Chapter: 7 Evolution

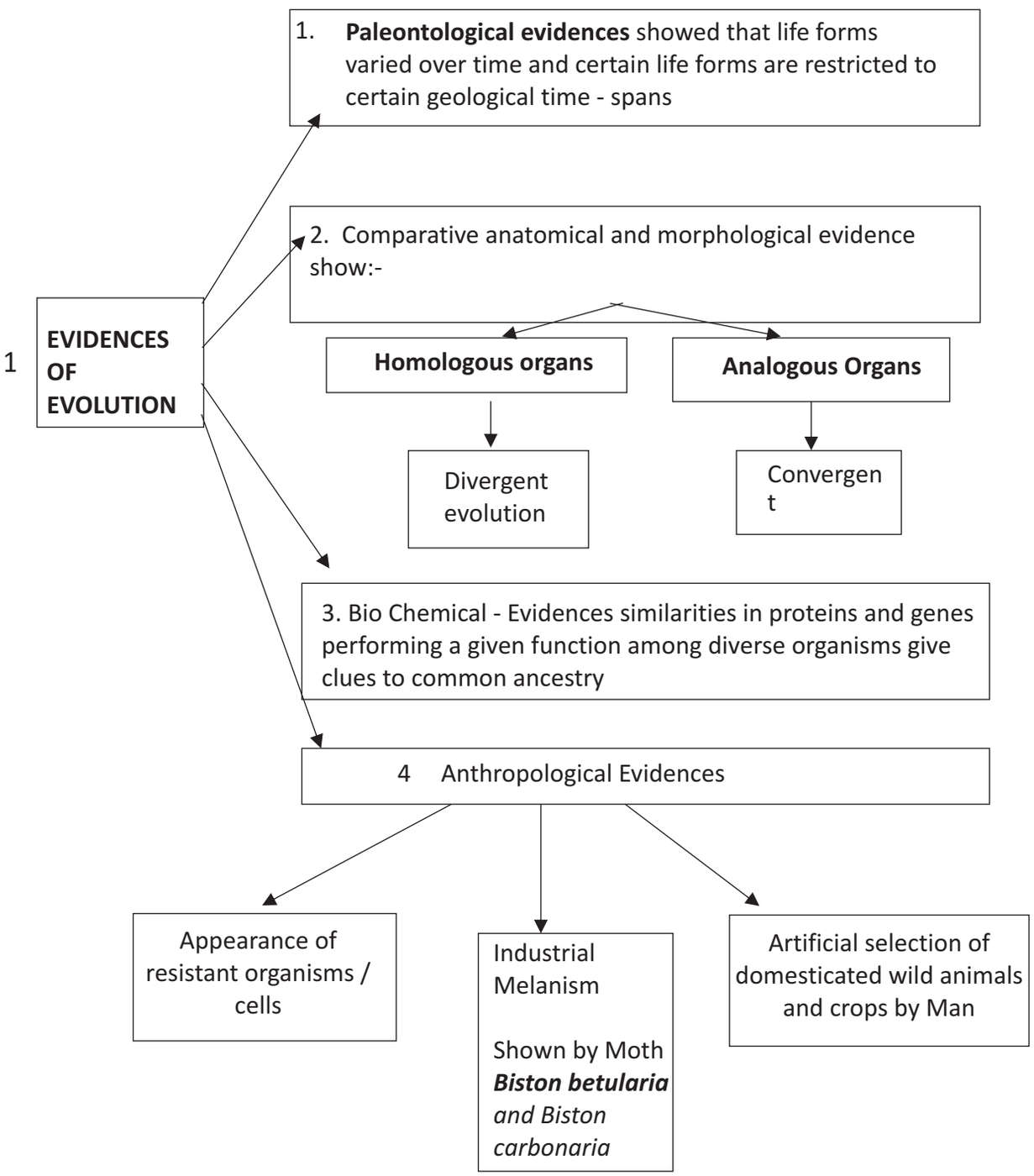
(KEY POINTS)

1	Homologous	Organs with similar origin and structure (SOS)but differ in appearance and function(DAF) Eg. Forelimbs of whale,bats,cheeta,horse
2	Divergent Evolution	Due to different needs some structures developed differently
3	Analogous	Organs with similar appearance and function (SAF)but differ in origin and structure (DOS) Eg. Wings of butterfly and bat
4	Convergent Evolution	Life originates from pre-existing life
5	Biogenesis	Life originates from pre-existing life
6	Adaptive Radiation	Evolution starting from a single point and radiating in different directions
7	Fossil	Preserved remains/imprints of plants and animals that lived millions of years ago
8	Paleontology	Systemic and scientific study of fossils
9	Saltation	Biological term for single step large mutation in a single leap/saltus.
10	Speciation	Process of evolving / formation of new species from the existing one
11	Differential reproduction	Different reproductive rate to the different individuals in a population
12	Biogeography	Study of distribution of various organisms from different parts of the earth
13	Founder effect	Changes in the allele frequencies in a new population due to migration of members
14	Genetic drift	Changes occurring in gene frequencies by chance
15	Gene flow / Gene migration	When individual migrate to another place or population, new genes / alleles are added to new population and are lost from the old population in turn changing the frequencies when gene migration occurs many a times.
16	Stabilization	Large number of individuals acquire mean character value
17	Directional change	Large number of individuals acquire value other than mean value
18	Distribution	Large number of individuals acquire peripheral character value at both ends of the distribution curve

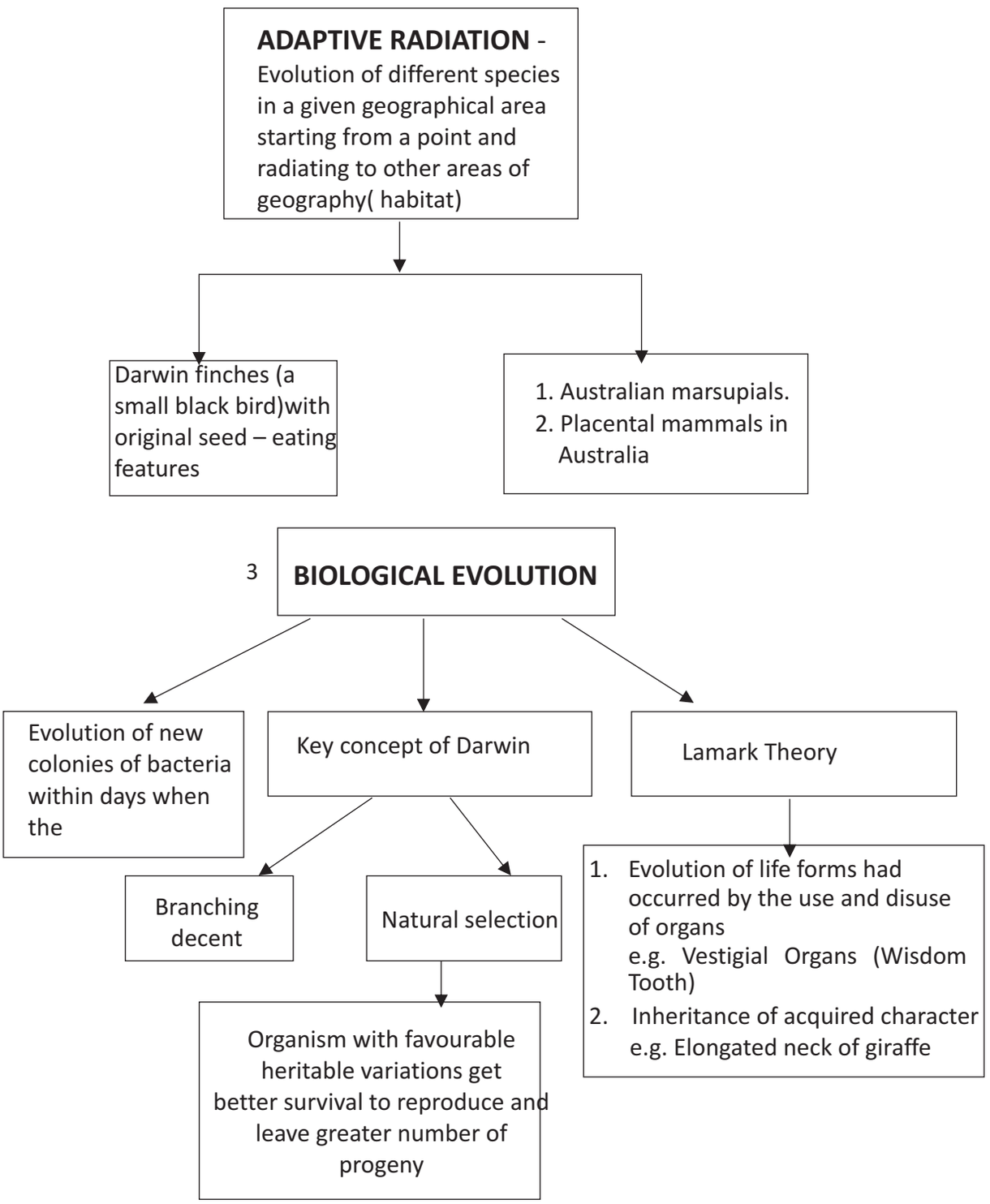
Origin of Life

Scientist	**Year**	**Theory/Experiment**	**Conclusion**
Lemaitre	1927	Big Bang theory	The universe expanded from explosion of a primordial, hot substance
Oparin and Haldane	1924 – 1929	Chemical evolution preceded organic evolution	Simple organic molecules originated from inorganic precursors.
Stanley Miller and Urey	1952	Synthesis of biomolecules by creation of similar conditions as primitive atmosphere on laboratory scale	Amino acids were synthesized from ammonia, methane and carbon dioxide inside specialized apparatus

CHAPTER 7 EVOLUTION
(FLOW CHART)



2 ADAPTIVE RADIATION



3 BIOLOGICAL EVOLUTION

4 **MECHANISM OF EVOLUTION**

- Hugo deviries
  - 1. Mutation causes evolution not minor variation
    2. Mutation are Random and direction less
    3. Single step mutation cause speciation (Saltation)
- Darwin
  - 1. Minor variations causes evolution
    2. Variation are small, gradual and directional

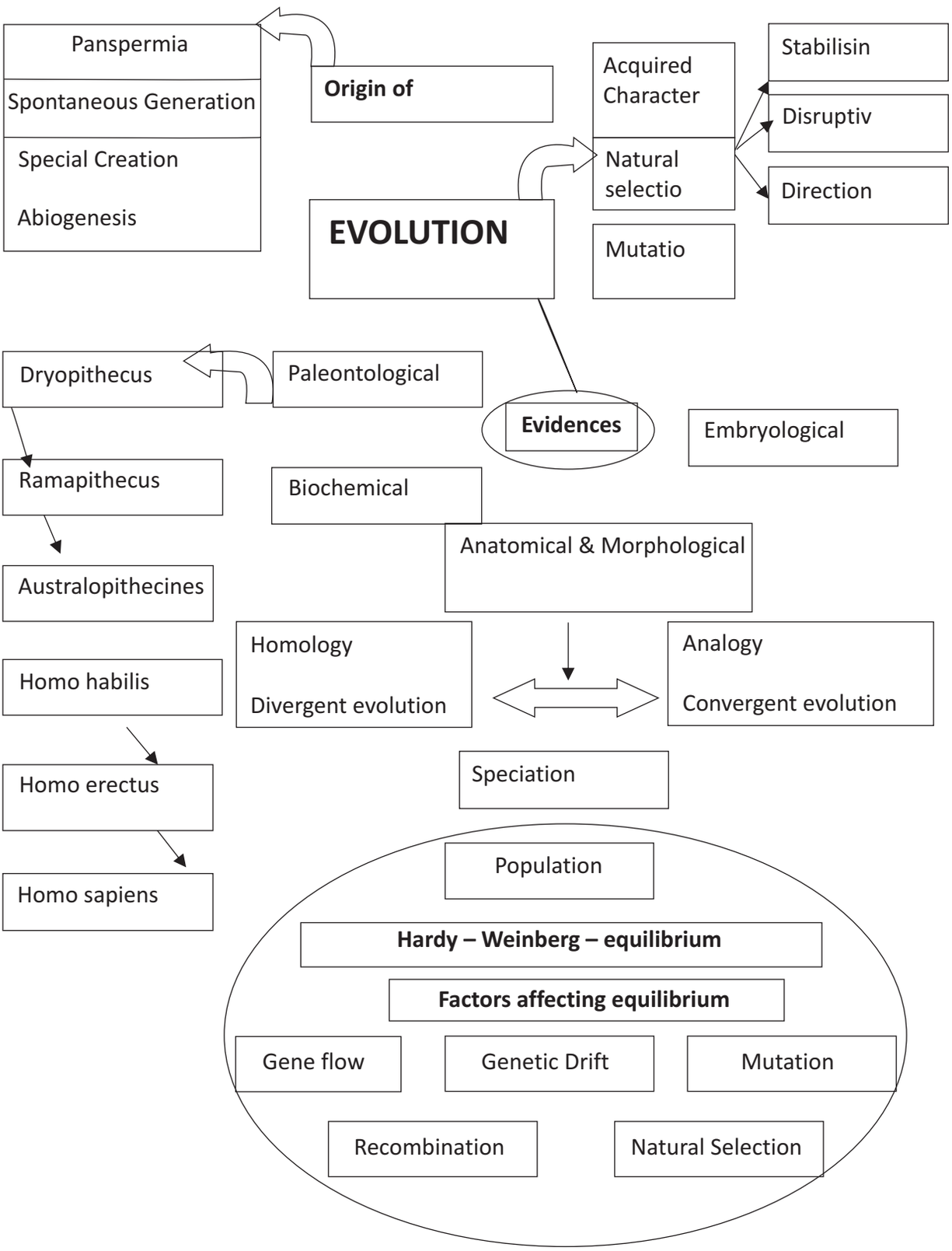
HARDY- WEINBERG CONTRIBUTATION

- Principle
  - Allele frequencies with in a population are stable and remain constant from generation to generation $\mathbf{p^2 + 2pq + q^2 = 1}$
- Factors affecting Hardy Weinberg Principle
  - Gene Migration /Gene flow
  - Genetic drift
  - Mutation
  - Recombination
  - Natural Selection
    - Stabilising
    - Directional
    - Disruptive

5 **Brief account of Evolution**

Time	Organism
3 billion years ago	First non cellular form of life
2000 million years	First cellular forms of life appeared
500 million years ago	Invertebrate formed
320 million years ago	Sea weeds and plants exists
350 million years ago	Fishes with stout and strong fins could move on land and go back to water - **coelacanth** called lobefins – evolved into the first amphibian

CHAPTER - 7 - EVOLUTION
(CONCEPT MAP)



CHAPTER - 7 - EVOLUTION
(QUESTION BANK)

1 Mark Questions

1. Identify the examples of convergent evolution from the following:
   (a) Flippers of penguins and dolphins.
   (b) Eyes of octopus and mammals
   © Vertebrate brains
2. What did Louis Pasteur's experiments on 'killed yeast' demonstrate? Name the theory that got disproved on the basis of his experiment.
3. *Coelacanth* was caught in 1938 in South Africa. Why is it very significant in the evolutionary history of vertebrates?
4. List the two characteristics of mutation that help in explaining evolution according to De Vries.
5. Why are lichens regarded as pollution indicators?
6. Pick out the ancestral line of Angiosperms from the list give below: Conifers, Seed ferns, Cycads, Ferns.
7. Mention the type of evolution that has brought the similarity as seen in potato tuber and sweet potato.

2 Marks Questions

1. List the two main propositions of Oparin and Haldane
2. How does paleontological evidence support evolution of organisms on Earth?
3. What does the comparison between the eyes of Octopus and those of mammals say about their ancestry and evolution?
4. Categories the following pairs of examples as convergent or divergent evolutions:
   (a) Eyes of octopus and mammals.
   (b) Wings of butterfly and birds.
   (c) Tuber of sweet potatoes and potato.
   (d) Thorns in bougainvillea and tendrils in cucurbits.
5. How do Darwin's finches illustrate adaptive radiation?
6. How does fitness of a population help in evolution?
7. How is generic drift different from gene migration? Explain.

3 Marks Questions

1. State the theory of abiogenesis. How does miller's experiment support this theory?
2. Evolution is the change of gene frequencies in a population in response to changes in environment in the time scale of years and not centuries. Justify the statement with reference to DDT.How does the theory of Hugo de varies support this?
3. How did Darwin theory of natural selection explain the appearance of new forms on the earth?

5 Marks Question

1 a) How does hardy Weinberg equation explain the genetic equilibrium?
   b)Describe hoe this equilibrium gets disturbed which may lead to founder effect.

Value based Question

2. The giant squirrel (*Ratufaindica)* occurs along the west coast. The population living in moist deciduous forests of Maharashtra has light brown fur, the population living in the dry deciduous forests of Gujarat has a yellow fur and of living in the wet evergreen forest of Kerala has chocolate brown fur.
   a) Give reasons for the difference in the fur color of the squirrels.
   b) How would you justify that despite these differences they all belong to same species?
   c) What value is indicated in this?

CHAPTER - 7 - EVOLUTION
(ANSWER KEY)

<table>
<tr><th>Q. No.</th><th>Value Points</th><th>Marks</th></tr>
<tr><td>1</td><td>(a), and (b)</td><td>1</td></tr>
<tr><td>2</td><td>Theory of spontaneous generation was disproved.</td><td></td></tr>
<tr><td>3</td><td>- Coelacanth has evolved into the first amphibians; they are fish with stout and strong fins that could move on land and go back to water.
- They were thought to be extinct.</td><td>1</td></tr>
<tr><td>4</td><td>Mutations are: Radom, Directionless</td><td>1</td></tr>
<tr><td>5</td><td>Since, lichens do not frown in polluted areas, they are regarded as pollution indicators.</td><td>1</td></tr>
<tr><td>6</td><td>Seed ferns.</td><td>1</td></tr>
<tr><td>7</td><td>Sweet potato tuners and potato tubers are analogous structures, evolved for the same function; analogous structures results from convergent evolution.</td><td>1</td></tr>
<tr><td>1</td><td>The first form of life could have come from, pre-existing non-living g organic molecules like RNA, proteins, etc.
Formation of life was preceded by chemical evolution that resulted in the formation of diverse organic molecules form inorganic constituents.</td><td>2</td></tr>
<tr><td>2</td><td>Paleontology is the study of fossils. It indicates
The geological time period in which the organisms existed.
That life forms varied over time and certain life forms are restricted to certain geological time pans.
That new forms of life have appeared at different times in the history of earth.</td><td>2</td></tr>
<tr><td>3</td><td>Eyes of octopus and those of mammals are analogous structures, which have resulted from convergent evolution. They have not evolved from common ancestors.</td><td>2</td></tr>
<tr><td>4</td><td>(a) Convergent evolution.
(b) Divergent evolution.
(c) Convergent evolution.
(b) Divergent evolution.</td><td>2</td></tr>
<tr><td>5</td><td>Adaptive radiation is the process of evolution of different species in a given geographical area starting from a point and literally radiatingto other geographical areas.
Darwin's finches were the small black birds, which Darwin observed in Galapagos Islands.
Loving in isolation for long, new kinds of finches must have evolved, which could survive in the new habitats.</td><td>2</td></tr>
<tr><td>6</td><td>Fitness, according to Darwin, refers ultimately and only to reproductive fitness.
Those who are better fit in an environment would outbreed others, who are less fit in that environment; they leave m-=ore progeny that others.
They will survive better and are selected by nature to reproduce and increase their population size.</td><td>2</td></tr>
<tr><td>7</td><td><table><tr><td>Genetic drift</td><td>Gene flow</td></tr><tr><td>Random changes in the allele frequencies of a population, occurring only by chance, constitute genetic drift.</td><td>If refers to the change in allelic frequencies of a given population, when individuals migrate into the population or form the population.</td></tr></table></td><td>2</td></tr>
</table>

1	Theory of chemical evolution of abiogenesis was proposed by Operon and Haldane. It states that the first form of life could have come from pre-existing non-living organic molecules like RNA's etc., and that and that formation of life was preceded by chemical evolution, i.e. Formation of diverse organic molecules from in organic constituents.	3
	Miller's experiment: - He created conditions similar to the primitive earth in the laboratory. - Electric discharge was produced in a closes flask, containing methane, hydrogen, ammonia, and water vapor. - The temperature was kept at 800 C - After a week, he observed formation of amino acids. - Such molecules must have reacted among themselves to form giant, self-replicating molecules, and the first form of life	
2.	As the environment changes the organism which are better adapted to the changed environment could survive better and reproduce. - When DDT was used, initially most of the mosquitoes died, but a few survived. -These few mosquitoes reproduce and their off springs were also resistant to DDT. - Today, the population of mosquitoes mostly contains DDT resistance mosquitoes. - The DDT resistant mosquitoes have evolved in a time scale of years or months and not centuries. - So, evolution is a direct process but stochastic process based on chance events. - According to Hugo de Varies, evolution occurs due to mutations. Large differences arising suddenly in a population. - According to him large, single-step mutation, called saltation, must have been the cause of DDT- resistance in mosquitoes.	3
3	Darwin's theory of Natural selection: Any population has built in variation for every character. Individuals with those characters which enable them to survive better would outbreed the others, who are less adapted. Fitness, according to Darwin's is reproductive fitness, i.e., individuals who are better fit in an environment leaves more progeny than others. These progenies now comes to possess more fit individuals, i.e., nature selects the better fit individuals and over a long period of time, through a number of generations, the population slowly becomes modified into a different form, or a species, which is called evolution	3
1	**a) Hardy-Weinberg Principle:** It states that the allele frequencies in a population are stable and remain constant for generation to generation; it is called genetic equilibrium. The sum total of all the allelic frequencies is one. (b) Genetic drift: - Genetic drift refers to the changes in allele frequencies that occur only by chance events. - Sometimes the changes in allele fre4quency is so different in the new sample of population, that they become a different species, - The originally drifted population becomes the founder and such an effect is called founder effect.	5
	Value based	
2	(a) The differences in the coloration of giant squirrel in different habitats are adaptations for the animals of camouflage with the background and escape predators. (b) Though they are different in their fur coloration, they can interbreed in nature to produce viable/fertile offspring; so they belong to the same species. (c) Nature provides protection to all life forms.	4