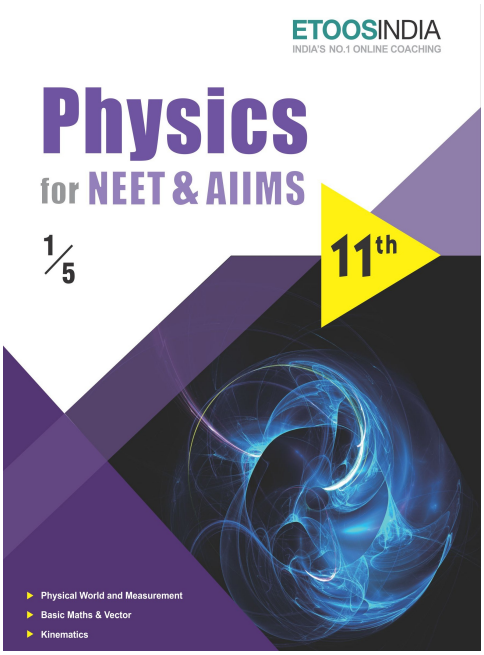
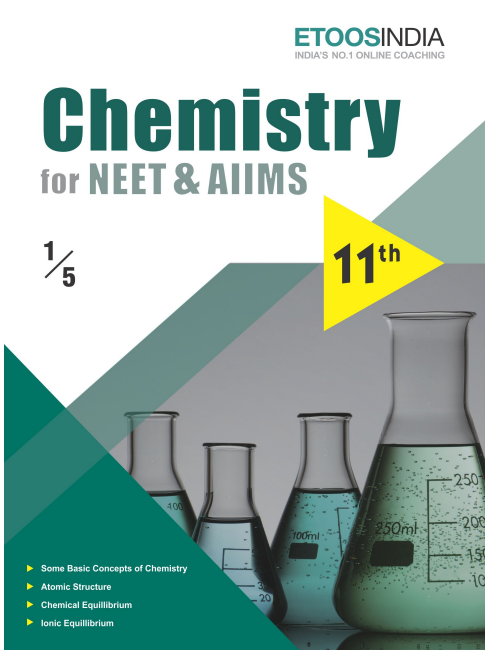
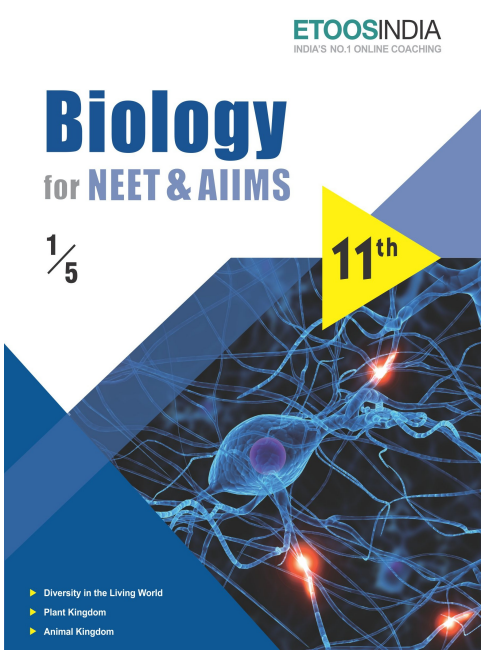
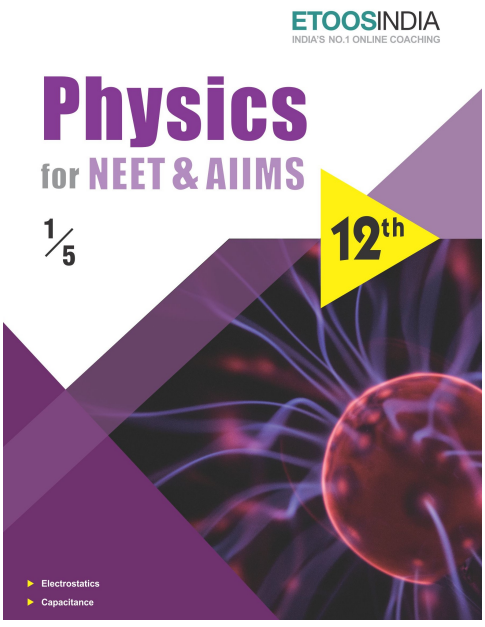
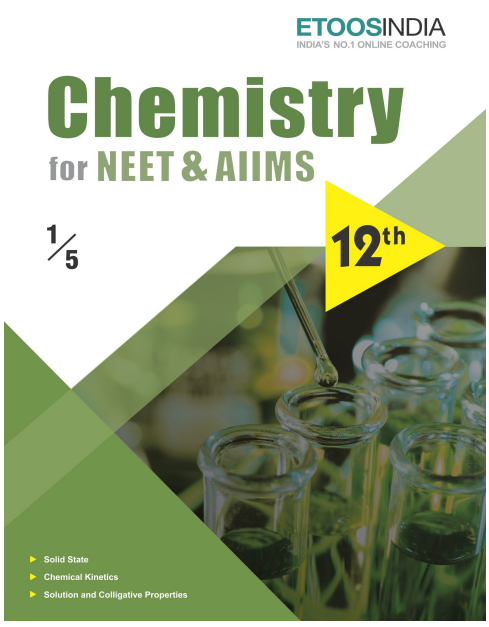
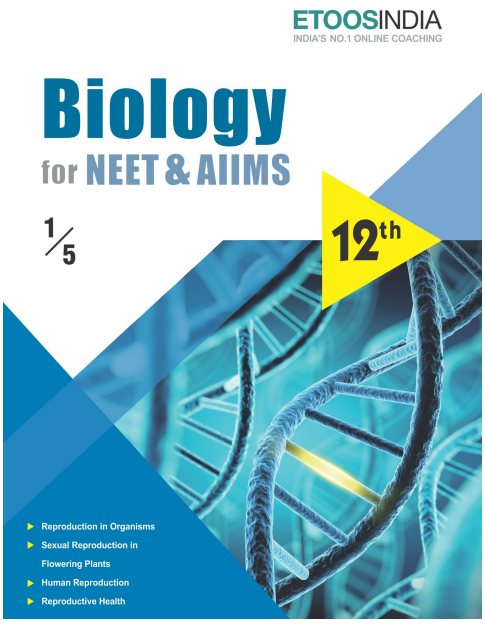












CHAPTER 07

EVOLUTION

*"My own suspicion is that the universe is not only queerer than we suppose, but queerer than \ we *can* suppose.".*

"J.B.S. HALDANE (1892-1964)"

INTRODUCTION

Evolutionary Biology is the study of history of life forms on earth. Our earth is full of living and non-living matter. This matter undergoes various changes from time to time, like living organisms take birth, grow, become old and ultimately at the end they die off. This is the life history of a particular organism.So to understand the changes in flora and fauna that have occured over millions of years on earth, we must have an understanding of the context of origin of life i.e., evolution of earth, of stars and indeed of the universe itself.

In this Chapter, we will deal with the various aspects of evolutionary biology like origin and evolution of life forms, the evidences of evolution. mechanism of evolution with special focus on evolution and origin of man.

Evolution

Origin of Life : This term is called Biopoiesis
Biogeny means Origin of first life.

1. **Theory of Special Creation**
   Almighty created everything including universe, earth, rocks, rivers, oceans, plants, animal and human beings. According to the Bible, the world was created within six days by God. The first man was Adam and first woman was Eve. According to Hindu mythology, the world was created by God Brahma. The first man was Manu.

2. **Abiogenesis or Auto biogenesis/Theory of Spontaneous generation**
   This theory states that living beings were formed spontaneously from non-living things like rain, mud, air, dung, etc. This theory has no scientific explanation and hence discarded. It was proposed by **Anaximander and supported by Aristotle** etc. **Von Helmont** (1577 - 1644) propounded origin of mice from human sweat & wheat grains kept in dark for 21 days.

3. **Theory of Biogenesis**
   According to this theory, life originated from pre-existing life. This theory was developed by **Francesco Redi** and was subsequently supported by **Spallanzani** and **Louis Pasteur.** This theory was also not accepted.
   (i) Francesco Redi : (1688). Put dead snake, fish meat and eel in separate wide mouthed flasks, some without cover, others covered with fine muslin and parchment paper. After a few days, he observed that maggots (larvae) did not appear in covered flasks but were present in uncovered flasks which were regularly visited by flies. Eggs and maggots of the flies were found to be present over muslin cover but not inside the covered flasks. Apparently the visiting flies laid eggs in the uncovered flasks from which maggots developed.
   (ii) Lazzaro Spallanzani : (1765) Boiled nutrition broth in glass flasks. The flasks were sealed immediately. Broth remained clear indefintely in the sealed flasks, showing that organisms do not arise through spontaneous generation.
   (iii) Louis Pasteur : (1864) Boiled broth in flasks having bent swan or S-shaped neck. No microrganisms were observed in broth after keeping for several days though, broth was connected to air through the bent neck. It is because the dirt carrying microrganisms got settled in the bent part of neck. When the neck was broken, colonies of microorganisms soon developed over the broth showing that microrganisms have come from air.

4. **Cosmozoic theory**
   According to Richter, life came to earth from some heavenly body such as spores through meteorites. Arrhenius supported by theory of pansmermia.

5. **Theory of Catastrophism**
   Proposed by Cuvier. A catastrophe completely destroys the life and each creation consisted of life quite different from that of previous one.

6. **Modern theory of life**

   Oparin theory or Oparin & Haldane theory ; Book of Oparin **"The origin of life"**.
   They described that life originated in 8 steps.

Step-1 Atomic Stage :

Earth was formed about 4600 million years ago Temperature of earth was 5000 – 6000°C. As earth cooled stratification of elements occured. The atoms of Nitrogen, Hydrogen, Oxygen.Carbon etc. formed the primitive atmosphere.

Step-2 Molecular Stage :

As the earth began to cool, its matter began to condense. But still it was so hot that water could exist only as vapour. Large quantities of H_2, N_2, Water vapour, CO_2, CH_4 and NH_3 were present, but free oxygen was not present. The atmosphere was reducing because H atoms were most numerous and most reactive in the primitive atmosphere.

ETOOS KEY POINTS

(1) Organic evolution states "**Descent with modification**" according to which present day complex living organisms have evolved from earlier simpler organisms by small and gradual changes over millions of years.
(2) Lamarck was first to propose an extensive theory of evolution.
(3) Charles Darwin explained "Theory of natural selection" in his book entitled "On the Origin of Species by Means of Natural Selection".
(4) Hugo de Vries (1901) proposed **Mutation theory of Evolution**.
(5) Modern Theory of evolution is a modified version of natural selection and is a reconciliation between Darwinism and Mutation theory.
(6) Seymouria (Extinct reptile) is a connecting link between reptiles and mammals
(7) Limulus (Arthropoda), Latimera (bony fish) are living fossils.

Etoos Tips & Formulas

→ Evolutionary biology is the study of history of life forms on earth.
→ Universe originated about 20 Billion years ago by thermo-nuclear explosion called Big-Bang.
→ Earth originated about 4.5 Billion year ago.
→ Stellar distances are measured in light years.
→ Life appeared 500 million years after the formation of eath i.e. almost four billion years back.
→ According to theory of spontaneous generation life came out of decaying and rotting matter like straw, mud etc.
→ Louis pasteur by careful experimentation demonstrated that life comes only from pre-existing lif e.
→ Oparin and Haldane propsoed that the first form of life could have come from pre-existing non living organ: molecules and that formation of life was preceded by chemical evolution.
→ To prove chemical evolution in 1953, Miller created electric discharge in a closed flask containing CH_4 H_2 NH_3 and water vapour at 800°C. He observed formation of amino acids.
→ The first non cellular forms of life could have originated 3 billion years ago.
→ Theory of special creation has three connotations-

→ All living organisms that we see today were created as such.
→ The diversity was always the same since creation and will be the same in future.
→ The earth is about 4000 years old.

→ All these ideas were strongly challenged during the nineteenth century based on observations made during a sea voyage in a sail ship called H.M.S. Beagle round the world, Charles Darwin concluded that existing living forms share similarities to varying degrees not only among themselves but also with life forms that existed million of years ago.
→ The fitness, according to Darwin, Refene ultimately and only to reproductive fitness.
→ Alfered Wallace a naturalist who worked in malay Archipelago."According to 'Panspermia theory' unit of life called 'spores' were transferred to different planets indcluding earth
→ The geological history of earth closely correlates with the biological history of earth.

→ Fossils are remains of hard parts of life forms found in Rocks.
→ Different aged rock sediments contain fossils of different life foms who probably died during the formation of the particular sediment.
→ Fossils represent extinct organism (**e.g.** Dinosaurs) Paleontology - study of fossils.
→ Homology present in organisms shows divergent evolution and analogy shows convergent evolution.
→ The same structure developed along different divergent evolution and these structures are homologous. Homology indicates common ancestory.
e.g. - Forelimbs of all mammals.
→ Visceral organs of vertebrates like heart, brain.
→ Thorn and tendrils of Bougainvillea and cucurbita.
→ Analogous structures are a result of convergent evolution. Different structures evolving for the same function. Similar habitat has resulted in selection of similar adaptive features in different groups of organisms.
e.g. - Eyes of octopus and mammals.
→ Flippers of Penguins and Dolphins.
→ Wings of butterfly and birds.
→ Potato and Sweet potato.
→ Proteins and genes performing a given function among diverse organisms give clues to common ancestry.
→ According to industral melanisation phenomenon in a mixed population, those that can better adapt, survive and increase in a population size. No variant is completely wiped out.

SOLVED EXAMPLE

Ex.1 Which of the following was most likely to have been absent in free form in the primordial atmosphere at the time of origin of life

Or

Miller performed experiment to prove abiogenic molecular evolution of life. Which molecule was not present in Miller's experiment

(A) O_2 **(B)** CH_4
(C) H_2 **(D)** NH_3

Sol. **(A)**

Ex.2 The complex organic compounds that may have first evolved in the direction of origin of life on earth, may have been

(A) Protein and amino acids
(B) Protein and nucleic acids
(C) Urea and nucleic acids
(D) Urea and amonia acids

Sol. **(B)**

Ex.3 In his classic experiment on the formation of amino acids, Stanley Miller passed an electric discharge in a mixture of

Or

Stanley Miller had put the oparin-Haldane theory to test in 1953 by creating in the laboratory, the probable condition of the primitive earth. In the experiment, simple amino acids were synthesized from which of the folowing mixture as observed after 18 days

(A) Steam, CH_4, H_2 and NH_3
(B) CH_4, CO_2, O_2 and H_2
(C) NH_3, O_2, H_2 and steam
(D) CH_4, H_2, N_2 and steam

Sol. **(A)**

Ex.4 Which one of the following is incorrect about the characteristics of protobionts (coacervates and microsphers) as envisaged in the abiogenic origin of life)

(A) They were partially isolated from the surrounding
(B) They could maintain an internal environment
(C) They were able to reproduce
(D) They could separate combinations of molecules from the surrounding

Sol. **(C)**

Ex.5 The greatest evolutionary change enabling the land vertebrates to be completely free from water, was the development of

(A) Four legs
(B) Lungs
(C) Shelled eggs and internal fertilization
(D) Four chambered heart

Sol. **(C)**

Ex.6 Evolution means

(A) History of race
(B) Development of race
(C) History and development of race with variations
(D) Progressive development of the race

Sol. **(C)**

Ex.7 Which one of the following are analogous structures

(A) Thorns of Bougainvillea and tendrils of Cucurbita
(B) Flippers of dolphin and legs of horse
(C) Wings of bat and wings of pigeon
(D) Gills of prawn and lungs of man

Sol. (C,D) : Wings of bat are skin folds stretched mainly between elongated finger but the wings of birds are a feather covering all alongs the arm. They look similar because they have a common use for flying, but their origin are not common. This makes them analogous charactertics rather than homologous characteristics.

Ex.8 Which one of the following in birds, indicates their reptilian ancestry

(A) Two special chambers crop and gizzard in their digestive tract
(B) Eggs with a calcareous shell
(C) Scales on their hind limbs
(D) Four chambered heart

Sol. **(C)**

Ex.9 Organs that have different embryonic origin but perform similar functions are

(A) Homologous organs
(B) Analogous organs
(C) Vestigeal organs
(D) Atavism

Sol. **(B)** : Analogous organs have different embryonic origin but perform similar functions. These organs are developed in organisms, widely different phylogentically due to similar habitats and modes of life.

Exercise # 1 SINGLE OBJECTIVE NEET LEVEL

1. Biogenesis means
(A) Origin of life from non-living organisms
(B) Origin of life from living organisms
(C) Origin of viruses and microbes
(D) None of these

2. About how long ago was the earth formed.
(A) 4.6 billion years ago (B) 10 billio years ago
(C) 3.0 billion years ago (D) 20 billion years ago

3. Type of nutrition in the primitive cells
Or
It is believed that the organisms first inhabied earth's surface were
(A) Heterotrophic or holozoic
(B) Heterophytic or holophytic
(C) Saprophytic
(D) Saprozoic

4. Louis Pasteur's view on the origin of life is that
(A) Life originated within six days
(B) Life originated spontaneously from the living organisms only
(C) Life originated spontaneously from the non-living substances
(D) Life came from other planet

5. Source of energy at the time of origin of life
(A) Heat, cosmic rays and lightning
(B) Heat only
(C) Cosmic rays only
(D) Lightning only

6. Select the correct statement from the following
(A) Darwinian variations are small and directionless
(B) Fitness is the end result of the ability to adapt and gets selected by nature
(C) All mammals except whales and camels have seven cervical vertebrae
(D) Mutations are random and directional

7. The organism which appeared first on earth is known as
(A) Eubiont (B) Probiont
(C) Eobiont (D) True biont

8. The concept of chemical evolution is based on
(A) Crystallization of chemicals
(B) Interaction of water, air and clay under intense heat
(C) Effect of solar radiation on chemicals
(D) Possible origin of life by combination of chemicals under suitable environmental conditions

9. Which one of the following amino-acids was not found to be synthesized in Miller's experiment
(A) Glutamic acid (B) Alanine
(C) Glycine (D) Aspartic acid

10. There is no life on moon because there is no
(A) Carbon (B) Nitrogen
(C) Water (D) Silicates

11. According to available evidence life evolved through the process of
(A) Abiogenesis
(B) Biogenesis
(C) Special creation
(D) Spontaneous generation

12. In the early earth, water and CO_2 were produced by the combination of O_2 with
(A) Ammonia and methane
(B) Hydrogen
(C) Organic matter
(D) Sulphates and nitrates
(E) Hydrogen sulphide

13. The prebiotic atmosphere of the earth was of a reducing nature. It was tranformed into an oxidizing atmosphere of present day due to the emergence of
(A) Cyanobacteria
(B) Angiosperms
(C) Photosynthetic bacteria
(D) Eukaryotic algae

14. Formation of which complex molecules was noticed by Urey and Miller when they subjected substances like NH_3 , CH_4, H_2O etc. to electric discharge
(A) Aquaregia (B) H_2SO_4
(C) HCN (D) Amino acids

15. The idea that life origniates from pre-existing life is referred as
(A) Biogenesis theory
(B) Special creation theory
(C) Abiogenesis theory
(D) Extraterrestrial theory

Exercise # 2

SINGLE OBJECTIVE | AIIMS LEVEL

1. Hot dilute soup was given by
(A) Oparin (B) Haldane
(C) Urey (D) None of these

2. Which is responsible for origin of life
(A) Spontaneous generation
(B) Special creation
(C) Catastrophy
(D) Chemosynthesis

3. Life originated in
(A) Precambrian era (B) Proterozoic era
(C) Mesozoic era (D) Caenozoic era

4. Origin of life took place in/on
(A) Water (B) Air
(C) Mountains (D) Land

5. The presence of salts (NaCl and others) in animal body fluid gives an inference that life originated in the
(A) Salf solutions (B) Rain water
(C) Primitive ocean (D) None of the above

6. According to one of the most accepted theory the earth almosphere before any life had originated consisted of
H_2O, H_2, NH_2
(A) CH_4 (B) O_2
(C) N_2 (D) None of these

7. Under certain conditions scientists have obtained cell - like structures. These are known as
(A) Microbes (B) Protists
(C) Coacervates (D) Prebiotic soup

8. Chemical theory of origin of life was given by
Or
Who proposed that the first form of life could have come from pri-existing living organic molecules
(A) Stanley Miller (B) Oparin and Haldane
(C) Louis Pasteur (D) Spallanzani

9. The abiogenesis occurred about how many billion years ago
(A) 1.2 billion (B) 1.5 billion
(C) 2.5 billion (D) 3.5 billion

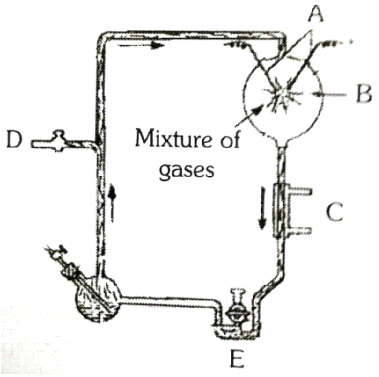
10. Theory of special creation was given by
(A) Weismann (B) Helmont
(C) Manpertuis (D) Father Saurez

11. The spark-discharge apparatus to test chemical evolution of life was designed by
Or
the first experiment on chemical evolution and origin of life was carried out by
(A) Oparin and Haldane (B) Miller and Urey
(C) Jacob and Monad (D) Dixon and Jolley

12. Coacervates are
(A) Colloid droplets
(B) Contain nucleoprotein
(C) Both (A) and (B)
(D) Protobiont

13. Theory of catastropism was supported by
(A) Louis Pasteur (B) A.I. Oparin
(C) Cuvier (D) Haldane

14. The diagram represents Miller's experiment. Choose the correct combination of labelling



(A) A-electrodes, B - $NH_3 + H_2 + H_2O + CH_4$, C - cold water, D-vacuum, E-U trap
(B) A-electrodes, B - $NH_4 + H_2 + CO_2 + CH_3$, C - hot water, D-vacuum, E-U trap
(C) A-electrodes, B - $NH_3 + H_2O$ C - hot water, D-tap, E-U trap
(D) A-electrodes, B - $NH_3 + H_2 + H_2O + CH_4$, C - steam, D - vacuum, E-U trap

15. Coacervates were experimentally produced by
(A) Urey and Miller
(B) Jacob and Monod
(C) Fischer and Huxley
(D) Sidney Fox and Oparin

Exercise # 3 PART - 1 MATRIX MATCH COLUMN

1. Match the scientists and their contributions in the field of evolution

Column - I Name of the scientist	Column - II Contribution
A. Charles Darwin	i. Mutation theory
B. Lamarck	ii. Germ plasma theory
C. Hugo de Vries	iii. Philosophie Zoologique
D. Ernst Haeckel	iv. The Origin of species
E. August Weismann	v. Biogenetic law
	vi. Eassy on population

(A) A - iv, B - iii, C - i, D - v, E - ii
(B) A - iv, B - iii, C - v, D - i, E - vi
(C) A - iv, B - iv, C - v, D - iii, E - i
(D) A - ii, B - iii, C - i, D - v, E - ii
(E) A - iii, B - iv, C - i, D - v, E - ii

2. Match the scientists listed under column - 'I' with ideas listed Column - 'II'

Column - I	Column - II
A. Darwin	i. Abigenesis
B. Oparin	ii. Use and disuse of organs
C. amarck	iii. Continental drift theory
D. Wagner	iv. Evolution by natural selection

Options :
(A) A - i., B - iv, C - ii, D - iii (B) A iv, B - i., C - ii, D - iii
(C) A - ii, B - iv, C - iii, D - i. (D) A - iv, B - iii, C - ii, D - i.

3. Match the evolution concepts and their proposers and select the right option

Column - I	Column - II
A. Saltation	i. Darwin
B. Formation of life was proceeded by chemica evolution	ii. Louis Pasteur
C. Reproductive fitness	iii. De vries
D. Life comes from pre-existing life	iv. Oparin and Haldane

(A) A - iii; B - iv; C - i; D - ii
(B) A - iv; B - iii; C - ii; D - i
(C) A - iv; B - ii; C - iii; D - i
(D) A - ii; B - iii; C - i; D - iv
(E) A - i; B - iv; C - iii; D - ii

4. Match Column - I with Column - II and select the correct option from the codes given below.

Column - I	Column - II
A. Francesco Redi	i. Theory of chemical evolution of life
B. L. Pasteur	ii. Disproval of spontaneous generation
C. Richter	iii. Swan necked flask experiment
D. Oparin	iv. Mutation
	v. Panspermia

(A) A - v; B - i.; C - iv; D - ii
(B) A - ii; B - iii; C - v; D - i.
(C) A - v; B - iv; C - ii; D - i.
(D) A - i.; B - ii; C - iii; D - iv

Exercise # 4

PART - 1 PREVIOUS YEAR (NEET/AIPMT)

1. Darwin's finches provide an excellent evidence in favour of evolution. This evidence comes from the field of [CBSE AIPMT 2000]
(A) Biogeography (B) Anatomy
(C) Embryology (D) Palaeontology

2. Which is not a vestigial part in humans ? [CBSE AIPMT 2000]
(A) Segmental muscles of abdomen
(B) Finger nails
(C) Third molar
(D) Coccyx

3. Which of the following primate is the closest relative of humans ? [CBSE AIPMT 2000]
(A) Rhesus monkey (B) Orangutan
(C) Gorilla (D) Gibbon

4. Which one of the following features is closely related with the evolution of humans ? [CBSE AIPMT 2000]
(A) Loss of tail (B) Shortening of jaws
(C) Binocular vision (D) Flat nails

5. Homo sapiens evolved during [CBSE ATPMT 2000]
(A) Pleistocene (B) Oligocene
(C) Pliocene (D) Miocene

6. Occurrence of endemic species in South-America and Australia is due to [CBSE ATPMT 2001]
(A) these species have been extinct from other
(B) continental separation
(C) there is no terrestrial route to these places
(D) retrogressive evolution

7. Half-life period of C^{14} is about [CBSE ATPMT 2001]
(A) 500 yr (B) 5730 yr
(C) 50 yr (D) 5×10^4 yr

8. Darwin's theory of pangenesis shows similarity with theory of inheritance of acquired characters then what will be correct according to it ? [CBSE ATPMT 2001]
(A) Useful organs become strong and developed while useless organs become extinct. These organs help in struggle for survival
(B) Size of organs increase with ageing
(C) Development of organs is due to will power
(D) There should be some physical basis of inheritance

9. Which of following is closest relative of man ?
(A) Chimpanzee (B) Gorilla
(C) Orangutan (D) Gibbon

10. Reason of diversity in living being is [CBSE ATPMT 2001]
(A) mutation
(B) gradual change
(C) long term evolutionary change
(D) short term evolutionary change

11. Similarities in organisms with different genotype indicates [CBSE ATPMT 2001]
(A) micro-evolution (B) macro-evolution
(C) convergent evolution (D) divergent evolution

12. Which of the following is correct order of evolutionary history of man ? [CBSE AIPMT 2001]
(A) Peking man, Homo sapiens, Neanderthal, Cro-magnon
(B) Peking man, Neanderthal, Homo sapiens, Cro-magnon
(C) Peking man, Heidalberg man, Neanderthal, Cro-magnon
(D) Peking man, Neanderthal, Homo sapiens, Heidalberg man

13. Two different species cannot live for long duration in the same niche or habitat' This law is [CBSE AIPMT 2002]
(A) Allen's law (B) Gause's hypothesis
(C) Dollo's rule (D) Weismann's theory

14. Sequence of which of the following is used to know the phylogeny ? [CBSE AIPMT 2002]
(A) mRNA (B) rRNA
(C) tRNA (D) DNA

15. In which era reptiles were dominant ? [CBSE AIPMT 2002]
(A) Coenozoic era (B) Mesozoic era
(C) Palaeozoic era (D) Archaeozoic era

16. According to fossils discovered up to present time origin and evolution of man was started from it [CBSE AIPMT 2002]
(A) France (B) Java
(C) Africa (D) China

17. In which condition the gene ratio remains constant for any species ? [CBSE AIPMT 2002]
(A) Sexual selection (B) Random mating
(C) Mutation (D) Gene flow

MOCK TEST

1. Which of the following is the correct sequence of events in the origin of life ?

I. Formation of protobionts
II. Synthesis of organic monomers
III. Synthesis of organic polymers
IV. Formation of DNA based genetic system

(A) I, II, III, IV (B) I, III, II, IV (C) II, III, I, IV (D) II, III, IV, I

2. Following are the two statements regarding the origin of life

(A) The earliest organisms that appeared on the earth were non-green and presumably anaerobes

(B) The first autotrophic organisms were the chemoautotrophs that never released oxygen of the above statements which one of the following option is correct ?

(A) Both (A) and (B) are correct
(B) Both (A) and (B) are false
(C) (A) is correct but (B) is false
(D) (B) is correct but (A) is false

3. According to the theory of spontaneous generation

(A) life originated from outer space
(B) life originated from decaying and rotting matter like straw, mud etc.
(C) life came from pre-existing life
(D) life came from both living and non-living matter

4. The idea of 'Natural Selection' as the fundamental process of evolutionary changes wa reached

(A) independently by Charles Darwin and Alfred Russel Wallace in 1990
(B) by Charles Darwin in 1866
(C) by Alfred Russel Wallace in 1901
(D) independently by Charles Darwin and Alfred Russel Wallace in 1859

5. Match the Column-I with Column-II and chose the right option

Column-I	Column-II
I. Thomas Malthus	A. Branching descent
II. Hugo de Vries	B. Studies on populations
III. Charles Darwin	C. Use and disuse theory
IV. Lamarck	D. Saltation

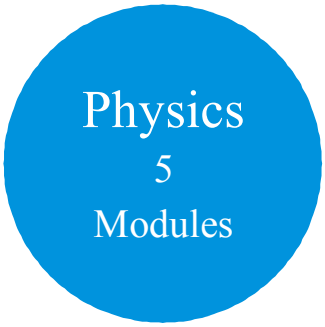
(A) I - D, II - A, III - C, IV - B
(B) I - B, II - D, III - A, IV - C
(C) I - B, II - D, III - C, IV - A
(D) I - C, II - B, III - A, IV - D
(E) I - B, II - A, III - C, IV - D

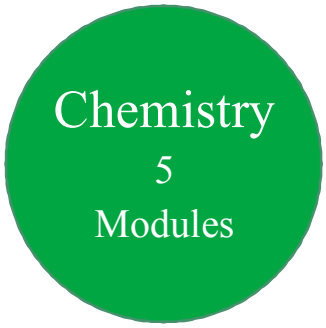
6. Match the evolution concepts and their proposers and select the right option

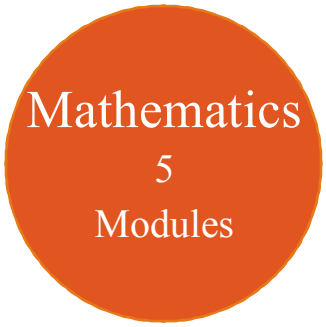
Column-I	Column-II
I. Salation	A. Darwin
II. Formation of life was proceeded by chemical evolution	B. Louis Pasteur
III. Reproductive fitness	C. de Vries
IV. Life comes from pre-existing life	D. Oparin and Haldane

(A) I - C, II - D, III - A, IV - B
(B) I - D, II - C, III - B, IV - A
(C) I - D, II - B, III - C, IV - A
(D) I - B, II - C, III - A, IV - D
(E) I - A, II - D, III - C, IV - B

11th Class Modules Chapter Details

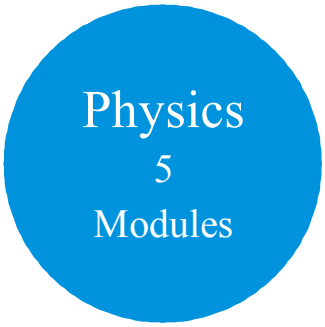


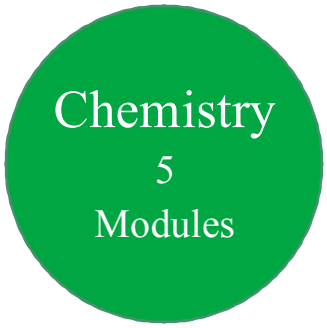


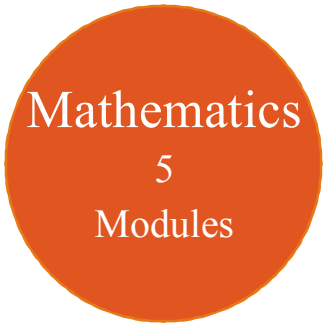


PHYSICS	CHEMISTRY	BIOLOGY
Module-1 1. Physical World & Measurements 2. Basic Maths & Vector 3. Kinematics **Module-2** 1. Law of Motion & Friction 2. Work, Energy & Power **Module-3** 1. Motion of system of particles & Rigid Body 2. Gravitation **Module-4** 1. Mechanical Properties of Matter 2. Thermal Properties of Matter **Module-5** 1. Oscillations 2. Waves	**Module-1(PC)** 1. Some Basic Conceps of Chemistry 2. Atomic Structure 3. Chemical Equilibrium 4. Ionic Equilibrium **Module-2(PC)** 1. Thermodynamics & Thermochemistry 2. Redox Reaction 3. States Of Matter (Gaseous & Liquid) **Module-3(IC)** 1. Periodic Table 2. Chemical Bonding 3. Hydrogen & Its Compounds 4. S-Block **Module-4(OC)** 1. Nomenclature of Organic Compounds 2. Isomerism 3. General Organic Chemistry **Module-5(OC)** 1. Reaction Mechanism 2. Hydrocarbon 3. Aromatic Hydrocarbon 4. Environmental Chemistry & Analysis Of Organic Compounds	**Module-1** 1. Diversity in the Living World 2. Plant Kingdom 3. Animal Kingdom **Module-2** 1. Morphology in Flowering Plants 2. Anatomy of Flowering Plants 3. Structural Organization in Animals **Module-3** 1. Cell: The Unit of Life 2. Biomolecules 3. Cell Cycle & Cell Division 4. Transport in Plants 5. Mineral Nutrition **Module-4** 1. Photosynthesis in Higher Plants 2. Respiration in Plants 3. Plant Growth and Development 4. Digestion & Absorption 5. Breathing & Exchange of Gases **Module-5** 1. Body Fluids & Its Circulation 2. Excretory Products & Their Elimination 3. Locomotion & Its Movement 4. Neural Control & Coordination 5. Chemical Coordination and Integration

12th Class Modules Chapter Details







PHYSICS

Module-1

1. Electrostatics
2. Capacitance

Module-2

1. Current Electricity
2. Magnetic Effect of Current and Magnetism

Module-3

1. Electromagnetic Induction
2. Alternating Current

Module-4

1. Geometrical Optics
2. Wave Optics

Module-5

1. Modern Physics
2. Nuclear Physics
3. Solids & Semiconductor Devices
4. Electromagnetic Waves

CHEMISTRY

Module-1(PC)

1. Solid State
2. Chemical Kinetics
3. Solutions and Colligative Properties

Module-2(PC)

1. Electrochemistry
2. Surface Chemistry

Module-3(IC)

1. P-Block Elements
2. Transition Elements (d & f block)
3. Co-ordination Compound
4. Metallurgy

Module-4(OC)

1. HaloAlkanes & HaloArenes
2. Alcohol, Phenol & Ether
3. Aldehyde, Ketone & Carboxylic Acid

Module-5(OC)

1. Nitrogen & Its Derivatives
2. Biomolecules & Polymers
3. Chemistry in Everyday Life

BIOLOGY

Module-1

1. Reproduction in Organisms
2. Sexual Reproduction in Flowering Plants
3. Human Reproduction
4. Reproductive Health

Module-2

1. Principles of Inheritance and Variation
2. Molecular Basis of Inheritance
3. Evolution

Module-3

1. Human Health and Disease
2. Strategies for Enhancement in Food Production
3. Microbes in Human Welfare

Module-4

1. Biotechnology: Principles and Processes
2. Biotechnology and Its Applications
3. Organisms and Populations

Module-5

1. Ecosystem
2. Biodiversity and Conservation
3. Environmental Issues