

**BIO · BIOLOGY**

16. Evolution

Official PMDC Solved Past Paper Topical Booklet · High-Yield Examination Series

© 47 Solved Questions

📅 2014 to 2024 Archive

📋 Boards: BUMHS, DUHS, KMU, MDCAT, NUMS, PMDC

📊 Weightage: 34% of MDCAT (68 MCQs)

Curated by Ibrahim for fellow bees. Every question in this chapter has been verified against official UHS, NUMS, SZABMU, DUHS, and KMU answer keys. Propolis cognitive autopsies are provided at the end of this booklet to explain core concepts and break down common distractor traps.

OFFICIAL SOLVED EDITION**Q1.**

UHS 2024

According to endosymbiosis theory, flagella may have derived by the ingestion of prokaryotes similar to:

- (A) Spirochete
- (B) Amoeboid prokaryote
- (C) Aerobic bacterium
- (D) Spirillum

Q2.

UHS 2024

The idea of inheritance of acquired characteristics was presented by:

- (A) Jean Baptist Lamarck
- (B) Charles Darwin
- (C) Thomas Malthus
- (D) Alfred Wallace

Q3.

KMU 2024

According to Lamarckism, the basis of evolution is:

- (A) Inheritance of acquired characteristics
- (B) Mutation
- (C) Natural selection
- (D) Survival of the fittest

Q4.

NUMS 2024

Children of a mason do not inherit strong muscles developed by father due to hard labour. This is an example of:

- (A) Survival of the fittest
- (B) Over production of offspring
- (C) Not inheriting acquired characters
- (D) Use and disuse of organs

Q5.

UHS 2024

Which of the following statements about natural selection is not true?

- (A) It is selected by a breeder
- (B) It affects variations that are heritable
- (C) It can improve the adaptation of species
- (D) It is regional in nature

Q6.

SZABMU 2024

Which of the following is the main point of Darwinism?

- (A) Descent with modification
- (B) Use and disuse of organ
- (C) Inheritance of acquired characters
- (D) Artificial Selection

Q7.

SZABMU 2024

The Darwin's observation on discovery and investigation on fossils is called

- (A) Biogeography
- (B) Chronology
- (C) Homology
- (D) Paleontology

Q8.

UHS 2024

Identify the correct pair of vestigial organs:

- (A) Ear Muscles & Vermiform appendix
- (B) Heart & Liver
- (C) Ear Muscles & Liver
- (D) Vermiform appendix & Heart

Q9.

KMU 2024

What best describes the hind leg bones seen in the whale?

- (A) Vestigial structures that had a function in an ancestor
- (B) Analogous to the fin of living fish
- (C) Fossil structure from an extinct ancestor
- (D) Homologous structure of the wings of a bat

Q10.

KMU 2024

Wings of birds and that of flying lizards provide evidence of:

- (A) Convergent evolution
- (B) Divergent evolution
- (C) No evolution
- (D) Same origin

Q11.

KMU 2024

The embryological stages of anatomical features show similarity in:

- (A) All vertebrates
- (B) All non-vertebrates
- (C) All living things
- (D) Human, jelly fish and mouse

Q12.

SZABMU 2024

The reduction of population size with some specific allele and genotype due to natural disaster is called:

- (A) Mutation
- (B) Founder effect
- (C) Bottle neck effect
- (D) Speciation

Q13.

SZABMU 2024

When humans purposefully apply selection pressure to populations, the process is known as:

- (A) Artificial selection
- (B) Natural selection
- (C) Evolution
- (D) Genetic drift

Q14.

SZABMU 2023

A general formula is derived by one of the following scientist for calculating the frequencies of alleles and genotypes in population at equilibrium:

- (A) Linnaeus
- (B) Lamarck
- (C) Darwin
- (D) Hardy Weinberg

Q15.

UHS 2023

According to evolutionary studies, prokaryotes may have arisen around:

- (A) 2.5 billion years ago
- (B) 3.5 billion years ago
- (C) 4.5 billion years ago
- (D) 5.5 billion years ago

Q16.

SZABMU 2023

When humans purposefully apply selection pressure to populations, the process is known as:

- (A) Artificial selection
- (B) Natural selection
- (C) Evolution
- (D) Genetic drift

Q17.

UHS 2023

Which of the following is not an example of disuse of organs?

- (A) Snake's legs
- (B) Muscle atrophy
- (C) Shedding of milk teeth
- (D) Movement of ear

Q18.

KMU 2023

Who proposed the concept that an organism can pass on acquired modifications to its offspring?

- (A) Lamarck
- (B) Darwin
- (C) Malthus
- (D) Aristotle

Q19.

UHS 2023

Which of the following is the main point of Darwinism?

- (A) Over production
- (B) Variation
- (C) Disuse of organ
- (D) Perceived unity of life

Q20.

SZABMU 2023

Which statement is not correct for the Darwin's theory of natural selection?

- (A) Survival in the struggle for existence is random
- (B) The fit individuals leave more offsprings into their environment
- (C) The unequal ability of individuals to survive and reproduce will lead to a gradual
- (D) Accumulation over the generations thus leading to the evolution of a new species

Q21.

KMU 2023

According to Neo-Darwinism, which of the following is a cause of evolution?

- (A) Reproductive isolation
- (B) Infinite large population
- (C) Environmental stability
- (D) Both A and B

Q22.

KMU 2023

Darwin's 'Origin of species by natural selection' is mainly concerned with:

- (A) Origin of life
- (B) Adaptation
- (C) Extinction
- (D) Speciation

Q23.

UHS 2023

Which of the following type of organs are supposed to be functional in ancestral species rather than in present day species:

- (A) Vestigial organs
- (B) Homologous organs
- (C) Analogous organs
- (D) Embryonic organs

Q24.

KMU 2023

All of the following paired organs/structures have homology except:

- (A) Human hand: Bat's wing
- (B) Bat's wing: Wings of butterfly
- (C) Horse front leg: Front flappers of whale
- (D) Wings of bird: wings of flying lizards

Q25.

KMU 2023

Identify fossil bird among the following:

- (A) Archaeopteryx
- (B) Equus
- (C) Python
- (D) Dawn horse

Q26.

NUMS 2023

This theory states that 'mitochondria and chloroplasts are, in effect, ancient bacteria which now live inside the larger cells':

- (A) Darwin's theory of evolution
- (B) Endosymbiont hypothesis
- (C) Neo-Darwinism
- (D) Lamarckism

Q27.

NUMS 2023

The organs which are similar in functions but differ in structure are called:

- (A) Analogous organs
- (B) Homologous organs
- (C) Convergent organs
- (D) Divergent organs

Q28.

KMU 2023

Who formulated the principle that 'ontogeny recapitulates phylogeny'?

- (A) Von Bear
- (B) Haeckel
- (C) Herbert Spencer
- (D) Darwin

Q29.

KMU 2022

The term 'survival of the fittest' was used by:

- (A) Lamarck
- (B) Herbert Spencer
- (C) Darwin
- (D) Mayr

Q30.

UHS 2022

Adaptations that an organism acquires by its own actions during its life span without modifying its genome are:

- (A) Heritable
- (B) Non-heritable
- (C) Can be made heritable through some modification
- (D) Sometimes heritable and other times non-heritable

Q31.

UHS 2022

The animal species on Galapagos resemble species living on the:

- (A) Northern Europe
- (B) Great Britain
- (C) South American mainland
- (D) North American mainland

Q32.

NUMS 2022

He presented the theory of 'origin of species by means of natural selection:

- (A) Darwin
- (B) Lamarck
- (C) Linnaeus
- (D) Hardy-Weinberg

Q33.

KMU 2022

The raw material that is used by natural selection for better survival is/are:

- (A) Variation only
- (B) Mutation only
- (C) Similarity only
- (D) Variation and mutation

Q34.

KMU 2022

A small biological unit that can evolve over time is

- (A) A specie
- (B) A population
- (C) An organism
- (D) Cell

Q35.

BUMHS 2022

Who held to the concept of unity of life?

- (A) Aristotle
- (B) Darwin
- (C) Lamarck
- (D) Alfred

Q36.

DUHS 2022

Evolution is transformation of the form and mode of existence of an organism in such manner that the descendants differ from their ancestor, according to:

- (A) Weismann
- (B) Darwin
- (C) Lamarck
- (D) Mendel

Q37.

UHS 2022

For evolutionary process to occur, which of the following is not a geographical barrier?

- (A) Ocean
- (B) River
- (C) Atmosphere
- (D) Mountains

Q38.

SZABMU 2022

Among the oldest known fossils comes the:

- (A) Prokaryotes
- (B) Amphibians
- (C) Reptiles
- (D) Fishes

Q39.

KMU 2022

The Archaeopteryx is a fossil bird which possesses the characters of both:

- (A) Reptiles and birds
- (B) Fishes and amphibians
- (C) Amphibians and reptiles
- (D) Birds and mammals

Q40.

DUHS 2022

Presence of remnant of pelvic girdle in whale and snake although they never have legs show evidence from:

- (A) Vestigial organs
- (B) Biochemical evidence
- (C) Paleontology
- (D) Embryology

Q41.

DUHS 2022

Artificial selection in breeding provides evidence for evolution is known as:

- (A) Domestication
- (B) Deme
- (C) Gene pool
- (D) Desired trait

Q42.

DUHS 2022

The organs perform same functions in different groups of organisms but are different in this internal structure called as:

- (A) Analogous organs
- (B) Homologous organs
- (C) Radial symmetry
- (D) Asymmetry

Q43.

PMDC 2020

This theory says that mitochondria and chloroplasts are in fact ancient bacteria which now live inside the larger cells.

- (A) Darwin's theory of evolution
- (B) Neo Darwinism
- (C) Endosymbiont theory
- (D) Lamarckism

Q44.

PMDC 2020

_____ occurs because natural selection gives some alleles a better chance of survival than others.

- (A) Evolution
- (B) Fitness
- (C) Crossing over
- (D) Artificial selection

Q45.

PMDC 2020

The organs which are similar in function but different in structure, are called:

- (A) Analogous organs
- (B) Convergent evolution
- (C) Homologous organs
- (D) Divergent evolution

Q46.

MDCAT 2017

According to the theory of natural selection, organisms produce:

- (A) More offspring than supported
- (B) Less offspring than supported
- (C) Offspring according to the resources available
- (D) Offspring to create resources

Q47.

DUHS 2014

Vestiges of vestigial organs are those organs which have ceased to be of any use in their possessor but they persist to reduce from generation after generation. In man, they are:

- (A) Vermiform appendix
- (B) Coccyx
- (C) Nictitating
- (D) All A, B, C

RAPID 5–COLUMN ANSWER KEY

Official PMDC verified answer keys for 16. Evolution.

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Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD
1	A	UHS 2024	11	A	KMU 2024	21	A	KMU 2023	31	C	UHS 2022	41	D	DUHS 2022
2	A	UHS 2024	12	C	SZABMU 2024	22	B	KMU 2023	32	A	NUMS 2022	42	A	DUHS 2022
3	A	KMU 2024	13	A	SZABMU 2024	23	A	UHS 2023	33	D	KMU 2022	43	C	PMDC 2020
4	C	NUMS 2024	14	D	SZABMU 2023	24	B	KMU 2023	34	B	KMU 2022	44	A	PMDC 2020
5	A	UHS 2024	15	B	UHS 2023	25	A	KMU 2023	35	B	BUMHS 2022	45	A	PMDC 2020
6	A	SZABMU 2024	16	A	SZABMU 2023	26	B	NUMS 2023	36	B	DUHS 2022	46	A	MDCAT 2017
7	D	SZABMU 2024	17	C	UHS 2023	27	A	NUMS 2023	37	C	UHS 2022	47	D	DUHS 2014
8	A	UHS 2024	18	A	KMU 2023	28	B	KMU 2023	38	A	SZABMU 2022			
9	A	KMU 2024	19	B	UHS 2023	29	B	KMU 2022	39	A	KMU 2022			
10	A	KMU 2024	20	A	SZABMU 2023	30	B	UHS 2022	40	A	DUHS 2022			

TOTAL
MCQS

47

CORRECT

INCORRECT

BLANK

ACCURACY

%

Scan the booklet QR code to enter answers in
BeambePrep Grind Mode for automated error
autopsies.

PROPOLIS COGNITIVE ERROR AUTOPSIES

Step-by-step conceptual derivations, formula working, and distractor autopsies for every question.

Question #1 Key: (A)

UHS 2024

According to endosymbiosis theory, flagella may have derived by the ingestion of prokaryotes similar to:

CORE CONCEPT AND DERIVATION

The endosymbiotic theory extends beyond mitochondria and chloroplasts, attempting to explain the origins of cellular motility structures.

Solution:

- Lynn Margulis proposed that eukaryotic flagella and cilia originated from a symbiotic relationship with motile, spiral-shaped bacteria.
- Specifically, she suggested they derived from ancient bacteria similar to modern **Spirochetes**, which attached to the surface of early host cells, eventually becoming the specialized motility appendages we see today.

Why other options are incorrect:

- Aerobic bacterium:** These are hypothesized to be the ancestors of mitochondria.
- Cyanobacteria (not listed but relevant):** Ancestors of chloroplasts.

Question #2 Key: (A)

UHS 2024

The idea of inheritance of acquired characteristics was presented by:

CORE CONCEPT AND DERIVATION

Before Mendelian genetics were understood, scientists formulated various hypotheses regarding how traits were inherited.

Solution:

- The French naturalist **Jean-Baptiste Lamarck** presented his theory of evolution in 1809.
- His central premise was the **inheritance of acquired characteristics**, arguing that traits modified through use or disuse during an organism's lifetime could be directly passed to its offspring.

Why other options are incorrect:

- Darwin / Wallace:** Co-discoverers of Natural Selection, which operates on pre-existing, inheritable variations, not lifetime acquisitions.
- Malthus:** Wrote an essay on population growth that heavily influenced Darwin.

Question #3 Key: (A)

KMU 2024

According to Lamarckism, the basis of evolution is:

CORE CONCEPT AND DERIVATION

Lamarck's theory of evolution is fundamentally driven by an organism's internal need to adapt to its environment during its lifetime.

Solution:

- Lamarckism revolves around two core principles: "Use and Disuse" and the **Inheritance of Acquired Characteristics**.
- He theorized that if an organism physically changed its body (e.g., stretching a neck to reach high leaves), this somatic change would fundamentally alter the "hereditary material" passed to its offspring.

Why other options are incorrect:

- Natural selection / Survival of the fittest:** The basis of Darwinism.
- Mutation:** The basis of modern genetics (Neo-Darwinism), unknown in Lamarck's time.

Question #4 Key: (C)

NUMS 2024

Children of a mason do not inherit strong muscles developed by father due to hard labour. This is an example o...

CORE CONCEPT AND DERIVATION

Modern genetics draws a strict line between somatic (body) cells and germ-line (reproductive) cells.

Solution:

- A mason develops strong muscles due to intense physical labor (an acquired, somatic trait).
- Because this environmental stress does not alter the DNA sequence in the mason's sperm cells, the muscular phenotype cannot be passed to his offspring.
- This scenario is a direct textbook refutation of Lamarckism, perfectly demonstrating the principle of **not inheriting acquired characters**.

Why other options are incorrect:

- This situation highlights the failure of the "Use and disuse" theory to explain inheritance, making option C the exact descriptive conclusion of the phenomenon.

Question #5 Key: (A)

UHS 2024

Which of the following statements about natural selection is not true?

CORE CONCEPT AND DERIVATION

Natural selection is driven entirely by environmental pressures, devoid of conscious intent or planning.

Solution:

- The statement "**It is selected by a breeder**" is completely **false** regarding natural selection.
- When a human breeder intentionally selects traits, the process is explicitly called **Artificial Selection**.
- Natural selection occurs naturally via environmental challenges (predation, climate, food availability).

Why other options are incorrect:

- Natural selection does act on heritable variations, does improve adaptations, and is strictly regional (a trait advantageous in an arctic environment might be lethal in a desert).

Question #6 Key: (A)

SZABMU 2024

Which of the following is the main point of Darwinism?

CORE CONCEPT AND DERIVATION

Darwin summarized his entire evolutionary theory into a single, elegant phrase.

Solution:

- The central, overarching theme of Darwinism is **Descent with modification**.
- This concept means that all current living species are descendants of older, ancestral species. As lineages branched off through generations, they accumulated modifications (adaptations) suited to their specific ways of life.

Why other options are incorrect:

- **Use and disuse / Acquired characters:** These are the main points of Lamarckism.
- **Artificial Selection:** This was a tool Darwin used to explain natural selection, not the main point of biological evolution itself.

Question #7 Key: (D)

SZABMU 2024

The Darwin's observation on discovery and investigation on fossils is called

CORE CONCEPT AND DERIVATION

Different fields of biological science provide distinct lines of evidence for evolution.

Solution:

- The scientific study of prehistoric life through the discovery, investigation, and analysis of **fossils** is strictly known as **Paleontology**.
- Darwin used paleontological evidence extensively to show that ancient extinct species shared similarities with modern living species (e.g., giant fossil sloths compared to living tree sloths in South America).

Why other options are incorrect:

- **Biogeography:** The study of the geographical distribution of species.
- **Homology:** The study of structural similarities due to shared ancestry.
- **Chronology:** The general study of time and historical order.

Question #8 Key: (A)

UHS 2024

Identify the correct pair of vestigial organs:

CORE CONCEPT AND DERIVATION

Vestigial organs are physical remnants of structures that had important functions in our evolutionary ancestors but have lost their primary purpose in modern humans.

Solution:

- **Vermiform appendix:** A shrunken remnant of a larger cecum used by our distant herbivorous ancestors to digest tough plant matter.
- **Ear Muscles (auricular muscles):** In many mammals (like dogs and horses), these muscles pivot the ears to localize sound. In humans, they are largely non-functional.
- Therefore, **Ear Muscles & Vermiform appendix** is the correct pair of vestigial organs.

Why other options are incorrect:

- The **Heart** and **Liver** are highly active, vital organs essential for immediate human survival; they are definitively not vestigial.

Question #9 Key: (A)

KMU 2024

What best describes the hind leg bones seen in the whale?

CORE CONCEPT AND DERIVATION

Anatomical oddities inside modern organisms offer direct proof of their evolutionary lineage.

Solution:

- Modern whales evolved from four-legged terrestrial mammals.
- As they transitioned to a fully aquatic lifestyle, their hind limbs became a hindrance to streamlined swimming.
- Through natural selection, the hind legs shrank over millions of years. The remaining tiny pelvic and leg bones buried deep inside a modern whale's blubber are classic **vestigial structures that had a function in a terrestrial ancestor**.

Why other options are incorrect:

- **Homologous to bat wings:** A whale's *front flipper* is homologous to a bat wing, but the *hind leg bones* are remnants of legs, not forelimbs.
- **Fossil:** They are living bones inside a modern animal, not fossilized rocks.

Question #10 Key: (A)

KMU 2024

Wings of birds and that of flying lizards provide evidence of:

CORE CONCEPT AND DERIVATION

When distinct lineages face identical environmental challenges, they often arrive at similar engineering solutions independently.

Solution:

- Birds and flying lizards (like the Draco lizard) are not closely related evolutionary groups.
- The wings of a bird are modified forelimbs with feathers. The "wings" of a flying lizard are usually elongated rib bones covered in a membrane of skin.
- Because they evolved from completely different anatomical structures to solve the same problem (gliding/flight), this represents **Convergent evolution** resulting in analogous structures.

Why other options are incorrect:

- **Divergent evolution / Same origin:** This would produce homologous structures (like a human arm and a bird wing), where the base anatomy is identical but the function might differ.

Question #11 Key: (A)

KMU 2024

The embryological stages of anatomical features show similarity in:

CORE CONCEPT AND DERIVATION

Comparative embryology reveals profound ancestral similarities that are often lost by adulthood.

Solution:

- During early embryonic development, **all vertebrates** (fishes, amphibians, reptiles, birds, and mammals) look astonishingly similar.
- They all develop a post-anal tail and pharyngeal gill slits/pouches at some stage in their embryogenesis.
- This shared developmental pathway is strong evidence that all vertebrates descended from a common aquatic ancestor.

Why other options are incorrect:

- **All living things:** Plants and fungi do not share vertebrate embryological stages.
- **Jellyfish:** Jellyfish are invertebrates (Cnidarians) and have entirely different embryological development (they lack a mesoderm and notochord).

Question #12 Key: (C)

SZABMU 2024

The reduction of population size with some specific allele and genotype due to natural disaster is called:

CORE CONCEPT AND DERIVATION

Genetic drift can drastically alter allele frequencies when populations undergo rapid, unselective downsizing.

Solution:

- When a sudden environmental catastrophe (like a flood, fire, or earthquake) indiscriminately wipes out a large portion of a population, the surviving individuals may not genetically represent the original population.
- This severe, random reduction in population size and genetic diversity is called the **Bottleneck effect**.

Why other options are incorrect:

- **Founder effect:** Occurs when a few individuals willingly migrate and establish a new isolated colony, not due to a disaster killing the majority.
- **Mutation:** The creation of a new allele, not the destruction of a population.

Question #13 Key: (A)

SZABMU 2024

When humans purposefully apply selection pressure to populations, the process is known as:

CORE CONCEPT AND DERIVATION

Evolutionary mechanisms can be steered by human intent.

Solution:

- **Artificial selection** (or selective breeding) occurs when humans purposefully act as the selective pressure.
- By deliberately breeding individuals that possess favorable traits (e.g., higher milk yield in cows, larger kernels in corn), humans accelerate and direct evolutionary changes within a population over relatively few generations.

Why other options are incorrect:

- **Natural selection:** Selection is driven entirely by natural environmental factors, without any purposeful intent.
- **Genetic drift:** A totally random change in allele frequencies due to chance events, unrelated to purposeful selection.

Question #14 Key: (D)

SZABMU 2023

A general formula is derived by one of the following scientist for calculating the frequencies of alleles and ...

CORE CONCEPT AND DERIVATION

Population genetics relies on mathematical models to determine if an evolving population is stable (in equilibrium).

Formula:

$$p^2 + 2pq + q^2 = 1$$

Solution:

- G.H. Hardy (a mathematician) and Wilhelm Weinberg (a physician) independently derived this principle in 1908.
- The **Hardy-Weinberg** equation allows scientists to calculate expected allele and genotype frequencies in a stable, non-evolving population under ideal conditions.

Why other options are incorrect:

- **Darwin/Lamarck/Linnaeus:** These prominent early biologists did not develop the mathematical foundations of population genetics; their work preceded the integration of genetics and evolution (the Modern Synthesis).

Question #15 Key: (B)

UHS 2023

According to evolutionary studies, prokaryotes may have arisen around:

CORE CONCEPT AND DERIVATION

The timeline of life on Earth is established through the radiometric dating of ancient rocks and fossils.

Solution:

- Earth is estimated to be about 4.5 to 4.6 billion years old.
- The oldest known definitive fossils of living organisms (stromatolites formed by ancient cyanobacteria/prokaryotes) date back to approximately **3.5 billion years ago**.
- These simple single-celled organisms dominated the Earth for billions of years before the first eukaryotes appeared.

Why other options are incorrect:

- **4.5 billion:** Roughly the formation of Earth, too early for life.
- **2.5 billion:** Eukaryotes began emerging around roughly this era, but prokaryotes are much older.
- **5.5 billion:** Older than the solar system itself.

Question #16 Key: (A)

SZABMU 2023

When humans purposefully apply selection pressure to populations, the process is known as:

CORE CONCEPT AND DERIVATION

Selection pressure can be exerted either by environmental factors or by intentional human intervention.

Solution:

- When **humans** act as the selective agent—choosing specific plants or animals with desirable traits to reproduce—the process is called **Artificial selection**.
- This method has been used for millennia to create modern agricultural crops, livestock breeds, and dog breeds from wild ancestors.

Why other options are incorrect:

- **Natural selection:** The environment dictates survival and reproductive success, not human preference.
- **Genetic drift:** A random fluctuation in allele frequencies, not a purposeful selection.

Question #17 Key: (C)

UHS 2023

Which of the following is not an example of disuse of organs?

CORE CONCEPT AND DERIVATION

The "use and disuse" theory (Lamarckism) or the modern concept of vestigial organs refers to anatomical structures losing function over evolutionary time due to lack of environmental necessity.

Solution:

- The **shedding of milk teeth (deciduous teeth)** is a programmed, physiological developmental process that occurs in all mammals to make way for permanent adult teeth.
- It is an active developmental stage, **not** an evolutionary consequence of an organ being "disused" over generations.

Why other options are incorrect:

- **Snake's legs / Ear muscles:** These are classic vestigial structures resulting from long-term evolutionary disuse.
- **Muscle atrophy:** Results from short-term physical disuse in an individual's lifetime.

Question #18 Key: (A)

KMU 2023

Who proposed the concept that an organism can pass on acquired modifications to its offspring?

CORE CONCEPT AND DERIVATION

Early evolutionary thought included the idea that traits developed during a single lifetime could be transmitted to the next generation.

Solution:

- The French biologist **Jean-Baptiste Lamarck** proposed the first cohesive theory of evolution in 1809.
- His primary mechanism was the **inheritance of acquired characteristics**, which suggested that modifications acquired by an organism through use or disuse of a body part could be directly passed on to its offspring (e.g., giraffes stretching their necks).
- Modern genetics has since proven this mechanism incorrect.

Why other options are incorrect:

- **Darwin:** Proposed natural selection, acting on inherited variations, not acquired somatic traits.
- **Malthus:** An economist who wrote about population growth limits.

Question #19 Key: (B)

UHS 2023

Which of the following is the main point of Darwinism?

CORE CONCEPT AND DERIVATION

Darwinian evolution hinges on the pre-existing genetic differences among individuals within a population.

Solution:

- While overproduction and survival of the fittest are key components, the absolute foundational requirement for natural selection is **Variation**.
- Without variation in traits, natural selection has nothing to "select" from; no individual would possess an advantage over another, making evolutionary adaptation impossible.

Why other options are incorrect:

- **Disuse of organ:** This is a hallmark of Lamarckism, not Darwinism.
- **Over production / Unity of life:** These are observations and conclusions of the theory, but variation acts as the fundamental raw material driving the mechanism.

Question #20 Key: (A)

SZABMU 2023

Which statement is not correct for the Darwin's theory of natural selection?

CORE CONCEPT AND DERIVATION

Natural selection is highly deterministic, not a random lottery.

Solution:

- The statement "**Survival in the struggle for existence is random**" is strictly **incorrect**.
- Darwin's theory explicitly states that survival is heavily influenced by inherited traits.
- Organisms with variations best suited to the local environment are naturally selected to survive and reproduce, making the process decidedly non-random.

Why other options are incorrect:

- **B, C, and D** are all core, accurate tenets of Darwin's theory: Fit individuals reproduce more, causing a gradual accumulation of advantageous traits that can eventually lead to speciation.

Question #21 **Key: (A)**

KMU 2023

According to Neo-Darwinism, which of the following is a cause of evolution?

CORE CONCEPT AND DERIVATION

Neo-Darwinism (the Modern Synthesis) combines Darwinian natural selection with Mendelian genetics and modern population dynamics to explain speciation.

Solution:

- **Reproductive isolation** is a primary driver of macroevolution and speciation.
- When populations are prevented from interbreeding (due to geographic, temporal, or behavioral barriers), their gene pools diverge over time due to differing selective pressures and genetic drift, ultimately forming new species.

Why other options are incorrect:

- **Infinite large population:** According to the Hardy-Weinberg principle, an infinitely large population actually prevents evolution (genetic drift is minimized, maintaining equilibrium).
- **Environmental stability:** Stable environments limit evolutionary change, whereas changing environments force adaptation.

Question #22 **Key: (B)**

KMU 2023

Darwin's 'Origin of species by natural selection' is mainly concerned with:

CORE CONCEPT AND DERIVATION

Darwin's primary focus was explaining how organisms become so perfectly suited to their specific environments.

Solution:

- The central theme of Darwin's "Origin of Species" is how populations change over time to become better fitted to their local environments.
- This process of modifying traits for survival is known as **Adaptation**.
- Natural selection is the mechanism, and adaptation is the resulting biological outcome that Darwin meticulously documented.

Why other options are incorrect:

- **Origin of life:** Darwin famously did not address how the very first spark of life began; he only addressed how life diversified *after* it existed.
- **Speciation / Extinction:** While discussed as consequences of natural selection, the driving narrative of the book is the mechanical process of adaptation.

Question #23 **Key: (A)**

UHS 2023

Which of the following type of organs are supposed to be functional in ancestral species rather than in presen...

CORE CONCEPT AND DERIVATION

Evolutionary baggage is often carried forward in a species' anatomy long after it ceases to be useful.

Solution:

- **Vestigial organs** are anatomical features that were fully developed and highly functional in a species' evolutionary ancestors.
- As the organism evolved and adapted to new environmental niches, these organs lost their original purpose.
- Consequently, they became reduced in size and function in present-day descendants (e.g., the human appendix, whale pelvis).

Why other options are incorrect:

- **Homologous / Analogous organs:** These describe highly functional organs in present-day organisms compared across different species.

Question #24 **Key: (B)**

KMU 2023

All of the following paired organs/structures have homology except:

CORE CONCEPT AND DERIVATION

Homologous structures arise from shared ancestry, while analogous structures arise from convergent evolution due to similar functional demands.

Solution:

- Homology implies a shared embryonic origin and underlying bone structure (e.g., the pentadactyl limb).
- A **Bat's wing** (mammalian bone structure) and the **Wings of a butterfly** (insect chitin structure) do **not** share a common ancestral origin.
- They only share a function (flight), making them purely **analogous** structures, not homologous.

Why other options are incorrect:

- **Human hand & Bat wing / Horse leg & Whale flipper / Bird wing & Lizard wing:** All these pairs represent tetrapod forelimbs derived from a common reptilian/amphibian ancestor, thus they are homologous.

Question #25 Key: (A)

KMU 2023

Identify fossil bird among the following:

CORE CONCEPT AND DERIVATION

Transitional fossils provide a snapshot of evolution in progress, linking major vertebrate groups.

Solution:

- **Archaeopteryx** (meaning "ancient wing") is the most famous fossil linking non-avian theropod dinosaurs to modern birds.
- It lived during the Late Jurassic period and possessed a mix of reptilian features (teeth, long bony tail) and avian features (flight feathers, wishbone).

Why other options are incorrect:

- **Equus:** The modern genus of horses, zebras, and donkeys.
- **Dawn horse (Eohippus/Hyracotherium):** An early fossil ancestor of the horse, not a bird.
- **Python:** A modern extant genus of non-venomous snakes.

Question #26 Key: (B)

NUMS 2023

This theory states that 'mitochondria and chloroplasts are, in effect, ancient bacteria which now live inside ...

CORE CONCEPT AND DERIVATION

The origin of complex eukaryotic cells is explained by the assimilation of simpler prokaryotic cells.

Solution:

- The **Endosymbiont hypothesis** (formulated robustly by Lynn Margulis) proposes that crucial eukaryotic organelles (mitochondria and chloroplasts) originated as free-living ancient bacteria.
- These bacteria were engulfed by a primitive host cell, forming a mutually beneficial (symbiotic) relationship.
- Evidence includes the fact that mitochondria and chloroplasts have their own circular DNA, ribosomes, and reproduce via binary fission, exactly like modern bacteria.

Why other options are incorrect:

- Darwinism, Neo-Darwinism, and Lamarckism describe macro/micro-evolutionary mechanisms at the population and organismal level, not the specific cellular origins of organelles.

Question #27 Key: (A)

NUMS 2023

The organs which are similar in functions but differ in structure are called:

CORE CONCEPT AND DERIVATION

When unrelated lineages face similar environmental pressures, they may evolve similar adaptations independently.

Solution:

- Structures that serve the same purpose (e.g., flight, swimming) but have entirely different evolutionary origins and internal anatomy are called **Analogous organs**.
- They are the direct result of convergent evolution. Examples include insect wings vs. bird wings, or the streamlined shape of sharks (fish) and dolphins (mammals).

Why other options are incorrect:

- **Homologous organs:** Similar structural origin, but often adapted for different functions.
- **Convergent/Divergent:** These terms describe the evolutionary process, while "analogous/homologous" strictly name the organs themselves.

Question #28 Key: (B)

KMU 2023

Who formulated the principle that 'ontogeny recapitulates phylogeny'?

CORE CONCEPT AND DERIVATION

Early comparative embryology sought to link developmental stages to evolutionary history.

Solution:

- The German biologist **Ernst Haeckel** formulated the Biogenetic Law, famously summarized as "**ontogeny recapitulates phylogeny**."
- This phrase suggests that the developmental stages of an embryo (ontogeny) represent an accelerated playback of its species' evolutionary history (phylogeny).
- While historically significant, modern science views this as an oversimplification; embryos share similarities because they share common ancestral developmental genes, not because they literally become adult versions of their ancestors in the womb.

Why other options are incorrect:

- **Von Baer:** Formulated rules of embryology that actually opposed Haeckel's strict recapitulation theory.
- **Darwin / Spencer:** Did not coin this specific embryological principle.

Question #29 Key: (B)

KMU 2022

The term 'survival of the fittest' was used by:

CORE CONCEPT AND DERIVATION

The term "survival of the fittest" refers to the reproductive success of organisms best suited to their environment. It is closely associated with natural selection.

Solution:

- British philosopher and sociologist **Herbert Spencer** first coined the phrase "survival of the fittest" after reading Charles Darwin's *On the Origin of Species*.
- He applied this concept to human societies and economics, a doctrine later known as Social Darwinism.
- Darwin later adopted the phrase in the 5th edition of his book as a synonym for natural selection.

Why other options are incorrect:

- Darwin:** Formulated the theory of natural selection but did not coin this specific phrase.
- Lamarck:** Known for the theory of inheritance of acquired characteristics.
- Mayr:** A prominent 20th-century evolutionary biologist known for the biological species concept.

Question #30 Key: (B)

UHS 2022

Adaptations that an organism acquires by its own actions during its life span without modifying its genome are...

CORE CONCEPT AND DERIVATION

Evolution operates on genetic variations that can be passed from parent to offspring. Traits acquired purely through environmental influence or physical actions do not alter the DNA sequence in gametes.

Solution:

- According to modern genetics, modifications acquired during an organism's lifetime (like enlarged muscles from weightlifting) are strictly somatic (body cell) changes.
- Because they do not modify the organism's genome (the DNA in reproductive cells), these traits cannot be passed to the next generation.
- Therefore, they are strictly **non-heritable**.

Why other options are incorrect:

- Heritable / Can be made heritable:** Lamarck historically believed acquired traits were heritable, but this was disproven by modern genetics (e.g., Weismann's experiments).

Question #31 Key: (C)

UHS 2022

The animal species on Galapagos resemble species living on the:

CORE CONCEPT AND DERIVATION

Biogeography provides critical evidence for evolution, illustrating how geographical proximity influences species relationships.

Solution:

- During his voyage on the HMS Beagle, Darwin noted that the unique flora and fauna of the Galapagos Islands were closely related to those on the nearest mainland.
- The Galapagos Islands are located off the western coast of South America.
- Therefore, the species on the islands most closely resembled those living on the **South American mainland**, suggesting they were colonized by strays from there that subsequently diversified.

Why other options are incorrect:

- The flora and fauna did not closely resemble species from Europe or North America, which geographically and climatically do not share recent evolutionary history with the Galapagos.

Question #32 Key: (A)

NUMS 2022

He presented the theory of 'origin of species by means of natural selection':

CORE CONCEPT AND DERIVATION

The publication of evolutionary theories fundamentally shifted biological sciences in the 19th century.

Solution:

- Charles Darwin** wrote and published the groundbreaking book "*On the Origin of Species by Means of Natural Selection*" in 1859.
- This work introduced the concept that populations evolve over generations through a process of natural selection.

Why other options are incorrect:

- Lamarck:** Published his theory of evolution based on the inheritance of acquired characteristics much earlier (1809).
- Linnaeus:** The father of modern taxonomy; he believed in the fixity of species.
- Hardy-Weinberg:** Developed a mathematical baseline for population genetics in the early 20th century.

Question #33 Key: (D)

KMU 2022

The raw material that is used by natural selection for better survival is/are:

CORE CONCEPT AND DERIVATION

Natural selection cannot operate without differences among individuals in a population.

Solution:

- **Mutations** are the ultimate source of new alleles and genetic novelties.
- These mutations lead to **variations** within a population.
- Natural selection acts upon these variations, selecting for traits that enhance survival and reproduction in a specific environment.
- Therefore, both variation and mutation act as the raw material for evolutionary change.

Why other options are incorrect:

- **Similarity only:** Clones with identical genetics offer no variation for natural selection to act upon; the population would be equally susceptible to environmental pressures.
- Selecting "only" variation or "only" mutation is incomplete, as they are inherently linked in providing evolutionary raw material.

Question #34 Key: (B)

KMU 2022

A small biological unit that can evolve over time is ____

CORE CONCEPT AND DERIVATION

Evolution operates on groups of interbreeding individuals, not on solitary entities.

Solution:

- An individual organism cannot evolve during its lifetime; it can only develop or acclimate.
- Evolution is defined as the change in allele frequencies over time.
- The smallest biological unit capable of exhibiting this change over successive generations is a **population**.

Why other options are incorrect:

- **An organism / Cell:** Individuals do not evolve; they retain the same genetic sequence from birth to death.
- **A specie:** While species evolve, a population is a *smaller*, localized unit of a species that is the fundamental operating level of microevolution.

Question #35 Key: (B)

BUMHS 2022

Who held to the concept of unity of life?

CORE CONCEPT AND DERIVATION

The "unity of life" is a foundational evolutionary concept describing the shared ancestry of all living organisms.

Solution:

- **Charles Darwin** emphasized the "unity of life" in his theory of descent with modification.
- He proposed that all organisms are related through descent from a common ancestor that lived in the remote past.
- He visualized the history of life as a branching tree, showing how diverse species share common biological characteristics due to shared lineages.

Why other options are incorrect:

- **Aristotle:** Believed species were fixed and arranged them on a strict hierarchy (Scala Naturae).
- **Lamarck:** Focused on linear progression toward perfection rather than a unified branching descent from a single ancestor.

Question #36 Key: (B)

DUHS 2022

Evolution is transformation of the form and mode of existence of an organism in such manner that the descenda...

CORE CONCEPT AND DERIVATION

The core definition of evolution encompasses the gradual change of populations resulting in descendants that are distinct from their ancestors.

Solution:

- **Charles Darwin** defined evolution fundamentally as "descent with modification."
- This means that as lineages progress through time, they accumulate genetic and phenotypic changes, transforming their form and mode of existence so that modern descendants differ significantly from their ancient ancestors.

Why other options are incorrect:

- **Lamarck:** Argued for inheritance of acquired characteristics, a specific incorrect mechanism.
- **Weismann:** Famous for the germ-plasm theory, disproving Lamarckism.
- **Mendel:** The father of genetics who discovered inheritance laws, not the broader theory of evolutionary transformation.

Question #37 Key: (C)

UHS 2022

For evolutionary process to occur, which of the following is not a geographical barrier?

CORE CONCEPT AND DERIVATION

Geographical isolation (allopatric speciation) requires physical barriers that prevent the free movement and interbreeding of terrestrial or aquatic populations.

Solution:

- A geographical barrier is a physical landscape feature that separates populations, cutting off gene flow.
- **Oceans, Rivers, and Mountains** are classic examples of physical land/water barriers that restrict organism movement.
- The **Atmosphere** is a continuous gaseous envelope surrounding the Earth. It does not act as a physical geographical boundary that divides surface-dwelling populations into isolated groups.

Why other options are incorrect:

- Oceans, rivers, and mountains directly block physical migration and lead to reproductive isolation.

Question #38 Key: (A)

SZABMU 2022

Among the oldest known fossils comes the:

CORE CONCEPT AND DERIVATION

The fossil record provides a chronological history of life on Earth, showing a progression from simple unicellular life to complex multicellular organisms.

Solution:

- The oldest undisputed fossil evidence points to the existence of **prokaryotes** (ancient bacteria).
- These fossilized remnants (often found in stromatolites) date back approximately 3.5 billion years.
- All other complex life forms (fishes, amphibians, reptiles) evolved much later in Earth's geological history.

Why other options are incorrect:

- Fishes, amphibians, and reptiles are all vertebrates (eukaryotes) that appeared hundreds of millions of years ago, which is billions of years after prokaryotes.

Question #39 Key: (A)

KMU 2022

The *Archaeopteryx* is a fossil bird which possesses the characters of both:

CORE CONCEPT AND DERIVATION

Transitional fossils exhibit traits common to both an ancestral group and its derived descendant group.

Solution:

- **Archaeopteryx** is one of the most famous transitional fossils in paleontology.
- It shows strong evidence that birds evolved from theropod reptiles (dinosaurs).
- It possessed **reptilian characters** (a long bony tail, teeth, and claws on its wings) alongside **avian (bird) characters** (feathers and wings).

Why other options are incorrect:

- It lacks characteristics tying it directly to amphibians, fishes, or mammals in a transitional sense.

Question #40 Key: (A)

DUHS 2022

Presence of remnant of pelvic girdle in whale and snake although they never have legs show evidence from:

CORE CONCEPT AND DERIVATION

Evolution leaves anatomical "clues" in modern organisms that point to the physical structures of their ancestors.

Solution:

- Whales and snakes evolved from four-legged (tetrapod) ancestors.
- Over time, as their mode of locomotion changed, the functional need for hind legs was lost.
- The remnants of the pelvic girdle and hind limb bones found inside their bodies are **vestigial organs**—structures reduced in size and lacking their original function, providing powerful evidence of descent with modification.

Why other options are incorrect:

- **Paleontology**: Involves the study of fossils, not structures in living organisms.
- **Biochemical / Embryology**: Refers to DNA/proteins and developmental stages, respectively, rather than adult anatomical remnants.

Question #41 Key: (D)

DUHS 2022

Artificial selection in breeding provides evidence for evolution is known as:

CORE CONCEPT AND DERIVATION

Selective breeding mechanisms.

Solution: Artificial selection operates when breeders deliberately select organisms exhibiting a **desired trait** to parent the next generation, demonstrating that species traits can change over time.

Question #42 Key: (A)

DUHS 2022

The organs perform same functions in different groups of organisms but are different in this internal structur...

CORE CONCEPT AND DERIVATION

Different evolutionary lineages can independently develop similar adaptations in response to similar environmental challenges.

Solution:

- Structures that look similar and perform the **same functions** but have completely **different internal anatomy and embryonic origins** are called **Analogous organs**.
- For example, the wing of a bat (mammal) and the wing of a butterfly (insect) are both used for flight, but their internal structures are unrelated.
- This represents convergent evolution.

Why other options are incorrect:

- **Homologous organs:** Have the same internal structure but often different functions (divergent evolution).
- **Symmetry:** Refers to body plans, not specific structural adaptations.

Question #43 Key: (C)

PMDC 2020

This theory says that mitochondria and chloroplasts are in fact ancient bacteria which now live inside the lar...

CORE CONCEPT AND DERIVATION

The origin of eukaryotic organelles is a key evolutionary concept explaining how complex cells developed from simpler prokaryotic ancestors.

Solution:

- The **Endosymbiotic theory** (or endosymbiont hypothesis) states that mitochondria and chloroplasts were once free-living ancient bacteria (prokaryotes).
- They were engulfed by an ancestral eukaryotic cell and established a mutually beneficial (symbiotic) relationship.
- Mitochondria are thought to derive from aerobic eubacteria, while chloroplasts derive from photosynthetic bacteria (cyanobacteria).

Why other options are incorrect:

- **Darwin's theory / Neo-Darwinism:** Focus on natural selection and genetic variation on a macroscopic or population scale, not the specific intracellular origin of organelles.
- **Lamarckism:** Focuses on the inheritance of acquired traits based on use and disuse, which is historically inaccurate.

Question #44 Key: (A)

PMDC 2020

_____ occurs because natural selection gives some alleles a better chance of survival than others.

CORE CONCEPT AND DERIVATION

Natural selection acts on the genetic variation within a population, favoring alleles that confer a survival and reproductive advantage.

Solution:

- When specific alleles provide a survival advantage, they increase in frequency over generations.
- This gradual change in the genetic makeup (allele frequencies) of a population over time is the very definition of **Evolution**.

Why other options are incorrect:

- **Fitness:** This is the measure of reproductive success, not the resulting process of change itself.
- **Crossing over:** A mechanism during meiosis that creates genetic variation, but it is not caused by natural selection.
- **Artificial selection:** This is driven by human preference, not natural environmental pressures.

Question #45 **Key: (A)**

PMDC 2020

The organs which are similar in function but different in structure, are called:

CORE CONCEPT AND DERIVATION

Comparative anatomy helps classify evolutionary pathways based on structural similarities and functional adaptations.

Solution:

- **Analogous organs** are structures that perform a similar function (e.g., flying) but have entirely different underlying anatomical blueprints and embryonic origins.
- Examples include the wings of insects and the wings of birds.
- They arise due to convergent evolution, where unrelated species adapt to similar environmental pressures.

Why other options are incorrect:

- **Homologous organs:** Have the same structural origin but may perform different functions (e.g., human arm and bat wing).
- **Convergent/Divergent evolution:** These are evolutionary processes, whereas the question specifically asks for the name of the organs.

Question #46 **Key: (A)**

MDCAT 2017

According to the theory of natural selection, organisms produce:

CORE CONCEPT AND DERIVATION

A fundamental premise of Darwinian evolution is the inherent capacity of populations to grow exponentially if unconstrained by environmental limits.

Solution:

- Darwin observed that all species are capable of producing **more offspring than the environment can support**.
- This overproduction leads to a struggle for existence (competition for limited resources such as food, space, and mates).
- Only a fraction of these offspring survive to reproduce, which drives the mechanism of natural selection.

Why other options are incorrect:

- If organisms produced equal or fewer offspring than resources could support, there would be no intense competition, and a primary driver of natural selection would be absent.

Question #47 **Key: (D)**

DUHS 2014

Vestiges of vestigial organs are those organs which have ceased to be of any use in their possessor but they p...

CORE CONCEPT AND DERIVATION

Vestigial organs are historical remnants of anatomical structures that served a functional purpose in an organism's evolutionary ancestors but have lost most or all of their original function.

Solution:

- **Vermiform appendix:** A remnant of a larger cecum used by herbivorous ancestors to digest cellulose.
- **Coccyx (tailbone):** The remnant of a lost tail from primate ancestors.
- **Nictitating membrane (plica semilunaris):** A remnant of a functional third eyelid found in other vertebrates like reptiles and birds.
- Therefore, **All A, B, C** are vestigial structures in humans.

Why other options are incorrect:

- Choosing only A, B, or C is incorrect because all three are classic textbook examples of human vestigial organs.