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BT101 Quiz File

Chapter-wise Solved MCQs

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Lesson 1: What is Ecosystem

1. According to the source handout, how is a **population defined?**

A) A group of organisms occupying different trophic levels in a community
B) A group of individuals belonging to the same species occupying the same space in particular
C) All living and non-living components interacting within a habitat
D) A collection of different species sharing the same food source

2. An **ecosystem consists of a community of living organisms interacting as a system with which of the following?**

A) Only other living organisms of the same species
B) Non-living components
C) Primary producers exclusively
D) Artificial energy sources

3. How does the text describe the nature of an ecosystem?

A) A static entity unaffected by environmental changes
B) A closed system that does not exchange energy
C) A dynamic entity subjected to disturbances and recovery
D) An artificial structure created by human activity

4. Which process represents the **recovery of an ecosystem after it undergoes disturbances?**

A) Autolysis
B) Succession
C) Putrefaction
D) Eutrophication

Answer Key

* **1. B** — A population is defined as a group of individuals belonging to the same species occupying the same space in particular.

* **2. B** — An ecosystem encompasses a community of living organisms interacting as a system with its non-living components.

* **3. C** — An ecosystem is characterized as a dynamic entity subjected to disturbances and recovery.

* **4. B** — Ecosystem recovery following a disturbance is referred to as succession.

Lesson 2: Flow of Energy in Ecosystem

1. Which form of energy **cannot be converted by living organisms into any of the other forms of energy?**

A) Light energy
B) Chemical-bond energy
C) Heat
D) Motion energy

2. How do plants convert solar energy during **photosynthesis?**

A) They convert heat into light energy
B) They convert light energy into chemical-bond energy

C) They convert chemical-bond energy into kinetic motion
D) They convert infrared heat into organic matter

3. At what wavelengths is heat radiated away from Earth into outer space?

A) Visible light wavelengths
B) Invisible infrared wavelengths
C) Ultraviolet wavelengths
D) Gamma ray wavelengths

4. What must occur for Earth's **global temperature to remain constant?**

A) All incoming solar radiation must be stored permanently in plant tissues
B) Incoming and outgoing flows of radiant energy must be equal
C) Organisms must convert 100% of light energy into heat
D) Heat radiation into outer space must be completely blocked

Answer Key

* **1. C** — Organisms can use many forms of energy, but they cannot convert heat to any other form of energy.

* **2. B** — Plants use light energy in photosynthesis to convert light energy into chemical-bond energy.

* **3. B** — Heat is radiated into outer space at invisible infrared wavelengths.

* **4. B** — Global temperature remains constant when Earth's incoming and outgoing flows of radiant energy are equal.

Lesson 3: Producers

1. How do **chemosynthetic organisms produce glucose according to the handout?**

A) By trapping sunlight with chlorophyll
B) By converting toxic molecules into glucose
C) By absorbing heat directly from outer space
D) By consuming organic matter from herbivores

2. Which of the following is cited in the source as an example of a **chemosynthetic organism?**

A) Koalas
B) Mussels
C) Orangutans
D) Hummingbirds

3. What is the defining characteristic of **primary producers?**

A) They liberate chemical-bond energy via glycolysis and Krebs cycle
B) They synthesize organic compounds from inorganic precursors
C) They ingest solid organic tissues from other populations
D) They decompose dead tissue via autolysis

4. What form of energy stored by primary producers is utilized by animals to make organic molecules?

A) Radiant heat energy
B) Chemical-bond energy

C) Infrared energy
D) Mechanical energy

Answer Key

* **1. B** — Chemosynthesis involves converting toxic molecules into glucose.

* **2. B** — Microbes and mussels are given as specific examples of chemosynthetic organisms.

* **3. B** — Producers synthesize organic compounds through processes like photosynthesis or chemosynthesis.

* **4. B** — Primary producers convert light into chemical-bond energy, which animals then use to make organic molecules.

Lesson 4: Consumers

1. According to the feeding strategy table in the text, which herbivores feed specifically on **plant fluids?**

A) Folivores
B) Mucivores
C) Palynivores
D) Xylophages

2. Through which metabolic processes do **heterotrophs liberate chemical-bond energy for metabolic use?**

A) Photosynthesis and chemosynthesis
B) Glycolysis, Krebs's cycle, and electron transport chain
C) Autolysis and putrefaction
D) Nitrification and denitrification

3. Termites are classified under which herbivorous feeding strategy because of their diet?

A) Granivores
B) Frugivores
C) Xylophages
D) Algivores

4. How do the digestive systems of **carnivores differ from those of herbivores?**

A) They are specialized to handle large amounts of plant fiber
B) They are more efficient in protein digestion
C) They rely exclusively on mutualistic gut flora to digest cellulose
D) They cannot liberate chemical-bond energy

Answer Key

* **1. B** — Mucivores are herbivores whose diet consists of plant fluids, such as aphids.

* **2. B** — Heterotrophs liberate chemical-bond energy for metabolic use in glycolysis, Krebs's cycle, and the electron transport chain.

* **3. C** — Termites are classified as xylophages because their primary diet is wood.

* **4. B** — Carnivores possess digestive systems that are more efficient in protein digestion.

Lesson 5: Decomposers

1. How do **decomposers obtain nutrients from dead or decaying organisms?**

A) By ingesting tissue fragments into an internal digestive tract
B) Directly through chemical and biological processes without ingestion
C) By trapping light energy using photosynthetic pigments
D) By preying on living primary consumers

2. Which organisms are identified as **primary decomposers that release digestive enzymes through their hyphae?**

A) Bacteria
B) Fungi
C) Protozoa
D) Viruses

3. Which term refers to the breakdown of tissues by the body's **own internal chemicals and enzymes?**

A) Putrefaction
B) Autolysis
C) Proteolysis
D) Eutrophication

4. During bacterial **putrefaction, which released compounds cause a characteristic decaying odor?**

A) Cadaverine and putrescine
B) Glucose and fructose
C) Nitrates and phosphates
D) Methane and ozone

Answer Key

* **1. B** — Decomposers absorb nutrients directly through chemical and biological processes without ingestion.

* **2. B** — Fungi are primary decomposers that release digestive enzymes through their hyphae to absorb organic matter.

* **3. B** — Autolysis is defined as the breaking down of tissues by the body's own internal chemicals and enzymes.

* **4. A** — Bacterial putrefaction breaks down tissues and releases cadaverine and putrescine, causing a decaying odor.

Lesson 6: Food Chain

1. According to the handout, how is a **food chain defined?**

A) A complex, multidirectional network of energy transfer among all organisms
B) A linear network of links to pass energy in the form of food
C) A cyclic process that only transfers heat between trophic levels
D) An artificial classification system containing only apex predators

2. Which pathway does a food chain follow as energy is transferred?

A) Multiple interconnected loops simultaneously

B) A direct, linear pathway of one animal at a time
C) A reverse flow from decomposers to primary consumers
D) A random non-directional energy transfer

3. What is the role of detritivores and decomposers in a food chain according to the text?

A) They prevent sunlight from reaching primary producers
B) They act exclusively as primary consumers
C) They return nutrients back into the soil to be available for producers
D) They stop the flow of energy entirely

4. Which sequence is given in the text as an example of feeding levels in a food chain?

A) Lion → Deer → Grass → Hawk
B) Snake → Frog → Grasshopper → Plants
C) Plants → Grasshopper → Frog → Snake → Hawk
D) Hawk → Plants → Frog → Snake

Answer Key

* **1. B** — A food chain is defined as a linear network of links used to pass energy in the form of food.

* **2. B** — A food chain follows a direct, linear pathway involving one animal at a time.

* **3. C** — Detritivores and decomposers return nutrients to the soil so they are available for primary producers.

* **4. C** — The handout explicitly lists the sequence: Plants → Grasshopper → Frog → Snake → Hawk.

Lesson 7: Food Web

1. How is a **food web described in comparison to a food chain?**

A) As a single linear pathway of energy flow
B) As complexly interconnected food chains in an ecological community
C) As a static model excluding primary producers
D) As a system without indirect species interactions

2. How do predators indirectly increase plant growth according to the text?

A) By converting inorganic carbon directly into soil nutrients
B) By preventing overgrazing through the suppression of herbivores
C) By producing solar energy via cellular respiration
D) By increasing the total biomass of primary consumers

3. What is a **trophic cascade?**

A) The direct conversion of heat into chemical-bond energy
B) Powerful indirect interactions occurring when a trophic level in a food web is suppressed
C) The linear movement of water through an ecosystem's soil
D) An artificial food chain consisting only of decomposers

4. Which term describes an effect that flows **down through a trophic chain from apex predators to lower levels?**

A) Bottom-up effect
B) Top-down effect
C) Horizontal effect

D) Eutrophication effect

Answer Key

* **1. B** — A food web consists of complexly interconnected food chains within an ecological community.

* **2. B** — Predators indirectly support plant growth by suppressing herbivores and preventing overgrazing.

* **3. B** — Trophic cascades are powerful indirect interactions triggered when a trophic level in a food web is suppressed.

* **4. B** — A top-down effect flows down through a trophic chain from apex predators to lower trophic levels.

Lesson 8: Trophic Levels & Productivity

1. What is **Gross Primary Productivity (GPP)?**

A) The total energy lost as heat during cellular respiration
B) The raw rate at which primary producers synthesize new organic matter
C) The rate at which herbivores produce secondary biomass
D) The mass of organic matter decomposed by fungi per year

2. What is the mathematical relationship used to calculate **Net Primary Productivity (NPP)?**

A) NPP = GPP + Respiration
B) NPP = GPP / Respiration
C) NPP = GPP – Respiration
D) NPP = Respiration – GPP

3. Which group of organisms makes the **major contribution to Primary Productivity (PP)?**

A) Mosses
B) Algae
C) Vascular plants
D) Liverworts

4. In what units is Net Primary Productivity (NPP) measured?

A) Liters / unit area / day
B) Mass / unit area / year
C) Calories / individual / second
D) Kilometers / unit time

Answer Key

* **1. B** — GPP is defined as the raw rate at which primary producers synthesize new organic matter.

* **2. C** — Net primary productivity is calculated as NPP = GPP – Respiration.

* **3. C** — Vascular plants make the major contribution to primary productivity in ecosystems.

* **4. B** — Net primary productivity is measured in terms of mass per unit area per year.

Lesson 9: How Trophic Levels Process Energy

1. What percentage of incoming solar energy is consumed in photosynthesis?

A) Small fraction (1%)

B) Exactly 10%
C) Roughly 50%
D) Nearly 99%

2. How much energy is lost when moving from one trophic level to the next in a food chain?

A) 10% is lost
B) 90% of energy is lost from one level to the next
C) 100% is converted into secondary productivity
D) Energy increases exponentially at higher trophic levels

3. What is a consequence of the exponential decline of chemical-bond energy along a trophic chain?

A) It increases top predator populations indefinitely
B) It limits the lengths of trophic chains and the number of top-level carnivores
C) It allows top carnivores to have small body sizes and low energy needs
D) It eliminates the need for primary producers in the ecosystem

4. According to the handout, which ecosystem has the highest Net Primary Productivity at **2000 g/m²/year?**

A) Deserts
B) Savanna
C) Wetlands and tropical rain forests
D) Temperate forests

Answer Key

* **1. A** — Only a small fraction (1%) of solar energy is consumed in photosynthesis, while 99% is converted to heat.

* **2. B** — There is a 90% loss of energy at every stage from one trophic level to the next.

* **3. B** — The exponential decline of energy limits the overall length of trophic chains and the number of top-level carnivores.

* **4. C** — Wetlands and tropical rain forests exhibit the highest NPP at 2000 g/m²/year.

Lesson 10: Ecological Pyramids

1. In an ecological pyramid diagram, what does the **width of each box represent?**

A) The physical geographic range of the species
B) The proportional productivity (or biomass/numbers) of that trophic level
C) The lifespan of the organisms in years
D) The rate of solar radiation absorbed by heat

2. What type of ecological pyramid occurs in aquatic systems where zooplankton biomass exceeds phytoplankton biomass?

A) Inverted Pyramid of Biomass
B) Inverted Pyramid of Energy Flow
C) Linear Pyramid of Numbers
D) Exponential Pyramid of Respiration

3. Why can a Pyramid of Energy Flow (Productivity) **never be inverted?**

A) Because top carnivores have smaller body sizes than primary producers
B) Because energy is lost at each successive trophic level through respiration and heat
C) Because decomposers return 100% of heat back into solar light
D) Because primary producers consume secondary productivity

4. Which type of pyramid illustrates the count of individual organisms present at each trophic level?

A) Pyramid of Biomass
B) Pyramid of Numbers
C) Inverted Biomass Pyramid
D) Pyramid of Phototaxis

Answer Key

* **1. B** — The width of each box in an ecological pyramid is proportional to the productivity or biomass/numbers of that level.

* **2. A** — In aquatic environments where zooplankton biomass (21 g/m²) exceeds phytoplankton biomass (4 g/m²), an inverted pyramid of biomass occurs.

* **3. B** — Energy flow pyramids can never be inverted because 90% of energy is lost as heat and respiration at each step.

* **4. B** — A Pyramid of Numbers displays the total count of individual organisms across trophic levels.

Lesson 11: Animals and Their Abiotic Environment

1. Which two categories of characteristics define an organism's **habitat according to the handout?**

A) Physical and Chemical
B) Abiotic/Physical and Biotic/Biological
C) Internal and External
D) Density-dependent and Density-independent

2. What occurs at either limit of an organism's **tolerance range?**

A) Metabolic rate doubles
B) Organisms reproduce at maximum capacity
C) One or more essential functions cease
D) The organism transitions into a k-selected species

3. Which term refers to the specific orientation or movement of an animal towards an environmental factor?

A) Taxis
B) Torpor
C) Aestivation
D) Succession

4. How is a **limiting factor defined in relation to an animal's abiotic environment?**

A) Any factor that remains constant regardless of time
B) Any environmental factor that falls outside the animal's tolerance range
C) The maximum population size supported by an ecosystem
D) A biological factor that promotes species richness

Answer Key

* **1. B** — Habitat characteristics are divided into abiotic/physical and biotic/biological factors.

* **2. C** — At either limit of a tolerance range, one or more essential biological functions cease.

* **3. A** — Taxis is defined as an animal's orientation or movement towards a specific environmental factor.

* **4. B** — A limiting factor is defined as any factor that falls outside an organism's tolerance range.

Lesson 12: Temperature

1. Which metabolic adaptation involves a brief reduction in metabolism and body temperature to survive periods without feeding, as seen in **bats and hummingbirds?**

A) Aestivation
B) Torpor
C) Winter sleep
D) Taxis

2. How does **winter sleep in large animals (such as bears) differ from true hibernation?**

A) Body temperature drops to sub-zero levels permanently
B) Metabolism increases significantly
C) It relies on large energy reserves and allows quick restoration of activity
D) It occurs only during extended periods of summer drought

3. **Aestivation is an adaptation that allows animals like frogs, turtles, and insects to survive under what conditions?**

A) Deep ocean pressure
B) Extended periods of drying and heat to avoid dehydration
C) Total darkness in deep caves
D) Freezing winter weather

4. Which pair of animals is explicitly listed in the text as undergoing true **hibernation?**

A) Bears and Elephants
B) Rodents and Shrews
C) Hummingbirds and Bats
D) Insects and Turtles

Answer Key

* **1. B** — Torpor is a temporary state of decreased metabolism and lowered body temperature seen in bats and hummingbirds.

* **2. C** — Winter sleep occurs in large animals with large energy reserves and allows quick restoration of activity.

* **3. B** — Aestivation enables survival during extended periods of drying, preventing temperature damage and dehydration.

* **4. B** — Rodents and shrews are explicitly cited in the text as examples of hibernators.

Lesson 13: Water & Light

1. Which of the following is listed as a **physiological adaptation animals use to avoid dehydration?**

A) Burrowing underground
B) Osmoregulation
C) Adopting a nocturnal lifestyle
D) Developing flattened body shapes

2. Which organism is cited in the handout as displaying **positive phototaxis?**

A) Planaria
B) Earthworm
C) Euglena
D) Aphid

3. What structural adaptations help aquatic organisms cope with strong **water currents?**

A) Large body size and fat stores
B) Suckers, hooks/claws, body flattening, and streamlining
C) High rates of transpiration
D) Increased skin pigmentation

4. How does photoperiod affect an animal's **annual biological clock?**

A) It triggers autolysis of tissues
B) It regulates reproduction and migration cycles
C) It shifts respiration from aerobic to anaerobic
D) It eliminates the need for osmoregulation

Answer Key

* **1. B** — Osmoregulation is a physiological adaptation used by animals to maintain water balance and prevent dehydration.

* **2. C** — Euglena is explicitly listed as exhibiting positive phototaxis.

* **3. B** — Aquatic animals cope with water currents using suckers, hooks/claws, body flattening, and streamlining.

* **4. B** — Annual photoperiods regulate long-term biological cycles like reproduction and migration.

Lesson 14: Population Growth

1. What is the definition of **Carrying Capacity (K) in an ecosystem?**

A) The total number of offspring produced by a population in one generation
B) The maximum population size of a species that the environment can sustain indefinitely
C) The rate at which energy is lost between trophic levels
D) The minimum biomass required to prevent ecosystem collapse

2. According to the reproduction rate table in the text, what is the reproductive rate of **elephants?**

A) Every 20 minutes
B) 600 eggs per lifetime
C) One offspring every 5–6 years
D) 30 to 140 offspring per year

3. In a **survivorship curve graph, what is plotted on the Y-axis and X-axis?**

A) Y-axis: Linear plot of age; X-axis: Logarithmic plot of survivors
B) Y-axis: Logarithmic plot of numbers of survivors; X-axis: Linear plot of age
C) Y-axis: Total biomass; X-axis: Temperature range
D) Y-axis: Net Primary Productivity; X-axis: Time in hours

4. Which type of survivorship curve is characterized by **high juvenile mortality and lower mortality in adults, as seen in fish?**

A) Type I (Convex)
B) Type II (Diagonal)
C) Type III (Concave)
D) Sigmoidal Curve

Answer Key

* **1. B** — Carrying capacity (K) is the maximum population size an environment can sustain indefinitely.

* **2. C** — Elephants have a reproductive rate of one offspring every 5–6 years.

* **3. B** — Survivorship curves plot a logarithmic number of survivors on the Y-axis against linear age on the X-axis.

* **4. C** — Type III (Concave) curves feature high juvenile mortality followed by lower adult mortality, typical of fish.

Lesson 15: Exponential Population Growth

1. Under what environmental conditions does **exponential population growth occur?**

A) When living space and food resources are severely limited
B) When resources are abundant in the environment
C) When population density exceeds carrying capacity
D) When density-dependent competition is at its maximum

2. What shape of curve is produced during **exponential population growth?**

A) S-shaped curve
B) Bell-shaped curve
C) J-shaped curve
D) Inverted pyramid curve

3. In the exponential growth formula **\(\frac{dN}{dt} = rN\), what does the variable **r** represent?**

A) Carrying capacity of the ecosystem
B) Intrinsic rate of natural increase
C) Respiration loss per unit area
D) Total number of dead individuals

4. Which two growth phases characterize **exponential population growth?**

A) Lag phase and log phase
B) Lag, log, deceleration, and steady phases
C) Primary phase and secondary phase
D) Convex phase and concave phase

Answer Key

* **1. B** — Exponential growth occurs when resources are abundant in the environment.

* **2. C** — Exponential population growth produces a J-shaped curve.

* **3. B** — In the formula dN/dt = rN, 'r' represents the intrinsic rate of natural increase.

* **4. A** — Exponential growth consists of two phases: lag and log.

Lesson 16: Logistics Population Growth

1. Under what environmental conditions does **logistic population growth occur?**

A) When resources are abundant and unlimited
B) When resources are limited in the environment
C) Only during severe natural disasters
D) When there are no competing species present

2. What shape of curve is produced by **logistic population growth?**

A) J-shaped curve
B) Bell-shaped curve
C) S-shaped (sigmoidal) curve
D) Inverted pyramid curve

3. Which mathematical formula represents **logistic population growth in the handout?**

A) $\frac{dN}{dt} = rN$
B) $\frac{dN}{dt} = \frac{rN(K - N)}{K}$
C) $\text{NPP} = \text{GPP} - \text{Respiration}$
D) $K = rN + dt$

4. Which four growth phases characterize **logistic population growth?**

A) Lag and log phases only
B) Primary, secondary, tertiary, and quaternary phases
C) Lag, log, deceleration, and steady phases
D) Convex, diagonal, concave, and S-shaped phases

Answer Key

* **1. B** — Logistic population growth occurs when environmental resources are limited.

* **2. C** — Logistic growth produces an S-shaped (sigmoidal) curve as the population approaches carrying capacity.

* **3. B** — The logistic growth formula is expressed as $\frac{dN}{dt} = \frac{rN(K - N)}{K}$, taking carrying capacity (K) into account.

* **4. C** — Logistic population growth consists of four distinct phases: lag, log, deceleration, and steady phases.

Lesson 17: r and k selected species

1. Which environmental habitats do **r-selected species typically exploit?**

A) Crowded, stable habitats near carrying capacity
B) Unstable or less crowded ecological habitats

C) High-density climax forest communities
D) Deep aquatic habitats exclusively

2. Which set of traits is characteristic of **K-selected species?**

A) Small body size and short generation time
B) Large body size, long life expectancy, and production of fewer offspring
C) High reproductive rate and early onset of maturity
D) Inability to compete for limited resources

3. Which of the following organisms is explicitly listed in the text as an example of an **r-selected species?**

A) Whales
B) Eagles
C) Rodents
D) Parrots

4. How do **K-selected species approach offspring investment?**

A) They produce millions of offspring with no parental care
B) They invest heavily in fewer offspring, leading to a high survival probability
C) They disperse offspring widely without parental investment
D) They reproduce only during the lag phase of growth

Answer Key

* **1. B** — r-selected species typically exploit less crowded or unstable ecological habitats where high growth rates are advantageous.

* **2. B** — K-selected species are characterized by large body size, long life expectancy, and production of fewer offspring.

* **3. C** — Rodents, bacteria, grasses, and cephalopods are explicitly cited as examples of r-selected species.

* **4. B** — K-selected species invest heavily in fewer offspring, giving them a relatively high probability of reaching adulthood.

Lesson 18: Population Regulation

1. Which of the following is classified as a **density-dependent factor regulating population size?**

A) Wildfire
B) Severe weather
C) Competition for limited food resources
D) Pollution

2. Why can **density-independent factors alone fail to keep a population at constant levels?**

A) Their strength varies depending on population density
B) They do not make a "correction" when population size gets too large
C) They increase carrying capacity exponentially
D) They affect only r-selected species

3. What effect can sporadic **density-independent events have on small populations?**

A) They increase genetic diversity
B) They risk wiping out small populations abruptly
C) They force the population into a steady phase
D) They double the intrinsic growth rate (\(r\))

4. What drives **cyclical oscillations in population size over time?**

A) Constant abiotic temperature ranges
B) Interactions between populations of at least two different species (e.g., predation or parasitism)
C) Complete absence of intraspecific competition
D) Uniform distribution of vascular plants

Answer Key

* **1. C** — Competition for food, water, shelter, and mates is a density-dependent factor.

* **2. B** — Density-independent factors do not depend on population density, so they fail to make a corrective adjustment when population size becomes too large.

* **3. B** — Sporadic density-independent events risk wiping out small populations abruptly.

* **4. B** — Cyclical oscillations are repeating rises and drops driven by interactions between two or more species, such as predation, parasitism, or food fluctuations.

Lesson 19: Communities

1. How is an **ecological community defined in the handout?**

A) A group of vascular plants and herbivores occupying a biome
B) A group of species living in a habitat, including plants, animals, fungi, protists, and prokaryotes
C) A collection of apex predators and decomposers
D) A single population occupying a specific space over time

2. Which two primary characteristics are used to describe an **ecological community?**

A) Carrying capacity and growth rate (\(r\))
B) Species richness and primary productivity
C) Torpor frequency and phototaxis
D) Biomass width and trophic length

3. According to the **individualistic concept supported by most ecologists, how do communities exist?**

A) As integrated, whole units that stay unchanged across space and time
B) As simple aggregations of species that happen to occur together based on ecological needs
C) As static biomes that are replaced instantaneously as a whole
D) As closed systems governed strictly by external climate

4. How does community composition change across a landscape under the **individualistic concept?**

A) It changes abruptly with zero overlap between species
B) It changes gradually as species appear, become abundant, or disappear based on individual needs
C) It remains completely identical across all geographic transects
D) It is regulated exclusively by density-independent catastrophes

Answer Key

* **1. B** — An ecological community comprises all plants, animals, fungi, protists, and prokaryotes occurring together at a locality.

* **2. B** — Communities are primarily characterized by species richness and primary productivity.

* **3. B** — The individualistic concept views communities as simple aggregations of species co-occurring according to individual ecological needs.

* **4. B** — Ecologists observe that community composition changes gradually across landscapes as species abundances shift independently.

Lesson 20: The Ecological Niche

1. How is an organism's **niche defined in the text?**

A) The physical geographic coordinates of its breeding territory
B) The total of all the ways an organism uses the resources of its environment
C) The maximum carrying capacity an environment can sustain
D) The linear transfer of heat energy to outer space

2. What is a species' **fundamental niche?**

A) The reduced set of conditions it occupies when competitors are present
B) The entire niche a species is capable of using based on physiological tolerance limits and resource needs
C) The specific microclimate found only at habitat edges
D) The role occupied exclusively after a climax community is established

3. What is a **realized niche?**

A) The potential niche used when zero competition exists
B) The actual set of environmental conditions in which a species establishes a stable population in the presence of competitors
C) The total biomass of primary producers in an aquatic ecosystem
D) An unstable niche created during exponential population growth

4. In the barnacle example from the handout, how does *Semibalanus balanoides* affect *Chthamalus stellatus*?

A) It forces *C. stellatus* out of part of its fundamental niche into a smaller realized niche
B) It expands the fundamental niche of *C. stellatus* into deeper waters
C) It eliminates *C. stellatus* completely through direct predation
D) It forms a mutualistic symbiotic relationship with *C. stellatus*

Answer Key

* **1. B** — An organism's niche is the sum of all ways it utilizes environmental resources, including space, food, and moisture.

* **2. B** — The fundamental niche represents the full range of conditions a species can physiologically tolerate and use.

* **3. B** — The realized niche is the actual set of conditions a species occupies when constrained by competing species.

* **4. A** — Interspecific competition from *S. balanoides* restricts *C. stellatus* to a smaller realized niche.

Lesson 21: The Ecological Stability

1. What is the name of the first community to become established in an area during ecological succession?

A) Climax community
B) Pioneer community
C) Seral community
D) Secondary community

2. In ecological succession, what is each individual successional stage called?

A) Seral stage
B) Pioneer stage
C) Trophic stage
D) Abiotic stage

3. How does a **climax community differ from the preceding seral stages according to the handout?**

A) It lacks all decomposers and primary producers
B) It can tolerate its own reactions
C) It consists only of r-selected invasive species
D) It experiences exponential population growth indefinitely

4. What type of succession occurs in an environment on a new substrate that lacks soil and vegetation?

A) Secondary succession
B) Primary succession
C) Cyclic succession
D) Trophic succession

Answer Key

* **1. B** — The first community to become established in an uncolonized area is called the pioneer community.

* **2. A** — Each intermediate stage in an ecological successional sequence is termed a seral stage.

* **3. B** — A climax community differs from earlier seral stages because it can tolerate its own reactions, achieving stability.

* **4. B** — Primary succession takes place on newly formed substrate completely devoid of vegetation and soil.

Lesson 22: Herbivory

1. Which type of grazing is specifically defined as feeding primarily on true grasses of the family Poaceae?

A) Coprophagy
B) Graminivory
C) Folivory
D) Xylophagy

2. Rabbits engage in **coprophagy by consuming which of the following?**

A) Wood bark and roots

B) Soft feces (caecotrophs)
C) Algae blooms
D) Plant fluids like sap

3. How do **browsers differ from grazers according to the source?**

A) Browsers feed exclusively on algae and phytoplankton
B) Browsers feed on non-grass plant material such as leaves, twigs, and shrubs
C) Browsers kill plants during feeding
D) Browsers ingest only nectar and pollen

4. Which of the following is cited in the text as a **chemical defense mechanism used by plants against herbivores?**

A) Silica deposits in cell walls
B) Thorns and hairs
C) Terpenes, phenols, and alkaloids
D) Flattened body shapes

Answer Key

* **1. B** — Graminivory is the specific grazing strategy of feeding on true grasses belonging to the family Poaceae.

* **2. B** — Coprophagy in rabbits involves eating their own soft feces, known as caecotrophs, to extract remaining nutrients.

* **3. B** — Browsers eat non-grass plant material including leaves, twigs, soft shoots, and woody shrubs.

* **4. C** — Terpenes, phenols, and alkaloids serve as chemical defenses that taste bitter or affect a herbivore's nervous system.

Lesson 23: Predation

1. What are the four primary stages in a predator's foraging cycle as outlined in the text?

A) Photosynthesis, Respiration, Glycolysis, and Fermentation
B) Search, Assess, Capture, and Handle
C) Autolysis, Putrefaction, Nitrification, and Denitrification
D) Lag phase, Log phase, Deceleration, and Steady phase

2. Which capture strategy involves a predator predicting a prey's motion and working out an interception path to attack?

A) Ambush
B) Ballistic interception
C) Pursuit predation
D) Coprophagy

3. During the **assessment stage of predation, how does a predator make a decision to attack?**

A) By calculating the carrying capacity (K) of the habitat
B) By evaluating the costs and benefits of attacking versus searching further
C) By undergoing aestivation or torpor
D) By releasing digestive enzymes extracellularly

4. Which of the following is explicitly given in the source as an example of **solitary predation?**

A) Wolves
B) Hyenas
C) Hawks
D) Termites

Answer Key

* **1. B** — A predator's foraging cycle consists of four distinct stages: Search, Assess, Capture, and Handle.

* **2. B** — Ballistic interception occurs when a predator predicts the prey's movement path and attacks along that predicted trajectory.

* **3. B** — During assessment, the predator decides whether to pursue or keep searching based on the energy cost versus benefit.

* **4. C** — Hawks are cited in the handout as an example of solitary predators, whereas wolves and hyenas perform group predation.

Lesson 24: Competition

1. What is the fundamental distinction between **intraspecific and **interspecific** competition?**

A) Intraspecific is between different species; interspecific is within the same species
B) Intraspecific occurs between members of the same species; interspecific occurs between different species
C) Intraspecific occurs only in plants; interspecific occurs only in carnivores
D) Intraspecific is density-independent; interspecific is density-dependent

2. What type of competition occurs when individuals compete indirectly by **depleting a shared resource, reducing fitness for both?**

A) Direct interference competition
B) Exploitative (indirect) competition
C) Pioneer competition
D) Ballistic competition

3. Fighting, stealing, and ritualistic combats are classified under which form of competition?

A) Direct competition
B) Indirect competition
C) Mutualistic competition
D) Commensal competition

4. According to the handout, by what percentage does the aphid *Fordinae geoica* out-compete *F. formicaria* in indirect interspecific competition?

A) 10%
B) 50%
C) 84%
D) 99%

Answer Key

* **1. B** — Intraspecific competition happens among members of the same species, while interspecific competition occurs between different species.

* **2. B** — Exploitative or indirect competition takes place when one individual depletes a shared resource, lowering fitness for all competitors.

* **3. A** — Direct competition involves active physical interactions such as fighting, stealing, and territorial disputes.

* **4. C** — The handout explicitly states that *Fordinae geoica* out-competes *F. formicaria* by 84% through indirect interspecific competition.

Lesson 25: Coevolution

1. How are **figs structurally described in the coevolution lecture?**

A) Single fleshy fruits containing a single seed
B) Specialized inflorescences containing hundreds of unisexual flowers
C) Vascular leaves modified for photosynthesis
D) Carnivorous plant traps with silica deposits

2. In the fig-wasp coevolutionary relationship, what structure on the fig exhibits a "lock-and-key" fit with the wasp's head shape?

A) Proboscis
B) Ostiole
C) Hyphae
D) Caecotroph

3. What are **gongylidia produced by fungi in their coevolutionary relationship with Attina ants?**

A) Toxic terpenes that deter predators
B) Nutritional hyphal swellings harvested by ants to feed their larvae
C) Specialized unisexual flowers
D) Digestive enzymes used for autolysis

4. How is **coevolution defined in the source text?**

A) The replacement of one ecological community by another over thousands of years
B) Two or more species living in the same habitat that reciprocally affect each other's evolution
C) Exponential growth of a population in an environment with unlimited resources
D) The breakdown of dead tissues by internal cellular enzymes

Answer Key

* **1. B** — Figs are not true individual fruits, but specialized inflorescences packed with hundreds of unisexual flowers.

* **2. B** — The shape of a fig's ostiole matches the head shape of its specific pollinator wasp in a lock-and-key adaptation.

* **3. B** — Gongylidia are nutrient-rich hyphal swellings produced by cultured fungi and harvested by Attina ants to feed their larvae.

* **4. B** — Coevolution occurs when two or more species in the same habitat exert selective pressures and reciprocally affect each other's evolutionary trajectory.

Lesson 26: Symbiosis

1. How does the handout define **obligate symbiosis using lichens as an example?**

A) Both species can choose whether or not to live together based on environmental conditions
B) One or both symbionts entirely depend on each other for survival and cannot live alone
C) One species acts as a parasite that eventually kills its host
D) Organisms interact only during brief seasonal mating periods

2. In **commensalism, what is the relationship between the two interacting species?**

A) Both species experience an increase in reproductive fitness
B) One species benefits while the other is harmed and loses fitness
C) One species gains benefits while the other is neither benefited nor harmed
D) Both species suffer a loss in overall population size

3. Which example is explicitly cited in the text to illustrate **commensalism?**

A) Hermit crab and sea anemone
B) Remora fish attached to sharks feeding on fecal matter
C) Fungal and photosynthetic partners in lichens
D) Liver fluke residing in animal tissues

4. A long-term symbiotic relationship where **both individuals benefit is known as which of the following?**

A) Commensalism
B) Parasitism
C) Mutualism
D) Amensalism

Answer Key

* **1. B** — Obligate symbiosis means one or both symbionts entirely depend on each other for survival, such as fungal partners in lichens that cannot live on their own.

* **2. C** — Commensalism is defined as a relationship where one species gains benefits while the other species is neither benefited nor harmed.

* **3. B** — Remoras riding attached to sharks and feeding on their hosts' fecal matter is given as an example of commensalism.

* **4. C** — Mutualism is a long-term relationship between individuals of different species where both individuals benefit.

Lesson 27: Parasitism

1. Which type of parasite is defined as reproducing **inside the host, with bacteria and viruses given as examples?**

A) Macroparasites
B) Microparasites
C) Ectoparasites
D) Micropredators

2. How do **idiobiont parasitoids handle their prey upon capture according to the handout?**

A) They lay eggs inside young larvae and allow the host to grow before emerging

B) They sting their prey, killing them outright or paralyzing them immediately
C) They attack multiple hosts sequentially without killing any of them
D) They feed exclusively on plant sap and fluids

3. Which evolutionary strategy of parasitism involves damaging or destroying the host's **reproductive system while leaving other systems intact?**

A) Vector transmitted parasitism
B) Directly transmitted parasitism
C) Parasitic castrators
D) Micropredatory blood-feeding

4. How are **micropredators distinguished from typical parasites in the source text?**

A) They live permanently inside the host's digestive tract
B) They attack more than one host and are mostly hematophagic (blood-feeding)
C) They enhance the host's fitness while acquiring nutrients
D) They form obligate mutualistic relationships with algae

Answer Key

* **1. B** — Microparasites reproduce inside the host, and bacteria and viruses are cited as examples.

* **2. B** — Idiobiont parasitoids sting their prey on capture, either killing them outright or paralyzing them immediately.

* **3. C** — Parasitic castrators partly or completely damage the reproductive system of the host so energy is redirected to parasite growth.

* **4. B** — Micropredators attack more than one host, reducing each host's fitness, and are mostly blood-feeding.

Lesson 28: Camouflage-1

1. How is **camouflage defined in the source handout?**

A) The resemblance of one species to another for aggressive imitation
B) The use of any combination of materials, coloration, or illumination for concealment from predators
C) The rapid, bold movement of stripes that creates an optical illusion
D) The release of noxious odors to deter attacks

2. Which principle of camouflage refers to objects hiding so that they are **hard to see?**

A) Mimicry
B) Motion dazzle
C) Crypsis
D) Aposematism

3. **Disruptive coloration uses strongly contrasting markings (such as spots or stripes) to achieve which effect?**

A) To produce light that matches a bright overhead background
B) To break up the outlines of an animal's body
C) To reflect light like a mirror from the side
D) To damage the host's reproductive system

4. Which animal is cited in the text as an example of **eliminating shadow by flattening its body to the ground with fringed white scales?**

A) Leopard
B) Egyptian nightjar
C) Horned Lizard
D) Bushbuck

Answer Key

* **1. B** — Camouflage, also known as cryptic coloration, is defined as the use of materials, coloration, or illumination for concealment from predators.

* **2. C** — Crypsis is the principle of camouflage where objects hide and become hard to see.

* **3. B** — Disruptive coloration consists of strongly contrasting markings like spots or stripes that break up the outlines of an animal.

* **4. C** — The Horned Lizard eliminates shadow by flattening its body to the ground with fringed white scales along its sides.

Lesson 29: Camouflage-2

1. How does **countershading work as a camouflage strategy in animals like gazelles, grasshoppers, and sharks?**

A) It uses photophores to project light downward toward predators
B) It uses graded color to counteract self-shadowing, creating an illusion of flatness
C) It allows animals to completely change their skin texture to match rocks
D) It reflects ambient light like a mirror from side angles

2. What mechanism is used in **counter-illumination to match a background that is brighter than the animal's body?**

A) Fringed white scales along the lateral margins
B) Light-producing organs (photophores) scattered over the underside
C) High-contrast stripes that create an optical illusion during movement
D) Silvering that reflects overhead sunlight sideways

3. Which animals are explicitly listed in the source as using **counter-illumination?**

A) Leopard and Giraffe
B) Hatchet fish and Firefly squid
C) Horned Lizard and Bushbuck
D) Egyptian nightjar and Parrot

4. Why is **transparency an effective camouflage strategy for floating marine animals like jellyfish?**

A) It reflects light from above to blind nearby predators
B) It makes them invisible to predators at a distance, especially in deeper water
C) It breaks up their body outline using spots and stripes
D) It disguises them as dangerous, distasteful species

Answer Key

* **1. B** — Countershading uses graded coloration to counteract the effect of self-shadowing, creating an illusion of flatness.

* **2. B** — Counter-illumination relies on light-producing organs (photophores) scattered over the underside to produce light matching a brighter background.

* **3. B** — Hatchet fish and Firefly squid are explicitly listed as examples of animals that use counter-illumination.

* **4. B** — Transparency makes marine animals like jellyfish invisible to predators at a distance and becomes more efficient in deeper water.

Lesson 30: Camouflage-3

1. How does **silvering create camouflage in fish such as herrings?**

A) It makes the body transparent to allow sunlight to pass straight through
B) It makes the body reflective like a mirror, reflecting light coming from above to make the fish invisible from the side
C) It creates bright red and yellow warning patterns to deter predators
D) It flattens the body against the ocean floor to eliminate shadows

2. What risk does **motion dazzle counteract when an animal moves?**

A) The loss of body heat to the surrounding environment
B) The risk of making the animal visible during movement by using rapidly moving bold patterns of contrasting stripes
C) The risk of attracting parasitic castrators
D) The accumulation of toxic chemicals in body tissues

3. Which animal is cited in the handout as using **motion dazzle?**

A) Zebra
B) Jellyfish
C) Hatchet fish
D) Horned Lizard

4. How does the handout distinguish **mimicry from camouflage?**

A) Mimicry relies strictly on transparency in aquatic environments
B) Mimicry involves imitating another species rather than hiding through camouflage strategies
C) Mimicry occurs only in r-selected species
D) Mimicry is used exclusively to eliminate body shadows on land

Answer Key

* **1. B** — Silvering makes the body reflective so light from above is reflected by a mirror-like body, making the fish invisible from the side.

* **2. B** — Motion dazzle uses rapidly moving bold contrasting stripes to degrade a predator's ability to estimate prey speed and direction during movement.

* **3. A** — The Zebra is explicitly given as an example of an animal that utilizes motion dazzle.

* **4. B** — Mimicry is distinguished from camouflage because organisms imitate another species for protection or aggression rather than hiding.

Lesson 31: Mimicry

1. In **Batesian mimicry, what distinguishes the **model** from the **mimic**?**

A) The model lacks basic protection, while the mimic possesses toxic chemicals
B) The model possesses inherent protection (e.g., poisonous chemicals), while the mimic lacks basic protection
C) The model is always smaller than the mimic and restricted to males
D) The model imitates honest warning signals of multiple distasteful species

2. Which species serve as the classic example of **Batesian mimicry in the handout?**

A) Monarch butterfly (Model) and Viceroy butterfly (Mimic)
B) Tiger moth (Model) and Honey badger (Mimic)
C) Zebra (Model) and Horned Lizard (Mimic)
D) Viceroy butterfly (Model) and Monarch butterfly (Mimic)

3. Why is Batesian mimicry often **restricted to females in certain species?**

A) Females do the choosing, so males must maintain the original recognizable form
B) Females require more camouflage due to higher metabolic rates
C) Males are inherently poisonous while females lack chemical defenses
D) Males migrate to upper atmospheric layers during mating season

4. How does **Müllerian mimicry differ from Batesian mimicry regarding the species involved?**

A) In Müllerian mimicry, harmless species imitate a single dangerous model
B) In Müllerian mimicry, two or more distasteful/noxious species evolve to look similar to each other
C) Müllerian mimicry is restricted exclusively to male organisms
D) Müllerian mimicry relies on transparency and silvering rather than warning coloration

Answer Key

* **1. B** — The model possesses inherent protection (like poisonous chemicals), whereas the mimic lacks basic protection but resembles the model.

* **2. A** — The Monarch butterfly acts as the protected model, and the Viceroy butterfly acts as the mimic.

* **3. A** — Females do the choosing, so males must retain the original form to remain recognizable.

* **4. B** — In Müllerian mimicry, multiple distasteful or harmful species share similar warning signals to mutually educate predators faster.

Lesson 32: Aposematism

1. What is the primary function of **aposematism (warning signals) in animals?**

A) To attract mates during diurnal photoperiods
B) To warn predators that the animal is toxic, distasteful, or dangerous to prevent an attack
C) To break up body outlines through disruptive coloration
D) To convert radiant solar heat into chemical-bond energy

2. Which color combination is explicitly listed as effective **primary warning signals in aposematic animals?**

A) Green, brown, gray, and beige
B) Red, yellow, black, and white
C) Blue, purple, silver, and gold

D) Pink, orange, teal, and maroon

3. How does the **Tiger moth advertise its unpalatability according to the handout?**

A) Through a noxious odor and body flattening
B) Through a bitter taste and ultrasonic sounds
C) Through reverse countershading and bioluminescent photophores
D) Through a neurotoxin and bright red stripes

4. What unique feature serves as an aposematic warning signal in the **Honey badger?**

A) Iridescent blue rings on its mantle
B) Reverse countershading paired with an aggressive temperament, sharp teeth, and claws
C) Ultrasonic clicking noises emitted during flight
D) Secretion of cadaverine and putrescine

Answer Key

* **1. B** — Aposematism serves to warn predators that an organism is dangerous, toxic, or distasteful, preventing attack.

* **2. B** — Red, yellow, black, and white are high-contrast colors listed as effective primary warning signals.

* **3. B** — The Tiger moth utilizes a bitter taste combined with ultrasonic sounds as warning signals.

* **4. B** — The Honey badger uses reverse countershading along with its aggressive behavior, teeth, and claws to signal its defense capabilities.

Lesson 33: Atmosphere and its Evolution-1

1. What force retains Earth's **atmosphere around the planet?**

A) Ocean currents
B) Earth's gravity
C) Solar radiation pressure
D) Magnetospheric convection

2. Which event brought about the accumulation of oxygen in Earth's atmosphere through photosynthesizing cyanobacteria?

A) The Great Oxygenation Event
B) The Carbonate Shift Event
C) The Eutrophication Event
D) The Ozone Depletion Event

3. What was the composition of Earth's **first atmosphere similar to?**

A) Pure nitrogen and oxygen gas
B) The solar nebula (a disc of gas and dirt)
C) High concentrations of ozone gas
D) 100% carbon dioxide and argon

4. Around how many million years ago did atmospheric oxygen stabilize at **15% after shifting from a reducing to an oxidizing atmosphere?**

A) 10,000 million years ago
B) 2,000 million years ago
C) 541 million years ago

D) 65 million years ago

Answer Key

* **1. B** — Earth's gravity retains the atmospheric gases surrounding the planet.

* **2. A** — Photosynthetic activity by cyanobacteria led to the Great Oxygenation Event.

* **3. B** — Earth's first atmosphere had a gas composition similar to the solar nebula.

* **4. C** — Oxygen levels shifted the atmosphere to an oxidizing state and stabilized at 15% around 541 million years ago.

Lesson 34: Atmosphere and its Evolution-2

1. Up to what altitude do the relative percentages of **permanent atmospheric gases remain constant?**

A) 12 km
B) 50 km
C) 80 – 100 km
D) 700 km

2. What happens to **air pressure and air density as altitude increases in the atmosphere?**

A) Both increase exponentially
B) Both decrease with altitude
C) Air pressure increases while air density decreases
D) Both remain completely constant up to the exosphere

3. Which physical property is used as a primary tool to distinguish between different **layers of the atmosphere?**

A) Nitrogen gas concentration
B) Temperature patterns across altitudes
C) Salinity of water vapor
D) Speed of oceanic currents

4. Which three gases constitute the **permanent gases of Earth's atmosphere?**

A) Carbon dioxide, methane, and water vapor
B) Nitrogen (78%), oxygen (21%), and argon (<1%)
C) Ozone, helium, and hydrogen
D) Nitrous oxide, sulfur dioxide, and carbon monoxide

Answer Key

* **1. C** — The relative proportions of permanent gases remain constant up to an altitude of 80–100 km.

* **2. B** — Air pressure and density both decrease as altitude increases.

* **3. B** — Temperature patterns across altitude serve as a primary tool to differentiate atmospheric layers.

* **4. B** — Nitrogen (78%), oxygen (21%), and argon (<1%) make up the permanent gases.

Lesson 35: Composition of Atmosphere

1. What are **aerosols defined as in the composition of the atmosphere?**

A) Soluble salts dissolved in ocean water
B) Suspended solid particles and liquid droplets (excluding cloud droplets)
C) Permanent atmospheric gases above 100 km
D) Gases produced exclusively by agricultural livestock

2. Which layer of Earth's atmosphere lies closest to the surface, spanning from **0 to 12 km?**

A) Stratosphere
B) Troposphere
C) Mesosphere
D) Thermosphere

3. What is the correct order of atmospheric layers from the **lowest altitude to the highest altitude?**

A) Exosphere → Thermosphere → Mesosphere → Stratosphere → Troposphere
B) Troposphere → Stratosphere → Mesosphere → Thermosphere → Exosphere
C) Stratosphere → Troposphere → Thermosphere → Mesosphere → Exosphere
D) Troposphere → Mesosphere → Stratosphere → Exosphere → Thermosphere

4. What is the approximate altitude range of the **Stratosphere according to the handout?**

A) 0 to 12 km
B) 12 to 50 km
C) 50 to 80 km
D) 80 to 700 km

Answer Key

* **1. B** — Aerosols are defined as suspended particles and liquid droplets, excluding cloud droplets.

* **2. B** — The troposphere extends from 0 to 12 km above Earth's surface.

* **3. B** — The order from ground up is Troposphere, Stratosphere, Mesosphere, Thermosphere, and Exosphere.

* **4. B** — The stratosphere spans from 12 to 50 km in altitude.

Lesson 36: Layers of Atmosphere

1. Which physical property is used as a primary tool to distinguish between different layers of the atmosphere?

A) Nitrogen gas concentration
B) Temperature patterns across altitudes
C) Rate of gravitational attraction
D) Total volume of water vapor

2. What happens to atmospheric air pressure and air density as altitude increases?

A) Air pressure increases while air density decreases
B) Both air pressure and air density decrease
C) Both air pressure and air density increase
D) Air pressure decreases while air density remains constant

3. Which boundary region separates the Troposphere from the Stratosphere?

A) Stratopause

B) Mesopause
C) Tropopause
D) Thermopause

4. At what altitude above equatorial regions is the Tropopause located?

A) 9 kilometres
B) 12 kilometres
C) 17 kilometres
D) 50 kilometres

Answer Key

* **1. B** — Temperature patterns across altitudes serve as a primary tool to distinguish atmospheric layers.

* **2. B** — Both air pressure and air density decrease as altitude increases.

* **3. C** — The Tropopause is the boundary region located between the troposphere and the stratosphere.

* **4. C** — The Tropopause is located 17 kilometres above equatorial regions and 9 kilometres over polar regions.

Lesson 37: Troposphere

1. What percentage of the total mass of Earth's atmosphere is contained within the Troposphere?

A) 21%
B) 50%
C) 75%
D) 99%

2. What is the total global average height of the Troposphere?

A) 6 km
B) 12 km
C) 13 km
D) 18 km

3. Why does temperature decrease with increasing altitude within the Troposphere?

A) Ground absorbs solar energy warming lower levels, while heat radiates away at the top
B) Ozone absorption cools the lower atmosphere
C) Air density increases significantly near the Tropopause
D) Solar winds cool the upper regions of the Troposphere

4. What percentage of the atmosphere's total mass of water vapor and aerosols is housed in the Troposphere?

A) 50%
B) 75%
C) 80%
D) 99%

Answer Key

* **1. C** — The Troposphere contains 75% of the total atmospheric mass.

* **2. C** — The total average height of the Troposphere is 13 km.

* **3. A** — Ground absorption of solar energy warms lower levels, while radiating heat away at the top causes upper cooling.

* **4. D** — The Troposphere contains 99% of the atmosphere's total mass of water vapor and aerosols.

Lesson 38: Stratosphere

1. Why does temperature INCREASE with altitude in the Stratosphere?

A) Friction from incoming meteorites
B) Absorption of solar ultraviolet radiation by the ozone layer
C) High gravitational pressure near the Stratopause
D) Reflection of infrared heat from ground surface

2. What maximum speed can winds reach in the Stratosphere according to the handout?

A) 50 km/h
B) 100 km/h
C) 220 km/h
D) 500 km/h

3. Which bird species is explicitly cited in the text as capable of flying in the upper troposphere / lower stratosphere?

A) Bar-headed geese
B) Hummingbirds
C) Albatross
D) Hawaiian honeycreepers

4. What is the atmospheric pressure at the Stratopause compared to sea level?

A) 1/10 of sea level pressure
B) 1/100 of sea level pressure
C) 1/1000 of sea level pressure
D) Equal to sea level pressure

Answer Key

* **1. B** — Temperature increases with altitude in the Stratosphere due to the ozone layer absorbing UV radiation.

* **2. C** — Wind speeds in the Stratosphere far exceed those in the troposphere, reaching near 220 km/h.

* **3. A** — Bar-headed geese (along with Rüppell's vulture) are explicitly cited as flying in the upper troposphere.

* **4. C** — Atmospheric pressure at the Stratopause is 1/1000 of the pressure at sea level.

Lesson 39: Mesosphere

1. Which layer of the atmosphere is explicitly referred to as "near space" in the source?

A) Troposphere
B) Stratosphere
C) Mesosphere

D) Exosphere

2. How low can temperatures drop in the upper Mesosphere depending on latitude and season?

A) -15 °C
B) -51 °C
C) -101 °C
D) -273 °C

3. What phenomenon is observed in the Mesosphere due to the entry of solar winds?

A) Photochemical smog
B) Polar aurora
C) Eutrophication
D) Acid rain deposition

4. What is the boundary region between the Mesosphere and the Thermosphere called?

A) Tropopause
B) Stratopause
C) Mesopause
D) Exopause

Answer Key

* **1. C** — The Mesosphere is explicitly designated as "near space" in the text.

* **2. C** — Temperatures in the upper Mesosphere fall as low as –101 °C due to decreasing solar radiation absorption and CO2 cooling.

* **3. B** — Polar auroras are observed in the Mesosphere due to the entry of solar winds.

* **4. C** — The Mesopause is the boundary layer between the Mesosphere and the Thermosphere.

Lesson 40: Thermosphere & Exosphere

1. Why is the Thermosphere also known as the ionosphere?

A) Extreme UV radiation causes photoionization and photodissociation of molecules into ions
B) It contains 99% of all water vapor ions
C) High concentrations of ozone react with nitrogen ions
D) Industrial pollution releases heavy metal ions into this layer

2. At around what altitude in the Thermosphere is air density so low that sound cannot be transmitted?

A) 12 km
B) 50 km
C) 80 km
D) 160 km

3. How are gas molecules characterized in the Exosphere?

A) They are densely packed and collide frequently
B) They are gravitationally bound, but density is too low for them to collide and behave as a gas
C) They consist entirely of ozone and water vapor
D) They move fast enough to generate continuous lightning

4. How much space debris strikes Earth daily and is destroyed by atmospheric friction before reaching the ground?

A) 1 ton
B) 10 tons
C) 100 tons
D) 1000 tons

Answer Key

* **1. A** — Extreme UV radiation causes photoionization and photodissociation of molecules into ions, creating the ionosphere.

* **2. D** — At around 160 km, density is so low that molecular interactions are too infrequent to permit sound transmission.

* **3. B** — In the Exosphere, molecules are gravitationally bound, but density is too low for them to behave as a gas by colliding.

* **4. C** — Friction with atmospheric gases destroys 100 tons of space debris striking Earth daily before it reaches the ground.

Lesson 41: Benefits of Atmosphere

1. How much space debris strikes Earth every single day and is destroyed by atmospheric friction before reaching the ground?

A) 10 tons
B) 50 tons
C) 100 tons
D) 500 tons

2. How much water vapor does the atmosphere hold at any given time to drive Earth's weather and water cycle?

A) 1,200 cubic kilometers
B) 12,900 cubic kilometers
C) 50,000 cubic kilometers
D) 100,000 cubic kilometers

3. According to the source, how many billion metric tons of carbon does the atmosphere contain in the form of carbon dioxide?

A) 75 billion metric tons
B) 250 billion metric tons
C) 750 billion metric tons
D) 1,500 billion metric tons

4. Which harmful radiation types are absorbed by atmospheric gases to prevent genetic mutations in living organisms?

A) Cosmic rays, gamma rays, and x-rays
B) Visible light and radio waves
C) Infrared heat waves exclusively
D) Microwave radiation

Answer Key

* **1. C** — Friction with atmospheric gases destroys 100 tons of space debris striking Earth daily long before it reaches the ground.

* **2. B** — The atmosphere holds around 12,900 cubic kilometers of water at any given time.

* **3. C** — The atmosphere contains approximately 750 billion metric tons of carbon in the form of carbon dioxide.

* **4. A** — Atmospheric gases absorb cosmic rays, gamma rays, and x-rays to prevent mutations.

Lesson 42: Carbon Cycle

1. In aquatic ecosystems, what compound is produced when dissolved carbon dioxide reacts with water?

A) Carbonic anhydrase
B) Bicarbonate ions
C) Methane gas
D) Calcium silicate

2. According to the handout, what percentage of the adult human body is carbon by weight?

A) 10%
B) 16%
C) 20%
D) 60%

3. Which specialized microbes produce methane gas (CH4) instead of carbon dioxide during organic decomposition?

A) Methanogens
B) Nitrifiers
C) Cyanobacteria
D) Actinomycetes

4. During which biological processes is water synthesized and broken down, respectively?

A) Synthesized in photosynthesis and broken down in chemosynthesis
B) Synthesized in aerobic respiration and broken down in photosynthesis
C) Synthesized in glycolysis and broken down in fermentation
D) Synthesized in autolysis and broken down in putrefaction

Answer Key

* **1. B** — In aquatic ecosystems, carbon dioxide reacts with water to form bicarbonate ions.

* **2. C** — Carbon is a major component of living organisms, making up 20% of the human body by weight.

* **3. A** — Methanogens are microbes that produce methane (CH4) instead of carbon dioxide.

* **4. B** — Water is synthesized during aerobic respiration and broken down during photosynthesis.

Lesson 43: Water Cycle -1

1. What percentage of the adult human body weight is composed of water?

A) 20%

B) 40%
C) 60%
D) 78%

2. What happens to water impurities during the process of evaporation?

A) They evaporate into the atmosphere alongside water vapor
B) They are left behind, leaving the atmospheric water vapor cleaner than it was on Earth
C) They are converted directly into bicarbonate ions
D) They freeze into ice crystals in the troposphere

3. Millions of small, suspended water droplets formed from condensation create clouds in the sky or what at ground level?

A) Fog
B) Smog
C) Aquifers
D) Caecotrophs

4. What is the process called when rainwater soaks into (infiltrates) the soil and underlying rock layers?

A) Transpiration
B) Surface runoff
C) Percolation (Infiltration)
D) Eutrophication

Answer Key

* **1. C** — Life depends on water, and the adult human body contains 60% water by weight.

* **2. B** — During evaporation, impurities in the water are left behind, making atmospheric water cleaner.

* **3. A** — Millions of suspended water droplets form clouds in the sky or fog at ground level.

* **4. C** — Percolation is the process where rainwater soaks into the soil and underlying rock layers.

Lesson 44: Water Cycle -2

1. How is groundwater naturally cleaned as it moves through soil and underground rock layers?

A) Through extreme heat generated by Earth's mantle
B) Through a natural filtering process that removes impurities
C) By reacting with atmospheric nitrogen gas
D) By exposure to high levels of ultraviolet light

2. What term describes the evaporation of water specifically occurring through plant leaves?

A) Transpiration
B) Percolation
C) Condensation
D) Autolysis

3. What path does water follow as it travels through a plant during transpiration?

A) Stems → roots → leaves
B) Leaves → stems → roots

C) Roots → stems → leaves
D) Flowers → roots → stems

4. What happens to precipitation that returns to land but cannot infiltrate the ground?

A) It transforms immediately into methane gas
B) It becomes surface runoff, flowing downhill into streams, rivers, lakes, and oceans
C) It forms permanent ice cores in tropical regions
D) It undergoes immediate nitrogen fixation

Answer Key

* **1. B** — Water moving through soil and rock layers undergoes a filtering process that cleans the water by removing impurities.

* **2. A** — The process of water evaporation through plant leaves is called transpiration.

* **3. C** — Water absorbed from soil moves from the roots through the stems to the leaves.

* **4. B** — Unabsorbed precipitation runs off the land surface and flows downhill into streams, rivers, lakes, and oceans.

Lesson 45: Nitrogen Cycle - 1

1. What percentage of a living organism's weight consists of nitrogen?

A) 1%
B) 16%
C) 20%
D) 78%

2. Which two forms of nitrogen are commonly absorbed and utilized by plants and algae?

A) Elemental dinitrogen (N2) and urea
B) Ammonia (NH3) and nitrate ions (NO3–)
C) Nitrous oxide (N2O) and cadaverine
D) Methane and organic proteins

3. Which of the following is explicitly listed in the text as one of the primary phases of the Nitrogen Cycle?

A) Phototaxis
B) Immobilization
C) Autolysis
D) Countershading

4. What C/N ratio threshold in soil microbial biomass determines whether **immobilization occurs instead of mineralization?**

A) C/N < 5
B) C/N < 10
C) C/N > 20
D) C/N > 100

Answer Key

* **1. B** — A living organism is 16% nitrogen by weight.

* **2. B** — Two commonly used nitrogen sources for plants and algae are ammonia (NH3) and nitrate ions (NO3–).

* **3. B** — The text outlines five phases of the nitrogen cycle: Ammonification, Immobilization, Nitrogen Fixation, Nitrification, and Denitrification.

* **4. C** — Immobilization occurs when nitrogen is limiting in the environment, governed by a C/N ratio greater than 20.

Lesson 46: Nitrogen Cycle -2

1. Which genus of bacteria catalyzes the first step of nitrification, converting ammonium (NH4+) to nitrite (NO2–)?

A) Nitrobacter
B) Nitrosomonas
C) Azotobacter
D) Clostridium

2. Below what pH level is the chemical reaction rate of nitrification completely inhibited?

A) pH < 8.0
B) pH < 6.6
C) pH < 6.0
D) pH < 4.5

3. Which functional group of bacteria performs **denitrification in the nitrogen cycle?**

A) Obligate aerobic bacteria
B) Facultative anaerobic bacteria
C) Autotrophic photosynthetic cyanobacteria
D) Methanogenic archaea

4. What chemical compound serves as the **terminal electron acceptor during the process of denitrification?**

A) Oxygen
B) Glucose
C) Nitrate (NO3–)
D) Ammonia

Answer Key

* **1. B** — Nitrosomonas catalyzes the first step of nitrification, converting ammonium to nitrite.

* **2. D** — Nitrification slows when pH drops below 6.0 and is completely inhibited when pH falls below 4.5.

* **3. B** — Denitrification is carried out by facultative anaerobic bacteria.

* **4. C** — Nitrate acts as the terminal electron acceptor during denitrification.

Lesson 47: Phosphorous Cycle

1. Unlike carbon and nitrogen, in what physical state is **phosphorus absent from the atmosphere?**

A) Solid state
B) Liquid state

C) Gaseous state
D) Dissolved state

2. How are phosphate salts initially released from rocks into soil water?

A) Through biological nitrogen fixation
B) Through weathering
C) Through photosynthesis
D) Through cellular respiration

3. How is the speed of the **phosphorus cycle described relative to other biogeochemical cycles?**

A) The fastest cycle
B) The slowest cycle
C) The only cycle driven by solar heat
D) The cycle with the largest atmospheric reservoir

4. What environmental problem is caused when increased fertilizer usage leads to phosphorus runoff into aquatic systems?

A) Acid rain
B) Biomagnification
C) Eutrophication
D) Ozone depletion

Answer Key

* **1. C** — Unlike carbon and nitrogen, phosphorus cannot be found in the air in a gaseous state.

* **2. B** — Weathering releases phosphate salts from rocks, dissolving them into soil water.

* **3. B** — The phosphorus cycle is characterized as the slowest biogeochemical cycle.

* **4. C** — Increased fertilizer runoff adds excess phosphorus to waterways, contributing to eutrophication.

Lesson 48: Extinction and Habitat Loss

1. According to the handout, when is the exact moment of **extinction officially defined?**

A) When a population falls below carrying capacity (K)
B) Upon the death of the last individual of the species
C) When a species enters the lag phase of growth
D) When habitat loss exceeds 50%

2. What is cited in the text as the **most important cause of modern-day extinction?**

A) Volcanic eruptions
B) Habitat loss
C) Acid rain deposition
D) Interspecific competition

3. Which animal group suffered the highest number of extinctions attributed to habitat loss in the source's summary table?

A) Mammals
B) Birds
C) Reptiles

D) Fish

4. According to the source, human activities adversely affect natural habitats in which three primary ways?

A) Photosynthesis, respiration, and decomposition
B) Habitat destruction, pollution, and habitat fragmentation
C) Autolysis, putrefaction, and fermentation
D) Eutrophication, taxis, and torpor

Answer Key

* **1. B** — The moment of extinction is defined as the death of the last individual of the species.

* **2. B** — Habitat loss is identified as the most important cause of modern-day extinction.

* **3. D** — In the provided group summary table, fish experienced the highest number of extinctions due to habitat loss (35 extinctions).

* **4. B** — Humans adversely affect natural habitats via habitat destruction, pollution, and habitat fragmentation.

Lesson 49: Destruction of Habitat -1

1. According to the source, what percentage of species will be lost if **90% of a habitat area is cleared?**

A) 10%
B) 25%
C) 50%
D) 90%

2. What percentage of Earth's total land surface is currently covered by **forests?**

A) 10%
B) 20%
C) 31%
D) 60%

3. Tropical deforestation is responsible for approximately what percentage of global **greenhouse gas emissions?**

A) 5%
B) 20%
C) 50%
D) 75%

4. How does deforestation directly affect the local **water cycle according to the handout?**

A) It increases transpiration rates significantly
B) It reduces transpiration by trees, resulting in a drier climate and lower soil moisture
C) It eliminates surface runoff completely
D) It prevents soil erosion and flooding

Answer Key

* **1. C** — Clearing 90% of a habitat area results in the loss of 50% of its species.

* **2. C** — Forests cover approximately 31% of Earth's land surface.

* **3. B** — Tropical deforestation accounts for roughly 20% of world greenhouse gas emissions.

* **4. B** — Deforestation reduces tree transpiration, leading to drier climates and decreased soil moisture.

Lesson 50: Habitat Fragmentation

1. How is **habitat fragmentation defined in the source handout?**

A) The complete conversion of forest land into agricultural pastures
B) The breaking up of one patch of habitat into several smaller, isolated patches
C) The increase in total forest area due to reforestation programs
D) The accumulation of heavy metal toxins in water bodies

2. What environmental change along habitat boundaries is noted as being **more dangerous to species survival than fragmentation itself?**

A) Complete lack of sunlight
B) Microclimate changes along the edges (edge effect)
C) Overexploitation of primary producers
D) Anaerobic decomposition in bogs

3. In a study of isolated rainforest fragments, by what percentage did tree biomass within 100 m of the forest edge decrease during the first 17 years?

A) 10%
B) 20%
C) 36%
D) 50%

4. In the isolated rainforest fragments of Manaus, Brazil, which animal group needing large areas disappeared first?

A) Fish
B) Insects
C) Monkeys
D) Birds

Answer Key

* **1. B** — Habitat fragmentation is defined as the breaking up of one patch of habitat into several smaller patches.

* **2. B** — Microclimate shifts along habitat edges (edge effect) are more dangerous to species survival than fragmentation itself.

* **3. C** — Tree biomass within 100 m of the forest edge declined by 36% in the first 17 years after fragment isolation.

* **4. C** — In the isolated fragments of Manaus, Brazil, monkeys requiring large habitat areas disappeared first.

Lesson 51: Effects of Habitat Fragmentation

1. What genetic consequence of habitat fragmentation increases the level of homozygosity and facilitates the expression of deleterious alleles?

A) Gene flow
B) Inbreeding depression
C) Hybrid vigor
D) Polyploidy

2. How does habitat fragmentation affect **genetic drift in small populations?**

A) It eliminates genetic drift entirely
B) It causes random changes in genetic makeup, leading to reduced genetic diversity
C) It stabilizes allele frequencies permanently
D) It prevents local extinctions

3. Why are small, fragmented populations weaker in adapting to environmental changes?

A) They contain larger pools of fitness-maintaining alleles
B) They have high rates of outward migration
C) They possess a smaller pool of fitness-maintaining alleles
D) They produce excess offspring during log phase

4. How does habitat fragmentation alter **predator-prey dynamics?**

A) By reducing safe zones for prey, making them more vulnerable to predators
B) By eliminating all apex predators from the ecosystem
C) By increasing the size of climax communities
D) By preventing interspecific competition

Answer Key

* **1. B** — Inbreeding depression in fragmented populations increases homozygosity and facilitates the expression of deleterious alleles.

* **2. B** — Genetic drift is increased in fragmented populations, causing random changes that reduce genetic diversity.

* **3. C** — Small populations have a smaller pool of fitness-maintaining alleles, making them weaker in adapting to environmental changes.

* **4. A** — Fragmentation reduces the area of safe zones for prey, increasing their vulnerability to predators.

Lesson 52: Invasive Species

1. In what year was the **Zebra Mussel accidentally introduced into the Great Lakes from the Caspian and Black Sea?**

A) 1885
B) 1988
C) 1992
D) 2001

2. Why is **Kudzu considered a noxious invasive weed in the United States?**

A) It releases neurotoxins through its roots to poison soil microbes
B) It climbs rapidly over trees and shrubs, killing them through heavy shading
C) It bioaccumulates heavy metals in top-level carnivores
D) It blocks intake pipes in marine power plants

3. The **Asian Tiger Mosquito was introduced to the continental United States in 1985 and acts as a vector for which disease?**

A) Typhoid
B) West Nile Virus
C) Cholera
D) Polio

4. Which invasive species, native to the Pacific Ocean, was introduced to waters around the United States in 1992 via the aquarium trade and possesses poisonous spines?

A) Remora
B) Lionfish
C) Zebra Mussel
D) Sea anemone

Answer Key

* **1. B** — The Zebra Mussel was accidentally introduced to the Great Lakes in 1988 from the Caspian and Black Sea.

* **2. B** — Kudzu grows rapidly over trees and shrubs, killing them by blocking sunlight through heavy shading.

* **3. B** — The Asian Tiger Mosquito serves as an insect vector for West Nile Virus.

* **4. B** — The Lionfish is native to the Pacific Ocean, has poisonous spines, and was introduced to U.S. waters in 1992.

Lesson 53: Overexploitation

1. Which two North American species are cited in the handout as classic examples of extreme **overharvesting/overexploitation?**

A) Monarch butterflies and Viceroy butterflies
B) Passenger pigeons and Bison
C) Koalas and Orangutans
D) Termites and Aphids

2. What occurs during a **cascade effect when an apex predator like the sperm whale is overhunted?**

A) Primary producers undergo rapid autolysis
B) Unchecked prey populations dramatically increase and overexploit their own food resources
C) Nitrification rates drop below pH 4.5
D) Interspecific competition is completely eliminated

3. Which animal group has been heavily threatened by commercial overhunting specifically for its **tusks?**

A) Chinchilla
B) Otter
C) Elephants
D) Vicuña

4. Which tree species in the West Indies was severely overexploited for commercial timber?

A) Cedar
B) Mahogany
C) Kudzu
D) Fig

Answer Key

* **1. B** — Passenger pigeons and Bison in North America are explicitly listed as examples of overexploitation.

* **2. B** — Removing an apex predator causes a cascade effect where unchecked prey overexploit lower trophic food resources.

* **3. C** — Elephants are threatened by commercial hunting for their ivory tusks.

* **4. B** — Mahogany trees in the West Indies were overharvested for timber.

Lesson 54: Land Pollution - 1

1. How is **pollution defined in the source handout?**

A) The natural shift in species composition during ecological succession
B) The introduction of contaminants that cause adverse, undesirable changes in the environment
C) The breakdown of dead tissues by internal cellular enzymes
D) The linear transfer of heat energy into outer space

2. Which of the following is classified as a **point source of pollution?**

A) Diffuse agricultural runoff containing sediment
B) A single identifiable source such as a factory drain or sewage pipe
C) Regional acid rain deposition
D) Dispersed atmospheric ozone dust

3. Land pollution is broadly categorized in the text as comprising which two components?

A) Primary pollutants and secondary pollutants
B) Solid waste and soil pollution
C) Point sources and non-point sources
D) Organic compounds and inorganic salts

4. Which of the following is listed as a major source of **solid waste in the text?**

A) Solar radiation
B) Wastes from agriculture, mining, industry, sewage treatment, and garbage
C) Transpiration from plant leaves
D) Dissolved oxygen in oligotrophic lakes

Answer Key

* **1. B** — Pollution is defined as undesirable physical, chemical, or biological changes caused by introducing contaminants.

* **2. B** — Point source pollution originates from a single identifiable source like a factory drain, landfill, or sewage pipe.

* **3. B** — Land pollution comprises solid waste and soil pollution.

* **4. B** — Solid waste sources include agriculture, mining, industrial waste, sewage solids, ashes, and garbage.

Lesson 55: Land Pollution - 2

1. How do **pesticides used in agriculture contribute to land and soil pollution?**

A) They increase Net Primary Productivity in rainforests
B) They kill or damage non-target life forms, crops, vegetation, and animals
C) They convert inorganic carbon into glucose
D) They prevent soil salinization completely

2. Which human health issue is cited as an indirect health effect of land pollution on the human body?

A) High altitude sickness
B) Respiratory problems and birth defects
C) Positive phototaxis
D) Hypothermia from winter sleep

3. What impact does land pollution have on natural habitats and wildlife?

A) It expands the fundamental niche of native insects
B) It exterminates wildlife, destroys vegetation shelter, and throws ecosystems out of balance
C) It increases the carrying capacity (K) of top carnivores
D) It stabilizes the phosphorus cycle

4. Which of the following is listed as an effective **preventative measure against land pollution?**

A) Increasing the use of chemical herbicides in urban areas
B) Educating people about littering, reusing/recycling domestic items, and reducing pesticide usage
C) Disposing of organic waste inside high-density residential areas
D) Removing legislative regulations on agricultural land clearing

Answer Key

* **1. B** — Most pesticides damage or kill unintended life forms, including non-target vegetation, birds, and animals.

* **2. B** — Land pollution can cause birth defects, skin problems, and indirect respiratory and breathing diseases.

* **3. B** — Land pollution destroys vegetation providing food and shelter, exterminating wildlife and throwing ecosystems out of balance.

* **4. B** — Preventions include public education, reusing/recycling domestic items, proper waste disposal, and reducing pesticide use.

Lesson 56: Water pollution - 1

1. What happens to Dissolved Oxygen (DO) levels in a body of water as Biological Oxygen Demand (BOD) increases due to sewage pollution?

A) Dissolved Oxygen increases proportionally
B) Dissolved Oxygen remains completely unchanged
C) Dissolved Oxygen decreases

D) Dissolved Oxygen converts directly into inorganic nitrogen

2. Which set of characteristics describes an **oligotrophic body of water?**

A) High nutrient levels, poor light penetration, low dissolved oxygen, and shallow waters
B) Unenriched clear water, low nutrient levels, high dissolved oxygen, and deep waters
C) High algal growth, silt bottom, high BOD, and presence of catfish
D) High concentrations of heavy metals, warm temperature, and low light penetration

3. Which problem is directly caused by **sediment pollution in aquatic ecosystems?**

A) It increases water temperature to accelerate bacterial respiration
B) It limits light penetration and covers aquatic plants and animals
C) It releases high levels of CFCs into the photic zone
D) It eliminates all disease-causing bacterial agents

4. Which of the following diseases is explicitly listed in the source as being transmitted by waterborne disease-causing agents from infected wastes?

A) Malaria and Dengue
B) Typhoid, cholera, and polio
C) Tuberculosis and Asthma
D) West Nile Virus and Yellow Fever

Answer Key

* **1. C** — As microorganisms break down biological wastes, the Biological Oxygen Demand increases, causing Dissolved Oxygen levels to decrease.

* **2. B** — Oligotrophic waters are unenriched and clear, featuring low nutrient levels, deep waters, and high dissolved oxygen.

* **3. B** — Sediment pollution consists of excessive suspended soil particles that limit light penetration and cover bottom-dwelling organisms.

* **4. B** — Infectious disease-causing agents in sewage transmit waterborne illnesses including typhoid, cholera, bacterial dysentery, polio, and infectious hepatitis.

Lesson 57: Water pollution - 2

1. Where does **mercury specifically bioaccumulate in marine food chains according to the handout?**

A) In the shell structures of primary producers
B) In the muscles of top predators of the open ocean
C) In the root systems of coastal mangroves
D) In the exoskeleton of zooplankton

2. How does **thermal pollution affect dissolved oxygen (DO) levels in aquatic ecosystems?**

A) Heated water holds less dissolved oxygen than cold water
B) Heated water holds significantly more dissolved oxygen than cold water
C) Thermal pollution has no effect on gas solubility or dissolved oxygen
D) Heated water converts dissolved oxygen into carbonic acid

3. Which human activity is identified in the text as the **leading source of water pollution?**

A) Commercial aviation

B) Agriculture
C) Domestic laundry
D) Mining of radioactive isotopes

4. Why do industrial wastes from **paper mills pose severe water pollution problems?**

A) They contain high concentrations of atmospheric aerosols
B) They cause high Biological Oxygen Demand (BOD) and release toxic compounds
C) They cause immediate freezing of aquatic water temperatures
D) They contain heavy concentrations of radioactive lead

Answer Key

* **1. B** — Mercury is an inorganic chemical pollutant that bioaccumulates in the muscle tissues of top open-ocean predators.

* **2. A** — Thermal pollution reduces oxygen solubility because warm water holds less dissolved oxygen than cold water.

* **3. B** — Agriculture is designated as the leading source of water pollution due to animal wastes, high BOD residues, and pesticide leaching.

* **4. B** — Paper mills produce industrial effluents characterized by high Biological Oxygen Demand and toxic chemical compounds.

Lesson 58: Air pollution - 1

1. How is a **secondary air pollutant defined in contrast to a primary air pollutant?**

A) A pollutant emitted directly into the air from an industrial smokestack
B) A harmful substance formed in the atmosphere when a primary pollutant reacts with normal atmospheric substances or other pollutants
C) A pollutant that consists exclusively of non-toxic natural ocean salts
D) An atmospheric gas that degrades only in deep aquatic sediments

2. According to the handout, why is **particulate material particularly dangerous to human health?**

A) It destroys the magnetosphere upon contact
B) It may contain toxic or carcinogenic materials, and extremely small particles can become lodged in lungs
C) It neutralizes all nitrogen oxides in the stratosphere
D) It prevents infrared heat from escaping into outer space

3. Which environmental issue is directly caused by **sulfur oxides released into the atmosphere?**

A) Acid precipitation
B) Eutrophication of deep ocean trenches
C) Biomagnification of mercury
D) High altitude winter sleep in mammals

4. How does **tropospheric ozone differ from stratospheric ozone in its environmental impact?**

A) Tropospheric ozone screens out harmful UVB rays, while stratospheric ozone causes smog

B) Tropospheric ozone is a man-made secondary pollutant and component of photochemical smog, whereas stratospheric ozone screens out harmful UV radiation
C) Tropospheric ozone is essential for plant transpiration, while stratospheric ozone causes respiratory failure
D) Both types of ozone are primary pollutants emitted directly from vehicle exhaust

Answer Key

* **1. B** — Secondary air pollutants are not emitted directly; they form in the atmosphere through reactions involving primary pollutants.

* **2. B** — Particulate material is dangerous because particles can carry toxic/carcinogenic chemicals and tiny particles lodge deep inside human lungs.

* **3. A** — Gases produced by chemical reactions between sulfur and oxygen react in the atmosphere to cause acid precipitation.

* **4. B** — Tropospheric ozone is a harmful component of photochemical smog near the ground, while stratospheric ozone protects life by absorbing UV radiation.

Lesson 59: Air pollution - 2

1. According to the source pie chart, what is the **largest single contributor to outdoor air pollution at **57%**?**

A) Industrial processes
B) Fuel combustion except in vehicles
C) Transportation
D) Miscellaneous waste burning

2. How is **photochemical smog defined in the source handout?**

A) A clear gas formed by cold arctic temperatures reacting with methane
B) A brownish-orange haze formed by chemical reactions involving sunlight, particulate suspension, nitrogen oxides, and hydrocarbons
C) White fog produced when water vapor condenses over agricultural fields
D) Pure sulfur dioxide gas emitted by volcanic activity

3. Which combination of pollutants reacts in the presence of **sunlight to form photochemical smog?**

A) Carbonic acid and calcium carbonate
B) Particulate suspension, nitrogen oxides, and hydrocarbons
C) Pure nitrogen gas and argon
D) Radon gas and helium

4. What health symptoms are associated with **low-level exposure to air pollution according to the text?**

A) Immediate loss of bone density
B) Eye irritation and inflammation of the respiratory tract
C) Hearing loss and memory loss
D) Severe hypothermia

Answer Key

* **1. C** — Transportation represents the largest source of outdoor air pollution, accounting for 57% of total emissions.

* **2. B** — Photochemical smog is a brownish-orange urban haze resulting from solar-driven reactions among particulates, nitrogen oxides, and hydrocarbons.

* **3. B** — Sunlight drives chemical reactions among suspended particulates, nitrogen oxides, and hydrocarbons to form photochemical smog.

* **4. B** — Low-level exposure to air pollutants irritates the eyes and inflames respiratory tract tissues.

Lesson 60: Light pollution

1. What alternative name is used for **light pollution in the source handout?**

A) Thermal pollution
B) Photo pollution
C) Radiation pollution
D) Aesthetic smog

2. Which human health issues are listed in the source as impacts of light pollution?

A) Typhoid, cholera, and dysentery
B) Stress, headaches, and Seasonal Affective Disorder (SAD)
C) Asbestos accumulation in lungs
D) Mercury poisoning

3. How does artificial **coastal lighting affect baby sea turtles?**

A) It accelerates their swimming speed in deep water
B) It confuses hatchlings, causing them to crawl away from the ocean toward roads and communities
C) It protects them from bird predators by blinding birds
D) It increases their metabolic rate during hibernation

4. Which set of animal behaviors and physiological processes is disrupted by light pollution?

A) Sleep, foraging behavior, reproduction, and animal navigation
B) Autolysis, putrefaction, and caecotrophe production
C) Nitrogen fixation and chemosynthesis
D) Osmoregulation in deep ocean hydrothermal vents

Answer Key

* **1. B** — Light pollution is also explicitly termed photo pollution in the text.

* **2. B** — Excessive or obtrusive artificial light compromises human health, causing stress, headaches, and Seasonal Affective Disorder.

* **3. B** — Coastal artificial lighting disorients hatchling sea turtles, leading them away from the sea toward roads and developed areas.

* **4. A** — Light pollution degrades photic habitats and disrupts animal sleep, foraging, reproduction, navigation, and predator-prey relationships.

Lesson 61: Noise pollution

1. According to the World Health Organization (WHO) statement cited in the handout, how should noise be recognized?

A) As an inevitable side-effect of industrialization
B) As a major threat to human well-being
C) As a temporary inconvenience with no lasting health impact
D) As a primary cause of atmospheric ozone depletion

2. Why is noise pollution characterized as an **underrated environmental problem in the source text?**

A) Because it only affects marine organisms in deep ocean trenches
B) Because human beings cannot see, smell, or taste it
C) Because it cannot be measured using decibel units
D) Because it occurs exclusively during nighttime hours

3. What is identified as the **main source of noise pollution in urban areas?**

A) Agricultural livestock operations
B) Transportation systems
C) Household plumbing and vacuum cleaners
D) Deep ocean oil drilling

4. Which combination of health problems is explicitly listed as a physiological or psychological effect of noise pollution?

A) High blood pressure, stress-related illness, memory loss, and hearing loss
B) Typhoid, cholera, polio, and hepatitis
C) Basal cell carcinoma, cataracts, and vitamin D deficiency
D) Inbreeding depression, gene flow, and genetic drift

Answer Key

* **1. B** — The World Health Organization stated that noise must be recognized as a major threat to human well-being.

* **2. B** — Noise pollution is underrated because humans cannot see, smell, or taste it.

* **3. B** — Transportation systems are designated as the main source of noise pollution in urban areas.

* **4. A** — Noise pollution causes high blood pressure, stress-related illness, memory loss, panic attacks, depression, and hearing loss.

Lesson 62: Acid Rain

1. What is the typical pH value of unpolluted rain, which is slightly acidic due to dissolved carbonic acid?

A) Exactly pH 7.0
B) Usually no lower than pH 5.7
C) Exactly pH 4.5
D) Lower than pH 3.0

2. Which human activity makes the **greatest contribution to acid rain through the release of sulfur dioxide (SO_2)?**

A) Burning coal in power plants
B) Commercial aviation fuel combustion
C) Agricultural fertilizer application

D) Nylon and nitric acid manufacturing

3. What chemical compound is formed when acid rain reacts with calcium carbonate in limestone and marble monuments?

A) Hydroxysulfonyl radical
B) Nitric acid
C) Gypsum
D) Bicarbonate ion

4. At what pH level does acid rain prevent most fish eggs from hatching in aquatic ecosystems?

A) pH lower than 7.0
B) pH lower than 6.6
C) pH lower than 5.0
D) pH lower than 3.5

Answer Key

* **1. B** — Unpolluted rain is slightly acidic due to carbonic acid, but usually has a pH no lower than 5.7.

* **2. A** — Burning coal in power plants makes the greatest human contribution to acid rain emissions.

* **3. C** — Acid rain reacts with calcium carbonate in limestone and marble monuments to form gypsum.

* **4. C** — At a pH lower than 5, most fish eggs will not hatch, and lower pH can kill adult fish.

Lesson 63: Disruption of water cycle and coastal ecosystem

1. How does **deforestation directly disrupt the water cycle according to the source?**

A) It increases the rate of transpiration from tree leaves
B) It reduces the volume of moisture released into the air through transpiration
C) It prevents surface runoff from reaching streams and rivers
D) It eliminates all soil erosion along coastlines

2. According to the handout, how many of the world's 17 largest cities are located along **coastal areas?**

A) 5
B) 8
C) 12
D) 14

3. How many people are estimated to live in coastal areas globally according to the text?

A) 500 million
B) 1 billion
C) 3 billion
D) 6 billion

4. How do **smog and acid rain contaminate water bodies through the water cycle?**

A) By blocking all evaporation from ocean surfaces
B) By bringing toxic atmospheric chemicals back to the ground via precipitation into runoff and groundwater
C) By converting freshwater lakes into oligotrophic systems

D) By destroying methane-producing bacteria in bogs

Answer Key

* **1. B** — Deforestation directly affects transpiration, reducing the volume of moisture released into the air by plants.

* **2. D** — 14 of the world's 17 largest cities are situated along coastal areas.

* **3. C** — Approximately 3 billion people currently live in coastal areas.

* **4. B** — Precipitation brings toxic atmospheric chemicals back down into surface runoff and infiltration, contaminating groundwater and water bodies.

Lesson 64: Greenhouse effect

1. Which two gases make up the majority of Earth's atmosphere but are **not good greenhouse gases?**

A) Carbon dioxide and methane
B) Nitrogen (N2) and Oxygen (O2)
C) Water vapor and nitrous oxide
D) Ozone and argon

2. What percentage of global carbon dioxide emissions is caused by the burning of fossil fuels for **electricity generation?**

A) 12%
B) 20%
C) 25%
D) 40%

3. How much more effective is **methane at trapping heat in the atmosphere compared to carbon dioxide by weight?**

A) 2 times
B) 5 times
C) More than 20 times
D) 100 times

4. What percentage of the Earth's natural greenhouse effect is caused by **water vapor (excluding clouds)?**

A) 10% to 20%
B) 36% to 70%
C) 75% to 90%
D) 99%

Answer Key

* **1. B** — The majority of Earth's atmosphere, consisting of N2 and O2, are not good greenhouse gases.

* **2. D** — Electricity generation via fossil fuel combustion accounts for 40% of global carbon dioxide emissions.

* **3. C** — Methane is more than 20 times as effective as CO2 at trapping heat in the atmosphere.

* **4. B** — Water vapor causes about 36% to 70% of the greenhouse effect on Earth, excluding clouds.

Lesson 65: Ozone Depletion

1. Where is approximately **90% of Earth's protective ozone located?**

A) Troposphere
B) Stratosphere
C) Mesosphere
D) Exosphere

2. Which specific band of solar ultraviolet radiation is primarily absorbed by stratospheric **ozone?**

A) UVA
B) UVB
C) UVC
D) Infrared

3. According to the source pie chart on Ozone Depleting Substances, which product category represents the **largest contributor at 36.1%?**

A) Refrigeration and Air Conditioning
B) Solvent Cleaning Products
C) Foam Products
D) Aerosols

4. Which type of human skin cancer is strongly linked specifically to **UVB exposure in the text?**

A) Basal and squamous cell carcinomas
B) Malignant melanoma exclusively
C) Kaposi sarcoma
D) Mesothelioma

Answer Key

* **1. B** — Nearly 90% of Earth's ozone is located in the stratosphere.
* **2. B** — Stratospheric ozone absorbs the band of ultraviolet radiation known as UVB.
* **3. B** — Solvent cleaning products make up the largest fraction of ozone-depleting substances at 36.1%.
* **4. A** — Basal and squamous cell carcinomas in humans have been strongly linked to UVB exposure.

Lesson 66: Global Warming

1. By how much has the average temperature of Earth's atmosphere risen since 1900 according to the handout?

A) 0.1 °C
B) About 1 °C
C) 3.5 °C
D) 5.0 °C

2. Which set of methods is listed in the source for inferring past climate and atmospheric CO2 concentrations?

A) Satellite radar and weather balloons

B) Radiometric solar flares and sunspot counts
C) Tree-rings, deep ocean sediments, ice core records, and corals
D) Deep mantle drilling and volcanic ash analysis

3. According to the source, how has atmospheric CO2 concentration changed in recent centuries based on Antarctic ice core data?

A) Decreased from 370 ppm to 270 ppm
B) Increased by about 30%, from 270 ppm to 370 ppm
C) Doubled from 100 ppm to 200 ppm
D) Remained strictly constant at 380 ppm

4. How does the CO2 cycle act as Earth's thermostat when the planet warms up?

A) It increases volcanic activity to release cooling aerosols
B) It increases ocean CO2 dissolution and carbonate mineral formation rates, pulling CO2 out of the atmosphere
C) It halts photosynthesis to prevent oxygen buildup
D) It decreases water vapor evaporation from tropical oceans

Answer Key

* **1. B** — Earth's average atmospheric temperature has risen by approximately 1 °C since 1900.

* **2. C** — Past atmospheric CO2 concentrations and temperatures are inferred using tree-rings, deep ocean sediments, ice core records, and corals.

* **3. B** — Antarctic ice core data shows atmospheric CO2 concentration rose rapidly by about 30%, from 270 ppm to 370 ppm.

* **4. B** — Warming increases the rate at which oceans dissolve CO2 and form carbonate minerals, removing CO2 from the air to cool the planet back down.

Lesson 67: Effects of Global Warming - 1

1. By what percentage per decade has Arctic sea ice extent decreased since 1978?

A) 0.5%
B) 2.7%
C) 7%
D) 15%

2. What was the average rate of global sea level rise between 1961 and 2003 as reported in the handout?

A) 0.5 mm per year
B) 1.8 mm per year
C) 5.0 mm per year
D) 12.5 mm per year

3. Why do oxygen levels in ocean water decrease as global temperatures rise (ocean deoxygenation)?

A) Oxygen is less soluble in warmer water
B) Oxygen reacts with dissolved CO2 to form nitric acid
C) Photosynthetic algae stop producing oxygen at higher altitudes
D) Decomposers consume 100% of atmospheric oxygen

4. By how much has the maximum area of seasonally frozen ground decreased in the Northern Hemisphere since 1900?

A) 2.7%
B) 5%
C) 7%
D) 20%

Answer Key

* **1. B** — Arctic sea ice extent has decreased at a rate of 2.7% per decade since 1978.

* **2. B** — Global sea level rose at an average rate of 1.8 mm per year between 1961 and 2003.

* **3. A** — Warmer ocean water holds less dissolved gas because oxygen solubility decreases as temperature increases.

* **4. C** — The maximum area of seasonally frozen ground in the Northern Hemisphere has decreased by 7% since 1900.

Lesson 68: Effects of Global Warming - 2

1. According to Pakistan's Department of Meteorology trends, by how much has the mean temperature risen in arid coastal areas, arid mountains, and hyper-arid plains?

A) 0.1–0.3 °C
B) 0.6–1.0 °C
C) 2.0–3.0 °C
D) 4.5–5.0 °C

2. In central Pakistan, what change in cloud cover was recorded alongside an increase in sunshine hours?

A) 10% increase in cloud cover
B) 3–5% decrease in cloud cover
C) 20% decrease in cloud cover
D) No change in cloud cover

3. What increase in net irrigation water requirement was observed in Pakistan despite no change in rainfall?

A) 1%
B) 5%
C) 15%
D) 25%

4. Which infectious diseases are explicitly listed in the source as human health impacts exacerbated by climate change?

A) Polio and Cholera
B) Malaria and Dengue
C) Tuberculosis and Asbestosis
D) Typhoid and Hepatitis

Answer Key

* **1. B** — Recent meteorological trends in Pakistan show a mean temperature rise of 0.6–1.0 °C across arid coastal areas, mountains, and hyper-arid plains.

* **2. B** — Central Pakistan experienced a 3–5% decrease in cloud cover, leading to an increase in sunshine hours.

* **3. B** — The net irrigation water requirement increased by 5% in Pakistan even with no recorded change in rainfall.

* **4. B** — Malaria and dengue are explicitly cited as climate-sensitive infectious diseases affecting human health.

Lesson 69: Biomagnification

1. How does **biomagnification differ from **bioaccumulation** according to the source?**

A) Biomagnification occurs within a single trophic level, while bioaccumulation occurs across trophic levels
B) Biomagnification occurs across trophic levels in a food chain, whereas bioaccumulation occurs within a single trophic level
C) Biomagnification applies only to gases, while bioaccumulation applies to heavy metals
D) Biomagnification occurs exclusively in freshwater lakes

2. Which three factors are required for biomagnification of a toxic substance to take place?

A) High solubility in water, high excretion rate, and rapid autolysis
B) Persistence, food chain energetics, and low/non-existent rate of internal degradation or excretion
C) High volatility, rapid bacterial putrefaction, and high nitrogen content
D) Phototaxis, aestivation, and high C/N ratio

3. Which pollutant is explicitly listed in the handout as undergoing biomagnification?

A) Cadaverine
B) Carbonic acid
C) DDT (dichlorodiphenyltrichloroethane)
D) Calcium carbonate

4. In the DDT food chain example provided in the text, what is the DDT concentration in **humans at the top level compared to 0.04 ppm in algae?**

A) 0.23 ppm
B) 2.07 ppm
C) 7.36 ppm
D) 13.55 ppm

Answer Key

* **1. B** — Biomagnification occurs across successive trophic levels in a food chain, while bioaccumulation takes place within an individual organism/trophic level over time.

* **2. B** — Biomagnification requires persistence in the environment, food chain energy transfer, and a low rate of internal degradation or excretion.

* **3. C** — DDT is listed as a primary example of a persistent pollutant that undergoes biomagnification across food chains.

* **4. D** — In the provided DDT food chain diagram, toxin concentration increases from 0.04 ppm in algae up to 13.55 ppm in humans.

Lesson 70: Type of Wastewater

1. According to the domestic wastewater pie chart in the handout, which household source accounts for the largest fraction at **40%?**

A) Bathing
B) Laundry
C) Toilet flushing
D) Kitchen sinks

2. What percentage of global fresh water use is consumed by **agriculture according to the text?**

A) 10% to 25%
B) 35% to 50%
C) 69% to 90%
D) Over 98%

3. What is the **number one cause of stream impairment in urban areas?**

A) Industrial acid rain
B) Stormwater runoff
C) Geothermal heat discharge
D) Radioactive waste seepage

4. How is **gray water distinguished from **black water** in wastewater classification?**

A) Gray water comes from flush toilets and contains high pathogen levels, while black water comes from rainfall
B) Gray water originates from non-toilet streams (sinks, showers) with fewer pathogens, while black water originates from toilets
C) Gray water is untreatable, whereas black water is easily purified for drinking water
D) Gray water is produced exclusively by industrial paper mills

Answer Key

* **1. C** — Flush toilets constitute the largest single source of domestic household wastewater at 40%.

* **2. C** — Agriculture accounts for 69% to 90% of global freshwater usage.

* **3. B** — Stormwater runoff from paved, non-permeable surfaces is the leading cause of stream impairment in urban environments.

* **4. B** — Gray water comes from household non-toilet sources and is easier to recycle, whereas black water comes from toilets and contains feces, urine, and high pathogen loads.

Lesson 71: Impacts of Wastewater on Environment

1. Which of the following is classified as a **non-persistent (degradable) pollutant in the handout?**

A) Lead and mercury isotopes
B) Domestic sewage
C) Polychlorinated biphenyls (PCBs)
D) Plastic polymers

2. What non-polluting end-products are typically formed when natural bacteria degrade organic wastewater?

A) Carbon dioxide and nitrogen gas
B) Sulfuric acid and ozone
C) Methane and cadaverine
D) Ammonium and nitrate ions

3. What condition occurs in a water body if the degradable pollution load becomes excessively high?

A) Biomagnification of heavy metals
B) Low oxygen levels and eutrophication
C) Immediate, irreversible extinction of all organisms
D) Total loss of water salinity

4. How is the environmental damage caused by degradable pollutants described when the pollution load is reduced?

A) Irreversible
B) Reversible
C) Permanent
D) Exponential

Answer Key

* **1. B** — Domestic sewage, fertilizers, and disease-causing microbes are classified as degradable pollutants.

* **2. A** — Degradation of organic matter by chemical reactions or bacteria yields non-polluting substances like carbon dioxide and nitrogen.

* **3. B** — A high degradable pollution load consumes dissolved oxygen, leading to low oxygen levels and eutrophication.

* **4. B** — Environmental damage from non-persistent pollutants is reversible once the pollution load is reduced.

Lesson 72: Treatment of Wastewater - 1

1. What depth range is specified for stabilization ponds (lagoons**) where sunlight, algae, and oxygen interact to clean wastewater?**

A) 1 to 2 feet deep
B) 3 to 5 feet deep
C) 10 to 15 feet deep
D) 20 to 30 feet deep

2. Which sewer system type is designed to carry **both stormwater runoff and wastewater together?**

A) Sanitary sewers
B) Combined sewers
C) Storm sewers
D) Subsurface drains

3. Which component of mechanical primary treatment is specifically used to settle out heavy inorganic particles ("grit"**)?**

A) Aeration tank
B) Trickling filter
C) Grit chamber
D) Activated charcoal filter

4. How deep is the bed of stones in a **trickling filter used during biological secondary treatment?**

A) 1 to 2 feet deep
B) 3 to 10 feet deep
C) 12 to 20 feet deep
D) Over 25 feet deep

Answer Key

* **1. B** — Lagoons or stabilization ponds are 3–5 feet deep systems utilizing sunlight, algae, and oxygen to treat wastewater.

* **2. B** — Combined sewers carry both stormwater runoff and sewage wastewater in a single collection pipe.

* **3. C** — A grit chamber removes heavy inorganic particles ("grit") during mechanical primary treatment.

* **4. B** — Trickling filters use a bed of stones 3–10 feet deep where bacteria multiply and decompose dissolved organic matter.

Lesson 73: Treatment of Wastewater - 2

1. In activated sludge secondary treatment, what is the mixture of raw sewage and activated sludge called as it leaves the aeration tank?

A) Seral liquor
B) Mixed liquor
C) Subsurface effluent
D) Caecotrophe

2. How does the construction cost of an **advanced (tertiary) treatment plant compare to a secondary treatment plant?**

A) It costs half as much
B) It costs the same
C) It costs twice as much
D) It costs ten times as much

3. Which advanced tertiary treatment process is used to remove **dissolved salts from wastewater?**

A) Alum coagulation
B) Activated charcoal adsorption
C) Electrodialysis
D) Chlorine bleaching

4. Which physical process is applied during advanced treatment specifically to remove **coloration from wastewater?**

A) Electrodialysis
B) Bleaching
C) Sedimentation
D) Grinding

Answer Key

* **1. B** — The mixture of activated sludge and raw sewage in the aeration tank is termed mixed liquor.

* **2. C** — Advanced tertiary treatment is extremely costly, costing twice as much to build as a secondary treatment plant.

* **3. C** — Electrodialysis is an advanced tertiary treatment method used specifically for salt removal.

* **4. B** — Bleaching is utilized during advanced tertiary treatment to eliminate coloration from the effluent.

Lesson 74: Protection of Endangered species

1. Which institution pioneered the field of **restoration ecology through early prairie restoration work in 1935?**

A) University of Wisconsin–Madison Arboretum
B) Harvard Forest Station
C) Smithsonian Conservation Biology Institute
D) Oxford Botanical Garden

2. What river in New England was successfully rehabilitated after severe chemical pollution from **dye plants?**

A) Hudson River
B) Nashua River
C) Mississippi River
D) Potomac River

3. In the captive breeding program for the **Hawaiian goose, a wild population of 9,000 was re-established starting from how many captive birds?**

A) 2 birds
B) 12 birds
C) 50 birds
D) 100 birds

4. Which national park in Pakistan is explicitly listed in the text as a protected area for conservation?

A) Margalla Hills National Park
B) Kirthar National Park
C) Ayubia National Park
D) Deosai National Park

Answer Key

* **1. A** — The University of Wisconsin–Madison Arboretum pioneered restoration ecology starting with prairie restoration in 1935.

* **2. B** — The Nashua River in New England was cleaned up and rehabilitated after being heavily polluted by dye plants.

* **3. B** — The Hawaiian goose recovery program started with 12 captive birds to release 9,000 back into the wild.

* **4. B** — Kirthar National Park (along with Hingol and Chitral) is explicitly cited as a national park example in Pakistan.

Lesson 75: Evolution

1. How is **evolution defined in the source handout?**

A) The replacement of primary producers by secondary consumers in an ecosystem
B) The change in heritable characteristics of biological populations over successive generations
C) The increase in population density beyond carrying capacity (K)
D) The artificial removal of invasive species from a degraded habitat

2. In what year did **Jean-Baptiste Lamarck propose the first evolutionary scheme suggesting changes over time?**

A) 1798
B) 1809
C) 1859
D) 1935

3. Which thinker's 1798 work on population growth and the struggle for resources directly influenced **Charles Darwin?**

A) Thomas Malthus
B) Jean-Baptiste Lamarck
C) Gregor Mendel
D) Alfred Russel Wallace

4. What foundational biological concept was proposed by Charles Darwin following his insights into resource competition?

A) Theory of Spontaneous Generation
B) Theory of Natural Selection
C) Law of Independent Assortment
D) Principle of Competitive Exclusion

Answer Key

* **1. B** — Evolution is defined as the change in heritable characteristics of biological populations over successive generations.

* **2. B** — Jean-Baptiste Lamarck proposed the first evolutionary scheme in 1809.

* **3. A** — Thomas Malthus's 1798 work proposed that population growth creates a struggle for resources, influencing Darwin.

* **4. B** — Influenced by Malthus, Darwin proposed the groundbreaking Theory of Natural Selection.

End of Quiz

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