



20 AP-style MCQs across topics 8.1 to 8.7. Practice, review, revisit.

WHAT'S INSIDE

- ✓ 20 MCQs, four options each, in the style of the real AP exam
- ✓ Every question tagged to a Unit 8 topic so you know what to revise
- ✓ Full answer key with a short explanation for every question
- ✓ Mix of standalone and stimulus-style stems, matching real AP question formats

HOW TO USE IT

- 1. Untimed pass.** Work through slowly, aiming for around 90 seconds per question. Read every option before you commit.
- 2. Timed pass.** Redo the pack in 30 minutes. That matches AP exam pace (1.5 minutes per MCQ) and builds stamina.
- 3. Review.** Check the answer key and mark every miss. Revise those topics on Cognito, then retry after a week.

TOPICS COVERED

- **8.1** Responses to the Environment
- **8.2** Energy Flow Through Ecosystems
- **8.3** Population Ecology
- **8.4** Effect of Density of Populations
- **8.5** Community Ecology
- **8.6** Biodiversity
- **8.7** Disruptions to Ecosystems

STRUGGLING WITH A TOPIC?



Any topic tricky? Scan the QR to jump straight to the Unit 8 notes on Cognito. For the full AP Biology course (all 8 units, lessons, quizzes, flashcards and past-paper FRQs), head to **cognitoedu.link/ap-bio-notes**. Rework the questions you got wrong a week later to lock the concepts in.

AP EXAM CONTEXT

10-15% 60

UNIT WEIGHT (MCQ SECTION)

MCQS ON THE REAL EXAM

1.5m

AVERAGE TIME PER MCQ

AP BIOLOGY

Unit 8: Ecology

SECTION I • MULTIPLE CHOICE

Time—30 minutes

20 Questions

Directions: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the one that is best in each case and mark it clearly on your answer sheet or circle your choice below.

- Which best describes phototropism in a growing plant seedling?
 - A growth response in which the shoot bends toward a light source.
 - A rapid loss of turgor pressure in response to a touch stimulus, causing the plant to fold up.
 - A seasonal shedding of leaves triggered by shorter days.
 - A random movement of cytoplasm regardless of any stimulus.
- Roughly 10% of the energy at one trophic level is passed on to the next trophic level. Which factor is the largest contributor to the loss of the other 90%?
 - Predation by higher trophic levels.
 - Direct absorption of sunlight by animals at each level of the food chain, bypassing consumption.
 - Loss as heat during cellular respiration and to undigested material.
 - Storage of energy in inorganic minerals.
- Based on Table 1, what is the approximate energy transfer efficiency from primary to secondary consumers?
 - 1.0%
 - 10%
 - 50%
 - 90%
- Which claim about the pond ecosystem is best supported by Table 1?
 - Energy flow is roughly constant across all four trophic levels.
 - Producers hold less energy than any consumer level.
 - The pond could support just as many large fish per square meter as it does producers on the same area.
 - Energy drops sharply at each trophic level, limiting how many top predators the pond can support.
- Why is a pyramid of energy always right-side up (widest at the base), while a pyramid of biomass or numbers can sometimes be inverted?
 - Energy cannot be created or destroyed, only transferred, so every trophic level ends up with the same amount of stored energy.
 - Producers always have larger individual body sizes than their consumers.
 - Energy is lost at every transfer, but standing biomass at a lower level can be smaller if it turns over fast.
 - Numbers of organisms always increase up a food chain.
- Atmospheric nitrogen (N_2) makes up about 78% of the atmosphere but is unavailable to most organisms until it is converted into a usable form. Which process is the main way that nitrogen enters ecosystems for use by plants and other producers?
 - Direct absorption of atmospheric N_2 gas through the open stomata on the underside of plant leaves.
 - Photosynthesis, which fixes atmospheric nitrogen into carbohydrates for producers.
 - Combustion of organic matter, which releases usable nitrate directly into the soil.
 - Nitrogen fixation by bacteria that convert atmospheric N_2 into ammonia (NH_3/NH_4^+).

Questions 3, 4 refer to the following information.

An ecologist estimated the total energy stored at each trophic level of a small pond ecosystem, expressed per square meter per year.

Table 1. Energy content at each trophic level ($\text{kJ} \cdot \text{m}^{-2} \cdot \text{yr}^{-1}$)

Trophic level	Example organism	Energy ($\text{kJ} \cdot \text{m}^{-2} \cdot \text{yr}^{-1}$)
Producers	Algae and aquatic plants	20,000
Primary consumers	Zooplankton and snails	2,100
Secondary consumers	Small fish	220
Tertiary consumers	Large fish	24

AP BIOLOGY · Unit 8: Ecology · Section I (continued)

Questions 7, 8 refer to the following information.

Two bacterial populations were grown in separate cultures with different maintenance regimes. Population X was grown in a continuously replenished culture (fresh nutrients supplied throughout). Population Y was grown in a closed flask with a fixed starting nutrient supply and no replenishment. Cell counts (in millions of cells per mL) were taken every 2 hours.

Table 2. Bacterial population size (millions per mL) over time

Time (h)	Population X	Population Y
0	1	1
2	2	2
4	4	4
6	8	7
8	16	9
10	32	10
12	64	10

- Which population in Table 2 is best described by logistic (S-shaped) growth?
 - Population X only
 - Population Y only
 - Both populations show identical logistic growth
 - Neither population shows any growth
- Which environmental factor is most likely responsible for the difference between populations X and Y in Table 2?
 - Population X had a smaller number of starting cells than population Y at time zero.
 - Population Y hit limits on resources such as nutrients or space in its closed flask.
 - Population X was denied any nutrients throughout the experiment.
 - Population Y had a much higher birth rate than population X.
- Which of the following is a density-dependent factor limiting population growth?
 - A sudden severe winter that reduces a bird population across the entire habitat.
 - A hurricane that destroys nesting habitat in a coastal area.
 - A wildfire ignited by a lightning strike during a dry summer.
 - An infectious disease that spreads more easily in crowded populations.

Questions 10, 11 refer to the following information.

A field biologist recorded reproductive strategy data for four animal species. Type A produces many small offspring with little parental care; Type B produces few large offspring with extensive parental care.

Table 3. Reproductive strategies of four species

Species	Offspring per event	Parental care	Age at reproduction
Atlantic cod	1,500,000	None	3 years
Mouse	8	Moderate	6 weeks
Elephant	1	Extensive (years)	12 years
Frog	3,000	None	2 years

- Which two species in Table 3 best fit the description of Type A (r-selected) life history?
 - Cod and frog
 - Mouse and elephant
 - Cod and elephant
 - Elephant and frog
- Which environment would most likely favor a species with the reproductive strategy of the elephant in Table 3?
 - An environment where a large fraction of offspring die each year from unpredictable weather events.
 - An environment where new patches of resource open up unpredictably and often go unclaimed for long periods.
 - An environment where offspring survival is largely independent of any parental care or defense.
 - An environment where density stays near carrying capacity and competition is strong.
- A deer population lives in a habitat with a carrying capacity (K) of 2,000 and an intrinsic per capita growth rate $r = 0.4$ per year. Using the logistic growth equation $dN/dt = rN(K - N)/K$, what is the approximate population growth rate when $N = 500$?
 - 0 deer per year (the population is at carrying capacity)
 - 150 deer per year
 - 200 deer per year
 - 800 deer per year

AP BIOLOGY · Unit 8: Ecology · Section I (continued)

Questions 13, 14 refer to the following information.

Two paramecium species (*P. aurelia* and *P. caudatum*) were grown alone and together in the same medium with limited food. Population sizes (cells per mL) were recorded after 12 days.

Table 4. Paramecium populations after 12 days (cells per mL)

Condition	<i>P. aurelia</i>	<i>P. caudatum</i>
Grown alone	142	104
Grown together	138	6

13. Which claim about paramecium interactions is best supported by Table 4?
- (A) *P. caudatum* outcompetes *P. aurelia* in mixed culture over the twelve-day observation window of the experiment.
- (B) *P. aurelia* and *P. caudatum* help each other grow when placed together.
- (C) *P. aurelia* outcompetes *P. caudatum* when they share the same limited resources.
- (D) The two species have no effect on each other.
14. According to the competitive exclusion principle, which outcome would allow *P. aurelia* and *P. caudatum* to coexist in the same habitat over the long term?
- (A) The two species evolve to use slightly different resources or feeding times.
- (B) The species mate with each other and become a single new species over generations.
- (C) One species learns to consume the other species instead of the shared food source.
- (D) Both species eat the same food more aggressively than before.

Questions 15, 16 refer to the following information.

Two islands (Small and Large) with different areas were surveyed for the number of bird species living on each.

Table 5. Bird species counts on two islands

Island	Area (km ²)	Number of bird species
Small	5	12
Large	500	48

15. Which claim about island biogeography is best supported by Table 5?
- (A) Larger islands support more bird species than smaller islands.
- (B) Smaller islands support more bird species than larger islands, likely due to reduced competition.
- (C) Island area has no effect on species richness.
- (D) Every species on the large island is also on the small island.
16. Based on the species-area relationship shown in Table 5, which prediction about extinction risk is best supported?
- (A) Bird species on the smaller island are on average at higher risk of local extinction than those on the larger island.
- (B) Bird species on the larger island are on average at higher risk of local extinction.
- (C) Both islands have the same extinction risk per species.
- (D) Neither island's bird populations face any extinction risk.

Questions 17, 18 refer to the following information.

Concentrations of a fat-soluble pesticide were measured in water, plants, and animals of a lake ecosystem.

Table 6. Pesticide concentration through the food chain (ppm)

Component	Trophic level	Pesticide (ppm)
Water	-	0.000003
Phytoplankton	Producer	0.04
Zooplankton	Primary consumer	0.5
Small fish	Secondary consumer	2.0
Large fish	Tertiary consumer	24.8

17. Which term best describes the pattern of pesticide concentration in Table 6?
- (A) Dilution of the pesticide as it passes up the food chain from water into predators at the top of the chain.
- (B) Random distribution unrelated to trophic level.
- (C) Rapid excretion of the pesticide at every trophic level.
- (D) Biomagnification as the pesticide passes up the food chain.

AP BIOLOGY · Unit 8: Ecology · Section I (continued)

18. Which prediction about the lake community is best supported by Table 6?
- (A) Large fish are the top consumers, so they are the least at risk from the pesticide.
 - (B) Phytoplankton hold the highest tissue concentrations of the pesticide anywhere in the lake ecosystem.
 - (C) Top predators such as large fish are most at risk from the toxic effects of the pesticide.
 - (D) Water animals cannot accumulate any fat-soluble compound because they live in water.

Questions 19, 20 refer to the following information.

A pond was seeded with an invasive fish species. The invader's population and the populations of two native fish species were tracked over 6 years.

Table 7. Fish populations after invasion (individuals)

Year	Invasive species	Native A	Native B
0	20	300	180
2	120	200	120
4	480	70	60
6	1,100	10	20

19. Which conclusion is best supported by Table 7?
- (A) The invasive species had no effect on the two native populations.
 - (B) The invasive species increased in number while both native populations sharply declined.
 - (C) The two native species both increased after the invasion.
 - (D) The invasive species went extinct within 6 years.
20. Which experimental approach would most directly test whether the invasive species is the cause of the native decline in Table 7?
- (A) Add more food to the pond for all of the fish species at each of the tracked sampling stations.
 - (B) Remove the invader from several enclosed sections of the pond and compare with untreated controls.
 - (C) Introduce a second invasive species to compete with the first.
 - (D) Wait another 6 years and re-count populations without any changes.

Q1. Answer: A

Topic 8.1 · Responses to the Environment

Phototropism is a directional growth response toward light, driven by the redistribution of auxin to the shaded side of the shoot, which causes those cells to elongate faster and bend the shoot toward the light. B describes thigmonasty in Mimosa. C describes leaf abscission tied to photoperiod. D is not a defined response.

Q2. Answer: C

Topic 8.2 · Energy Flow Through Ecosystems

Most of the energy at each level is used by that level's own metabolism, which releases heat, or is lost in feces and other undigested material. Only about 10% is stored as new biomass and available to the next level. A is a small contributor. B is not how animals get energy. D confuses energy with nutrient cycling.

Q3. Answer: B

Topic 8.2 · Energy Flow Through Ecosystems

Efficiency = (energy in secondary consumers) / (energy in primary consumers) $\times 100 = 220 / 2,100 \times 100 \approx 10.5\%$. This matches the classic ~10% rule. A is roughly the primary-to-tertiary transfer ($24/2,100 \approx 1.1\%$), not the primary-to-secondary step. C (50%) and D (90%) are not supported by any pair of rows in the table.

Q4. Answer: D

Topic 8.2 · Energy Flow Through Ecosystems

Energy falls from 20,000 to 2,100 to 220 to 24 $\text{kJ}\cdot\text{m}^{-2}\cdot\text{yr}^{-1}$, an order of magnitude at each step. The tiny amount left at the tertiary level (24 $\text{kJ}\cdot\text{m}^{-2}\cdot\text{yr}^{-1}$) tightly limits how many large fish the pond can support. A contradicts the drop. B reverses the pattern. C contradicts the near thousand-fold difference between producers and tertiary consumers.

Q5. Answer: C

Topic 8.2 · Energy Flow Through Ecosystems

The second law of thermodynamics guarantees energy loss at each transfer, so an energy pyramid must be widest at the base. Biomass or number pyramids can invert when producers turn over quickly (e.g., ocean phytoplankton have low standing biomass but very high productivity), so the standing stock at higher levels can look larger even though total energy still drops. A states the first law correctly but misapplies it (energy transfer between levels still loses usable energy to heat). B is factually wrong. D reverses the general trend.

Q6. Answer: D

Topic 8.2 · Energy Flow Through Ecosystems

Nitrogen fixation by prokaryotes (free-living cyanobacteria and Rhizobium in legume root nodules) reduces atmospheric N_2 to ammonia, which is then further processed into nitrate by other bacteria (nitrification) and taken up by plants. A is wrong: N_2 does enter leaves but stays gaseous and unusable; plants cannot break the $\text{N}\equiv\text{N}$ triple bond. B confuses the carbon cycle with the nitrogen cycle. C is only a small contributor: high-temperature combustion produces some NO_x that can deposit as nitrate, but the main biological entry route for fixed nitrogen is bacterial fixation.

Q7. Answer: B

Topic 8.4 · Effect of Density of Populations

Population Y doubles at first (1 to 4) but then slows (7, 9, 10) and levels off at 10 million per mL, the classic S-curve of logistic growth as the population approaches carrying capacity. Population X keeps doubling every 2 hours, which is exponential (J-shaped) growth. C ignores the difference. D contradicts both curves rising.

Q8. Answer: B

Topic 8.4 · Effect of Density of Populations

The plateau in population Y at 10 million/mL is what happens when density-dependent factors such as nutrient depletion, waste build-up, or space limitation cap growth. Population X was continuously resupplied with fresh nutrients (from the preamble), so resources never became limiting and growth remained exponential. A is contradicted by identical starting values. C contradicts observed growth in X. D would predict Y grows faster, not slower.

Q9. Answer: D

Topic 8.4 · Effect of Density of Populations

Density-dependent factors have a stronger effect on population growth at higher densities. Infectious diseases spread more easily when hosts are packed together, so their per-individual impact rises with density. Weather events (A, B, C) hit populations without regard to how dense they are, so they are density-independent.

Q10. Answer: A

Topic 8.3 · Population Ecology

r-selected species produce very many offspring and invest little in parental care, relying on high offspring numbers to offset high mortality. Atlantic cod (over a million eggs, no parental care) and frog (thousands of eggs, no care) both fit this pattern. Elephant is the textbook K-selected species (one calf, years of care, late maturity). Mouse is intermediate (small litters, some maternal care).

Q11. Answer: D

Topic 8.3 · Population Ecology

K-selected species like elephants make few large, well-cared-for offspring that can compete for limited resources near carrying capacity. That strategy pays off where competition is intense and offspring quality matters more than quantity. A, B, and C describe unstable or unpredictable environments where producing many cheap offspring pays off (the r-selected strategy).

Q12. Answer: B

Topic 8.4 · Effect of Density of Populations

Plug in the values: $dN/dt = 0.4 \times 500 \times (2,000 - 500)/2,000 = 200 \times 0.75 = 150$ deer per year. A applies at $N = K$, when the term $(K - N)/K = 0$, but here N is only 500 out of 2,000. C (200) is $rK/4$, the maximum growth rate at $N = K/2 = 1,000$, not the value at $N = 500$. D (800) is rK , which ignores both N and the $(K - N)/K$ braking factor.

Q13. Answer: C

Topic 8.5 · Community Ecology

Alone, both species grow to over 100 cells/mL. In mixed culture, *P. aurelia* is nearly unchanged (142 to 138) while *P. caudatum* collapses (104 to 6). This is Gause's competitive exclusion: *P. aurelia* takes over the shared niche. A reverses the winner. B contradicts the drop in *P. caudatum*. D contradicts the collapse of *P. caudatum*.

Q14. Answer: A

Topic 8.5 · Community Ecology

Two species cannot occupy exactly the same niche in the same place indefinitely, but they can coexist if they diverge in resource use, timing, or microhabitat (resource partitioning or character displacement). Evolving to use slightly different resources or feeding times is exactly this route. B invents an interspecies fusion that does not occur in *Paramecium*. C describes predation, not coexistence. D would deepen competition, not resolve it.

Q15. Answer: A

Topic 8.6 · Biodiversity

The large island (500 km²) has 48 bird species, compared with 12 on the small island (5 km²). Larger islands can support more habitats and larger populations, both of which support more species. This is the species-area relationship. B reverses the trend. C contradicts the 4× difference. D goes beyond the data (which only counts species, not identity).

Q16. Answer: A

Topic 8.6 · Biodiversity

Smaller islands support smaller populations of each species, which are more vulnerable to random events, inbreeding, and habitat loss. That raises the local extinction rate per species. B reverses this. C ignores the effect of population size and habitat area. D contradicts basic conservation biology.

Q17. Answer: D

Topic 8.7 · Disruptions to Ecosystems

The fat-soluble pesticide rises from 0.000003 ppm in water to 24.8 ppm in top predators, about 8-million-fold ($24.8/0.000003 \approx 8 \times 10^6$). Fat-soluble toxins are stored, not excreted, and each predator eats many prey; the water-to-phytoplankton step is bioconcentration and each higher step is biomagnification. A reverses the trend. B ignores the clear ordering. C contradicts the accumulation.

Q18. Answer: C

Topic 8.7 · Disruptions to Ecosystems

Large fish have accumulated 24.8 ppm of the pesticide, about 12× the level in small fish (2.0 ppm) and more than 600× the level in phytoplankton (0.04 ppm). The classic DDT and mercury poisoning of top predators (bald eagles, pike, tuna) follows this exact pattern. A reverses the risk direction. B contradicts the phytoplankton value (0.04 ppm). D contradicts the observed accumulation.

Q19. Answer: B

Topic 8.7 · Disruptions to Ecosystems

The invader rose from 20 to 1,100 individuals in six years while Native A fell from 300 to 10 and Native B fell from 180 to 20. That coincident pattern (invader up, natives down) is the classic signature of a disruptive invasion, driven by predation, competition, or both. A, C, and D all contradict the trends directly.

Q20. Answer: B

Topic 8.7 · Disruptions to Ecosystems

A controlled removal experiment isolates the invader's effect: if native populations recover in the invader-free zones but not elsewhere, the invader is likely the cause. A adds a confounding variable. C adds another disturbance. D is a purely observational continuation and does not test causation.