Evolution

Class 12 Biology · 24 NEET MCQs with answers & explanations

Evolution is a concept-heavy and high-scoring chapter for NEET. It covers the origin of life, theories of evolution (Lamarck vs Darwin), evidences for evolution (homology, analogy, fossils), adaptive radiation, Hardy-Weinberg equilibrium and human evolution. NEET frequently tests the Hardy-Weinberg factors and the distinction between homologous and analogous organs.

Key Evolutionary Concepts

Concept	Key Fact
Origin of life	Oparin-Haldane hypothesis → chemical evolution; Miller-Urey experiment produced amino acids
Homologous organs	Same origin, different function (e.g. forelimbs of whale, bat, human) — divergent evolution
Analogous organs	Different origin, same function (e.g. wings of butterfly and bird) — convergent evolution
Hardy-Weinberg	$p^2 + 2pq + q^2 = 1$; disrupted by mutation, selection, drift, migration, non-random mating
Adaptive radiation	Darwin's finches (Galapagos); Australian marsupials — one ancestor, many forms
Human evolution	Dryopithecus → Ramapithecus → Australopithecus → Homo habilis → H. erectus → H. sapiens

Questions

Q1. Genetic drift is expected to have the strongest effect in which population?

(A) A large randomly mating population with high gene flow
(B) A small isolated population with limited gene flow
(C) A large population with stable allele frequencies
(D) A population maintained at Hardy-Weinberg equilibrium

Q2. Which pair represents homologous structures and therefore provides evidence of divergent evolution?

(A) Forelimbs of humans, bats and whales
(B) Wings of butterfly and bird
(C) Flippers of penguin and dolphin
(D) Eyes of octopus and mammals

Q3. Which hypothesis states that life originated from non-living organic molecules formed under primitive Earth conditions?

(A) Chemical evolution hypothesis
(B) Panspermia hypothesis
(C) Biogenesis hypothesis
(D) Special creation hypothesis

Q4. The early Earth atmosphere during origin of life lacked which gas, according to NCERT?

(A) Ozone
(B) Nitrogen
(C) Oxygen
(D) Carbon dioxide

Q5. Which type of natural selection favors individuals with intermediate phenotypes and eliminates extremes?

(A) Stabilizing selection
(B) Directional selection
(C) Disruptive selection
(D) Random selection

Q6. Which type of natural selection shifts the population phenotype toward one extreme of trait distribution?

(A) Random selection
(B) Directional selection
(C) Stabilizing selection
(D) Balancing selection

Q7. Which observation during the voyage of HMS Beagle most influenced Darwin's thinking about evolution?

(A) Beak variation among finches on Galapagos islands
(B) Discovery of marine bacteria in seawater
(C) Presence of identical species on all islands
(D) Uniform plant distribution across continents

Q8. Darwin proposed that evolution occurs primarily through:

(A) Mass extinction followed by new creation
(B) Gradual accumulation of favourable heritable variations
(C) Random mutation alone without environmental filter
(D) Direct transformation of organs by environment

Q9. The sweet potato and potato both function as food-storage organs, but the former is a modified root and the latter a modified stem. This is an example of:

(A) Homology with divergent evolution
(B) Analogy with divergent evolution
(C) Analogy with convergent evolution
(D) Homology with convergent evolution

Q10. A scientist finds two organisms with similar functional structures but concludes that their structural origins are different. Which evolutionary inference is most appropriate?

(A) They show homology and divergent evolution
(B) They show analogy and convergent evolution
(C) They show homology and convergent evolution
(D) They show analogy and divergent evolution

Q11. Which type of organs share the same basic structural plan but perform different functions in different organisms?

(A) Homologous organs
(B) Analogous organs
(C) Vestigial organs
(D) Rudimentary organs

Q12. The forelimbs of humans, whales, bats, and horses are considered homologous because they:

(A) Perform identical functions in all species
(B) Share similar internal bone organisation despite different functions
(C) Develop at different embryonic stages
(D) Contain identical bone numbers and proportions

Q13. Which observation is most appropriately explained by convergent evolution?

(A) Forelimbs of humans, bats and whales share a common structural plan
(B) Darwin's finches diverged from one common ancestor
(C) A small population showed random allele-frequency change
(D) Dolphins and sharks independently evolved streamlined bodies

Q14. Which is a necessary condition for Hardy-Weinberg equilibrium?

(A) Continuous migration between populations
(B) Random mating
(C) Strong directional natural selection
(D) High mutation rate

Q15. The scientific study of human evolutionary history using fossil evidence and comparative anatomy is called:

(A) Paleoanthropology
(B) Ethology
(C) Primatology
(D) Taxonomy

Q16. According to fossil and genetic evidence, the earliest hominins evolved on which continent?

(A) Asia
(B) Africa
(C) Europe
(D) South America

Q17. The Hardy–Weinberg principle describes the relationship between allele and genotype frequencies in a population under which condition?

(A) Genetic equilibrium with no evolutionary forces
(B) Random mutation dominance
(C) Constant directional selection
(D) Complete reproductive isolation

Q18. In Hardy–Weinberg equilibrium, the sum of frequencies of all alleles at a locus equals:

(A) Zero
(B) One
(C) Two
(D) Four

Q19. The evolutionary process by which new species arise from existing populations is called:

(A) Speciation
(B) Mutation
(C) Adaptation
(D) Natural selection

Q20. Speciation most commonly begins when populations become:

(A) Genetically identical
(B) Reproductively isolated
(C) Uniform in phenotype
(D) Free from mutation

Q21. Which of the following BEST distinguishes adaptive radiation from ordinary microevolution?

(A) Adaptive radiation produces multiple new species across ecological niches; microevolution changes allele frequency within one population
(B) Adaptive radiation occurs only in aquatic habitats
(C) Microevolution always leads to extinction of ancestral forms
(D) Adaptive radiation requires polyploidy to generate new species

Q22. Geographic isolation promotes adaptive radiation primarily because:

(A) It increases mutation rate in isolated populations
(B) It prevents gene flow, allowing subpopulations to diverge under different selection pressures
(C) It causes immediate polyploidy in founder populations
(D) It eliminates all interspecific competition instantly

Q23. Disruptive selection differs from stabilising selection in that it:

(A) Favours extreme phenotypes at both ends, splitting population into two groups
(B) Favours the most common phenotype in the population
(C) Reduces variance in phenotype over generations
(D) Maintains current allele frequencies at equilibrium

Q24. Sexual selection is best classified as:

(A) A form of genetic drift independent of phenotype
(B) A subset of natural selection based on differential reproductive success due to mate choice
(C) A mutation-driven process creating secondary sexual characters
(D) A form of gene flow between isolated populations

Answer key

1-B	**2-A**	**3-A**	**4-C**	**5-A**	**6-B**	**7-A**	**8-B**
9-C	**10-B**	**11-A**	**12-B**	**13-D**	**14-B**	**15-A**	**16-B**

17-A	18-B	19-A	20-B	21-A	22-B	23-A	24-B

Answers with explanations

Q1 — Answer: (B) A small isolated population with limited gene flow
Genetic drift is a random change in allele frequency and is strongest in small, isolated populations because chance sampling can substantially alter allele frequencies. Large populations buffer random fluctuations, making option A incorrect. Options C and D describe conditions that actually oppose allelic change.

Q2 — Answer: (A) Forelimbs of humans, bats and whales
Human, bat and whale forelimbs share the same basic pentadactyl structural plan but perform different functions, indicating common ancestry and divergent evolution. Butterfly-bird wings and penguin-dolphin flippers perform similar functions from different origins and are analogous, representing convergent evolution. Octopus and mammal eyes are also analogous structures.

Q3 — Answer: (A) Chemical evolution hypothesis
Chemical evolution hypothesis proposes that organic molecules arose abiotically from inorganic substances in the primitive reducing atmosphere. Biogenesis (C) states life comes only from existing life — the opposite. Panspermia (B) invokes extraterrestrial origin, not Earth-based chemical synthesis.

Q4 — Answer: (C) Oxygen
Primitive Earth had a reducing atmosphere — free oxygen (O_2) was absent, which was essential for abiotic synthesis of organic molecules. Ozone (A) is derived from O_2, so it was also absent, but the primary NCERT emphasis is on free oxygen. Nitrogen and CO_2 were present.

Q5 — Answer: (A) Stabilizing selection
Stabilizing selection favors average phenotypes and reduces variation at extremes.

Q6 — Answer: (B) Directional selection
Directional selection occurs when environmental pressure favors one extreme phenotype.

Q7 — Answer: (A) Beak variation among finches on Galapagos islands
Darwin observed distinct beak shapes among Galapagos finches, each adapted to different food sources, suggesting populations change over time through environment-driven selection. Identical species on all islands (C) would have suggested no adaptive change, not supported the theory.

Q8 — Answer: (B) Gradual accumulation of favourable heritable variations
Darwin's core mechanism is natural selection acting on pre-existing heritable variation, gradually increasing frequency of favourable traits. Option D describes Lamarck's theory, a common trap; random mutation alone (C) lacks the selective filter Darwin emphasised.

Q9 — Answer: (C) Analogy with convergent evolution
Same function with different structural origins indicates analogy. Sweet potato is a root modification whereas potato is a stem modification — they have no common structural plan. Such similarity in function despite different structural origins is produced by convergent evolution.

Q10 — Answer: (B) They show analogy and convergent evolution
Similar function with different structural origin is the defining criterion for analogy. Analogous structures arise independently through convergent evolution under similar selective pressures. Homology requires a shared structural origin from a common ancestor, which is absent here.

Q11 — Answer: (A) Homologous organs
Homologous organs share structural similarity due to common ancestry but are adapted to different functions in different organisms — the hallmark of divergent evolution. Analogous organs (B) share function but differ in structure and origin.

Q12 — Answer: (B) Share similar internal bone organisation despite different functions
Homologous organs are defined by common structural plan (same bones: humerus, radius, ulna, carpals) inherited from a common ancestor, regardless of functional divergence. Option D is the trap — bone number can vary; it is the organisational pattern that is conserved.

Q13 — Answer: (D) Dolphins and sharks independently evolved streamlined bodies
Dolphins and sharks belong to unrelated lineages but independently evolved similar streamlined body forms due to comparable aquatic environments. This is convergent evolution producing analogous structures. Option A illustrates divergent evolution; Option B illustrates adaptive radiation; Option C describes genetic drift.

Q14 — Answer: (B) Random mating
Random mating is one of the five conditions required for Hardy-Weinberg equilibrium. Migration introduces alleles from outside, mutation creates new alleles, and directional selection changes allele frequencies — all of these disturb equilibrium.

Q15 — Answer: (A) Paleoanthropology
Paleoanthropology specifically studies human origins and evolution through fossil analysis and skeletal comparison. Primatology studies living primates; ethology studies animal behaviour; taxonomy deals with classification.

Q16 — Answer: (B) Africa
Africa is established as the cradle of hominin evolution — oldest hominin fossils (Australopithecus, Homo habilis) are found there, and mitochondrial DNA studies confirm African origin of modern humans.

Q17 — Answer: (A) Genetic equilibrium with no evolutionary forces
H–W equilibrium holds only when all five evolutionary forces (mutation, selection, gene flow, genetic drift, non-random mating) are absent. Directional selection and isolation both disturb equilibrium. Genetic equilibrium means allele frequencies remain constant across generations.

Q18 — Answer: (B) One
$p + q = 1$ because allele frequencies represent proportions of a whole and must sum to 1. This is the foundational equation from which genotype frequencies are derived. A sum of zero or two is mathematically impossible for frequency values.

Q19 — Answer: (A) Speciation
Speciation is the process by which reproductively isolated populations diverge genetically to form distinct species. It is distinct from mutation (which generates variation) and adaptation (which is the outcome of selection).

Q20 — Answer: (B) Reproductively isolated
Reproductive isolation prevents gene flow, allowing populations to accumulate independent genetic changes and diverge. Genetic identity and phenotypic uniformity are the opposite of what drives speciation.

Q21 — Answer: (A) Adaptive radiation produces multiple new species across ecological niches; microevolution changes allele frequency within one population
Adaptive radiation is a macroevolutionary event producing species-level divergence into multiple niches; microevolution (allele frequency shifts) operates within a single species and does not produce niche diversification.

Q22 — Answer: (B) It prevents gene flow, allowing subpopulations to diverge under different selection pressures
Without gene flow, isolated subpopulations accumulate different adaptations in response to local conditions. Isolation is the prerequisite; niche diversity then drives divergence into distinct species.

Q23 — Answer: (A) Favours extreme phenotypes at both ends, splitting population into two groups
Disruptive selection favours both extreme phenotypes and eliminates intermediates, potentially splitting one population into two — this can drive sympatric speciation. Stabilising selection does the opposite, favouring the mean and reducing variance. Only disruptive selection can increase phenotypic bimodality.

Q24 — Answer: (B) A subset of natural selection based on differential reproductive success due to mate choice
Sexual selection is a mechanism of natural selection where certain traits increase mating success rather than survival. It can drive rapid allele frequency change — sometimes in directions opposing survival advantage — making it a potent disruptor of H–W equilibrium distinct from ecological selection.

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