	INDIAN SCHOOL AL WADI AL KABIR	
Class: XII	**Department: SCIENCE 2026 – 2027** **SUBJECT: BIOLOGY**	**Date: 18/08/2026**
Worksheet: 06 **With answers**	**UNIT- VII- GENETICS AND EVOLUTION** **CHAPTER:6- EVOLUTION**	**Note:** **A4 FILE FORMAT**
CLASS & SEC:	**NAME OF THE STUDENT:**	**ROLL NO.**

I. MULTIPLE CHOICE QUESTIONS (1M)

1. Which of the following was absent in the atmosphere of primitive Earth?
   A. Methane
   B. Ammonia
   C. Water vapour
   D. Oxygen
2. The concept of "Chemical Evolution" was proposed by which of the following scientists?
   A. Charles Darwin
   B. Oparin and Haldane
   C. Louis Pasteur
   D. S.L. Miller
3. Flippers of penguins and dolphins are examples of which type of evolution?
   A. Divergent evolution
   B. Convergent evolution
   C. Co-evolution
   D. Adaptive radiation
4. In a stable population under the Hardy-Weinberg principle, the frequency of homozygous dominant individuals is represented by which term?
   A. p
   B. q^2
   C. p^2
   D. 2pq
5. According to Hugo de Vries, what is the mechanism of evolution?
   A. Minor variations
   B. Saltation
   C. Phenotypic plasticity
   D. Slow directional change

Two statements are given - one labelled as **Assertion (A)** and the other labelled as **Reason (R)**. Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

A. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct

explanation of the Assertion (A).

C. Assertion (A) is true, but Reason (R) is false.

D. Assertion (A) is false, but Reason (R) is true.

6. **Assertion (A):** *Homo habilis* was called the tool-maker or handyman.
   Reason (R): They had a cranial capacity between 650–800 cc and probably did not eat meat.
7. **Assertion (A):** Darwin's finches show an amazing diversity of beaks on the Galapagos islands.
   Reason (R): They all evolved from a common ancestral seed-eating finch that adapted to different food sources.
8. **Assertion (A):** Herbicide-resistant varieties of weeds have been selected out in a much shorter time scale.
   Reason (R): Evolution by natural selection is an absolute, deterministic process directed by a pre-planned goal.
9. **Assertion (A):** Sometimes the change in allele frequency is so different in a new sample of population that they become a new species.
   Reason (R): The original drifted population becomes founders, and the effect is called founder effect.

II. <u>VERY SHORT ANSWER TYPE QUESTIONS(2M)</u>

10. What is adaptive radiation? Explain with a suitable example. (CBSE 2023)
11. Why are the wings of a butterfly and the wings of a bird called analogous organs? What type of evolution do they show? (CBSE 2020)
12. Explain the observation made on the moth population in England after industrialisation. (CBSE 2024)

III. <u>SHORT ANSWER TYPE QUESTIONS (3M)</u>

13. Describe the Urey and Miller experiment with a neat, labelled diagram. What did it prove?
14. Distinguish between Homologous and Analogous organs. Give one plant example and one animal example for each.

IV. <u>CASE STUDY BASED QUESTIONS (4M)</u>

15. When a small group of individuals migrates or is separated by chance from a larger parental population, the allelic frequencies in the new group can be drastically different from the original pool. This random change in gene frequency, operating purely by chance rather than natural selection, is a major factor in microevolution. If this isolated group successfully establishes a new colony, their limited genetic variety forms the basis of all future generations. Over time, the change in allele frequency becomes so different in this new sample of the population that they become a completely new species. The original drifted population acts as the root of this divergence, and the resulting phenotypic and genotypic shift is deeply studied under population genetics. This phenomenon proves that evolution is a stochastic process based on chance events in nature rather than a strictly deterministic, pre-planned journey.

    A. What is the specific genetic term given to the evolutionary phenomenon described in the passage where a small drifted population becomes a new species?

    B. Identify and state the size condition of the population where this random change in allele frequencies by chance is most prominent.

C. Mention the algebraic equation that represents genetic equilibrium in a stable population, and state what happens to this equation when the phenomenon described above occurs.

D. How does the mechanism of evolution described in the passage differ fundamentally from Charles Darwin's concept of natural selection regarding the directional nature of evolution?

V. LONG ANSWER TYPE QUESTIONS (5M)

16. (i) What are the two major concepts proposed by Charles Darwin?
    (ii) How did Hugo de Vries' views on evolution differ from Darwin's theory?
    (iii) Explain "Evolution by Anthropogenic Action" with two examples.
17. What is the Hardy-Weinberg Principle? State the five factors that affect the equilibrium.

VI BOARD QUESTIONS

18. (i) Mention any two characteristics of Neanderthal man that lived in East and Central Asia.
    (ii) Identify the following hominids with respect to human evolution:
    (I) Brain capacity 900 cc, probably ate meat.
    (II) First human-like with brain capacity 650 – 800 cc. (CBSE 2026)
19. The allele for brown eyes (B) is dominant over blue eyes (b). In a population, 36% of individuals have blue eyes. Assuming Hardy-Weinberg equilibrium, calculate:
    (i) Frequency of allele B
    (ii) Percentage of heterozygous individuals
    (iii) Percentage of individuals that are homozygous dominant (Working to be shown) (CBSE 2026)

Answer Key

Q. No.	Answer
1	D. Oxygen
2	B. Oparin and Haldane
3	B. Convergent evolution
4	C. p^2
5	B. Saltation
	ASSERTION & REASONING
6.	B. Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
7.	A. Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of the Assertion (A).
8.	C. Assertion (A) is true, but Reason (R) is false.
9.	B. Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
II	**VERY SHORT ANSWER TYPE QUESTIONS(2M)**
10.	Adaptive radiation is an evolutionary process where different species evolve from a common ancestor within a specific geographical area. This happens when the ancestral population spreads into new habitats and adapts to different environmental niches. **Example (Darwin's Finches):** On the Galapagos Islands, Charles Darwin observed that an original stock of seed-eating finches evolved into many new species. Due to geographic isolation

	on different islands, their beaks modified over time to suit new food sources, such as insects, cactus fruits, and seeds.
11.	They are called analogous organs because they do not share a common embryonic or anatomical origin. A butterfly wing is a modification of the integument (skin), while a bird wing is a bony forelimb covered in feathers. However, they both evolved to perform the exact same function, which is flight. **Type of Evolution:** They show convergent evolution. This occurs when completely unrelated species develop similar functional traits as an adaptation to a common environment or mode of life.
12.	In the collection made after industrialisation (1950s), there was a drastic shift in the moth population. The dark-winged (melanised) moths (*Biston betularia*) became highly abundant, while the grey/white-winged moths became very rare. **Reason:** Before the industries came up, thick white lichens grew on tree trunks, camouflaging the white moths from predatory birds. After industrialisation, the lichens died due to pollution, and the trunks turned black from soot. This allowed the dark moths to blend in safely, while the white moths stood out and were heavily hunted by birds.
III	**SHORT ANSWER TYPE QUESTIONS (3M)**
13.	**The Experiment:** In 1953, S.L. Miller and H.C. Urey created conditions in a laboratory similar to those on primitive Earth. They built a closed apparatus and created an electric discharge using tungsten electrodes in a flask containing methane (CH_4), ammonia (NH_3), hydrogen (H_2), and water vapour (H_2O) at 800°C. **Observation:** After running the experiment for 15 days, they observed the formation of simple organic compounds, specifically amino acids (like glycine, alanine, and aspartic acid). **Conclusion:** It provided direct experimental proof for Oparin and Haldane's theory of chemical evolution, showing that non-living inorganic molecules could give rise to the organic building blocks of life REFER FIG 6.1 FROM NCERT TEXTBOOK
14.	

Feature	Homologous Organs	Analogous Organs
Basic Definition	Organs that have the same structural plan and origin but perform different functions**.**	Organs that have different structural plans and origins but perform the same function**.**
Type of Evolution	They indicate Divergent Evolution (sharing a common ancestor).	They indicate Convergent Evolution (adapting to a similar habitat).
Animal Example	Forelimbs of a human, bat, cheetah, and whale (all have humerus, radius, ulna, carpals).	Flippers of penguins (birds) and dolphins (mammals).
Plant Example	Thorns of *Bougainvillea* and tendrils of *Cucurbita* (both arise from the axillary bud).	Sweet potato (root modification) and potato (stem modification).

IV	**CASE STUDY BASED QUESTIONS (4M)**
15.	**A.** The phenomenon described is called the Founder Effect**,** which is a direct consequence of Genetic Drift**.** The original group of individuals that branches off to form the new colony is called the "founders."
	B. This random change by chance is most prominent and effective only in small, isolated

populations. In large populations, random chance events do not significantly alter the overall allele frequency of the gene pool.

C. The algebraic equation representing genetic equilibrium (Hardy-Weinberg principle) is:

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

When the Founder Effect or genetic drift occurs, the gene frequencies change, causing the sum total to deviate from this equilibrium. This deviation indicates that evolution is actively occurring in that population.

D.

- The mechanism in the passage (Genetic Drift/Founder Effect) is completely random and directionless, acting purely by chance or accidents in nature.
- On the other hand, Charles Darwin's natural selection is a highly directional process, where nature systematically selects specific advantageous variations that make an organism better adapted to its environment over generations.

V **LONG ANSWER TYPE QUESTIONS (5M)**

16. **(a) Two Key Concepts of Darwinian Theory**

1. **Branching Descent:** This concept states that all living organisms share a common ancestry. New species develop from pre-existing ones through gradual modifications, forming a branching tree of life.
2. **Natural Selection:** This is the driving mechanism of evolution. Resources in nature are limited, causing a struggle for existence. Nature selects those individuals with advantageous variations that make them fit for the environment. These individuals reproduce more successfully and pass traits to the next generation.

(b) Differences Between Darwin's and Hugo de Vries' Theories

Evolutionary Feature	Charles Darwin's View	Hugo de Vries' Mutation View
Primary Cause	Based on minor, continuous variations within a population.	Based on large, sudden mutations (observed in evening primrose).
Directional Nature	Variations are highly directional and gradual.	Mutations are completely random and directionless.
Speed of Process	Evolution is a slow, continuous process over thousands of years.	Evolution is sudden, occurring via saltation (single-step large mutation).

(c) Evolution by Anthropogenic Action

This refers to accelerated evolution driven purely by human activities and interventions over a very short time scale.

1. **Excessive Use of Pesticides and Herbicides:** When chemical pesticides are repeatedly sprayed on fields to eliminate pests, a tiny fraction of the insect population with inherent, natural mutations survives the chemical. These resistant variants breed rapidly. Within a few years, the entire population becomes completely pesticide-resistant due to human-induced selection.
2. **Antibiotic-Resistant Microbes:** The overuse or misuse of antibiotics to treat bacterial infections kills off normal sensitive bacteria. However, rare bacterial cells that carry mutations making them drug-resistant survive and multiply. Within months or years, new antibiotic-resistant bacterial strains emerge because of human medical actions.

17.	The **Hardy-Weinberg Principle** states that allele frequencies in a large, randomly mating population remain stable and constant from generation to generation. This is true as long as there are no evolutionary forces acting on it. The mathematical equation is written as: $$p^2 + 2pq + q^2 = 1$$ • p^2 = Frequency of homozygous dominant individuals • 2pq= Frequency of heterozygous individuals • q^2 = Frequency of homozygous recessive individuals **Five Factors Disrupting Equilibrium** Any change in this stability leads to evolution. The five major factors that affect this equilibrium are: • **Gene Migration / Gene Flow:** When individuals move out of or into a population, genes are lost or added, altering the original allele frequencies. • **Genetic Drift:** A random change in allele frequencies that happens purely by chance, mostly in small populations. It can lead to the Founder Effect**.** • **Mutation:** Random genetic changes that introduce entirely new alleles into a population. • **Genetic Recombination:** New combinations of genes formed during crossing over in meiosis, leading to variations in offspring. • **Natural Selection:** The process where organisms better adapted to their environment tend to survive and produce more offspring. When the measured allele frequencies differ from expected Hardy-Weinberg values, it directly proves that evolution is actively occurring in that population.
VI	**BOARD QUESTIONS**
18	• Brain size was 1400 cc • They used hides to protect their bodies • They buried their dead bodies (Any two) • (ii) (I) Homo erectus (II) Homo habilis
19	Given: (i) Frequency of blue-eyed individuals (bb) = 36% As per Hardy-Weinberg equilibrium if q2 =0.36 then q = 0.6 Acc. to Hardy- Weinberg equilibrium, (p +q) =1 Therefore, p = 1- 0.6 = 0.4. Frequency of allele B (p) = 0.4 (ii) Heterozygous individuals (2pq): 2pq = 2 × 0.4 × 0.6 = 0.48 = 48% (iii) Homozygous dominant (p2) p2= (0.4) × (0.4) =0.16=16%

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