for this last
category if student notes presence of these organisms is significance in the absence of
other sensitive species.

Not Accepted: canary, elephant fish (test species not used in natural environment)