Chapter 2

Diversity in Living Organism & Their Mode of Reproduction

- Life has evolved on planet Earth over millions of years ago.
- Different kinds of life forms exist on Earth which ranges from microscopic bacteria of few micrometre to red wood trees of 100 metres and blue whale of 30 metres in size.
- For our convenience, we put them into different classes, groups and sub groups on the basis of similarities and differences among them.
- The process of reproduction ensures continuing of life on earth.
- **Reproduction** gives rise to more organisms with the same basic characterstics as their parents.

Basis of Classification : Aristotle classified animals on the basis of their habitat - land and water. Later on organisms were divided into groups and sub groups on the basis of particular characteristics like form and function. A whole hierarchy of mutually related characteristics is used for classification

Some Important characteristics are :

(i) Presence and absence of nucleus in the cell.

(ii) Body composed of single cell or group of cells.

(iii) Autotrophs (producing own food) and heterotrophs (getting food from outside).

(iv) Development and organisation of different body parts.

Classification and Evolution :

- The life forms that we see today have arisen by accumulation of changes in the body design that help the organisms to survive in a better way *i.e.* through evolution.
- Older organisms are simpler while younger organisms are complex. The complexity in design comes during evolution.
- Charles Darwin was a British scientist who gave the **Theory of Evolution**. He wrote the famous book "**The Origin of Species**".

The Hierarchy of Classification – Groups :

- **Ernst Haeckel** (1894), **Robert Whittaker** (1959) and **Carl Woese** (1977) classified organisms into kingdoms. **Whittaker** divided them into 5 kingdoms, **Monera, Protista, Fungi, Plantae** and **Animalia** on the basis of their cell structure, mode and source of nutrition and body organisation.
- Various levels of classification are –

  Kingdom → Phylum (animals)/ Division (plants) → Class → Order → Family → Genus → Species.
- Species is the basic unit of classification.

The 5 kingdoms of Whittaker are –

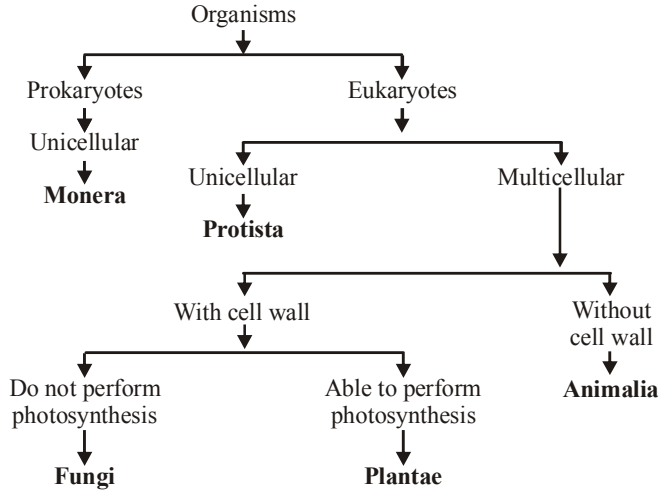
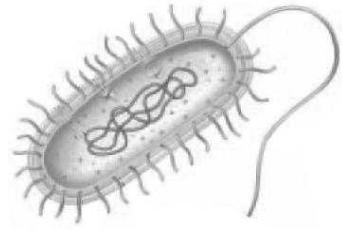


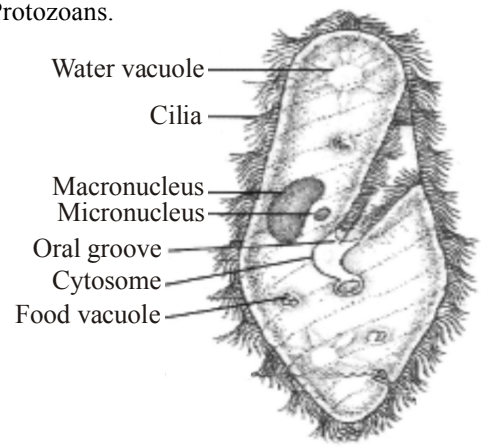
Fig. The five kingdom classification

(i) **Monera –** They are usually unicellular, do not have well defined nucleus and organelles. Cell wall may be present or absent. Mode of nutrition is autotrophic or heterotrophic. *E.g.* Bacteria, Blue-green algae, Mycoplasma.



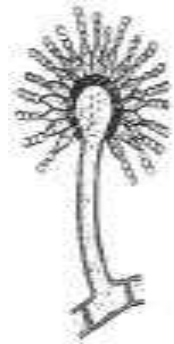
Bacteria

(ii) **Protista –** They are unicellular, eukaryotic organisms. Cilia or flagella help in movement. They have autotrophic or heterotrophic mode of nutrition. *E.g.* Algae, Diatoms, Protozoans.



Paramecium

3. **Fungi –** They are heterotrophic, eukaryotic organisms. They are saprophytes that use decaying organic material as food. Cell wall is made of chitin. The symbiotic relation with blue green algae forms lichens. *E.g.* Yeast, Mushrooms.



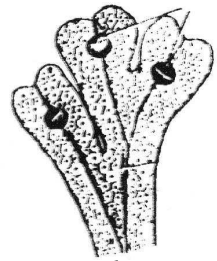
Aspergillus

4. **Plantae –** They are multicellular eukaryotes with cell walls. They have autotrophic mode of nutrition. All plants are included in this group. **Plants are divided into following 5 groups –**

(i) **Thallophyta –** Plant body is like a thallus, not differentiated in root, stem and leaves. Commonly called algae. eg. *Spirogyra, Ulothrix, Chara.*

Ulothrix

(ii) **Bryophyta –** It is also called amphibians of the plants kingdom. Body is differentiated to form stem and leaf. *e.g. Funaria, Marchantia.*

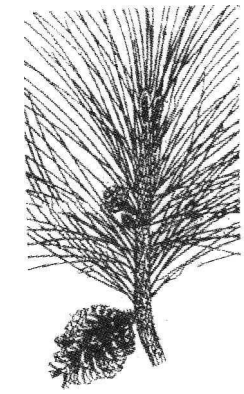


Marchantia

(iii) **Pteridophyta –** Plant body is differentiated into root, stem and leaves. Specialised water conducting tissues present. *E. g.* Ferns, *Marsilea.*

Fern

(iv) **Gymnosperms –** They bear naked seeds, and are usually perennial, and woody. *Eg*. Pines, Deodar.



Pinus

(v) **Angiosperms –** They are flowering plants in which seeds are enclosed within fruit. **Angiosperms are of two types** :
Monocots – Seeds with single cotyledon.
Dicots – Seeds with two cotyledons.

5. **Animalia –** They are eukaryotic, multicellular and heterotrophic organisms that do not have cell wall. **On the basis of extent and type of body design, they are classified as–**

(i) **Porifera –** It includes non-motile animals. Holes or pores are present all over the body. They are commonly called sponges. *E.g. Spongilla, Sycon.*

(ii) **Coelenterata –** Also called cnidaria. They have more differentiated body organisation. They are water animals with coelenteron (body cavity). *E.g.* jelly fish, Sea anemone, etc.

(iii) **Platyhelminthes –** Body is dorsiventrally flat so they are called flatworms. Body is bilaterally symmetrical and triploblastic. *E.g.* Planaria, Tapeworms.

(iv) **Nematoda –** Body is triploblastic, bilaterally symmetrical, and has tissue level of organisation, Pseudocoel is present. *E.g. Ascaris, Wuchereria.*

(v) **Annelida –** Body is bilaterally symmetrical and triploblastic. True body coelom is present. True organs are present. *Eg*. Earthworms, Leeches etc.

(vi) **Arthropoda –** Body is bilaterally symmetrical and segmented. They have open circulatory system, jointed legs are present. *E.g*. Prawns, Butterflies. etc.

(vii) **Mollusca –** Body is bilaterally symmetrical with little segmentation. Coelom is reduced. They have open circulatory system. Foot, kidney like organs are present. *E.g*. Snails, Mussels etc.

(viii) **Echinodermata –** They are spiny skinned animals. Body is triploblastic. They have tube system for movement of body. *E.g*. Starfish, Sea urchins.

(ix) **Protochordata –** Body is bilaterally symmetrical, triploblastic with a coelom. Notochord is a long rod like structure running along the back of animal. *E.g. Balanoglossus, Herdmania.*

(x) **Vertebrata –** Animals have vertebral column and skeleton. Body is bilaterally symmetrical, triploblastic, coelomic and segmented.

- **Important features of vertebrates :**
  (i) Presence of notochord
  (ii) Presence of dorsal nerve cord
  (iii) Triploblastic
  (iv) Presence of paired gill pouches
  (v) Coelomic body
- **Vertebrates are divided into 5 classes :**
  (i) **Pisces –** Include fishes which are aquatic. Skin is covered with scales or plates. Gills are present. *E.g.* Shark, Rohu.
  (ii) **Amphibia** – They have mucus glands in skin. Respiration is through gills or lungs. Animals are found both in water and on land. They have 3- chambered heart. *E.g.* Toads, Frogs, Salamander.
  (iii) **Reptilia –** They are cold blooded animals with scales and breathe through lungs. They have 3 – chambered heart. They lay eggs in water. *E.g.* Snakes, Turtles, Crocodiles etc.
  (iv) **Aves –** They are warm blooded animals with 4 – chambered heart. They have feathers and forelimbs are modified for flight. They breathe through lungs. *E.g.* Pigeon, Sparrow, Ostrich.
  (v) **Mammalia –** They are warm blooded animals with 4 – chambered heart. They have mammary glands for milk production. They show care for young ones, skin has hairs and sweat glands. They give birth to young ones.

Reproduction : The production of new organisms from the existing organisms of the same species is known as reproduction.

- **Asexual Reproduction :**

(i) Fission :
  (1) **Binary fission** – The parent organism divides to form two new organisms. *E.*g. *Amoeba*.
  (2) **Multiple fission** – The parent organism divides to form many new organisms at the same time. *E.*g. – *Plasmodium*.

(ii) Budding : A small part of the body of the parent organism grows out as a 'bud' which then detaches and becomes a new organism. *E.g. Hydra.*

(iii) Spore formation : The parent plant produces hundreds of microscopic reproductive units (spores). Under favourable conditions, they germinate and produce new plants.

(iv) Regeneration : The process of getting back full organism from its body parts is called regeneration. *E.g. Hydra*.

(v) Vegetative propagation : New plants are obtained from the parts of old plants (like stems, roots, and leaves), without the help of any reproductive organs. *E.g.* banana, orange, rose.

(vi) **Tissue culture:** The production of new plants from a small piece of plant tissue (or cells) removed from the growing tips of a plant in a suitable growth medium (culture solution).

(vii) **Fragmentation :** The breaking up of the body of a simple multicellular organism into two (or more) pieces on maturing, each of which subsequently grows to form a complete new organism, *e.g. Spirogyra* and Sea anemones.

- Artificial propagation of plants includes — **cutting, layering and grafting.**

Sexual Reproduction

In sexual reproduction, a male gamete (germ cells) fuses with a female gamete to form a new cell called '**zygote**'.

- Male gametes are known as **sperms** and these are produced in **testes**. Female gametes are known as **ovum** and are produced in **ovary**.
- When male gamete and female gamete fuse, they form a zygote and the process is known as **fertilization**.

Sexual Reproduction in Flowering Plants

- Flower is meant essentially for sexual reproduction. Different parts of the flowers are **sepals, petals, stamens and carpels**.
- Stamens and carpel are directly concerned with the process of sexual reproduction. **Stamen** is the male reproductive part. **Carpel** is the female reproductive part.
- **Pollination** is the process in which pollen grains are transferred from the anther to stigma of the carpel. It is of two types **self-pollination** and **cross-pollination**.

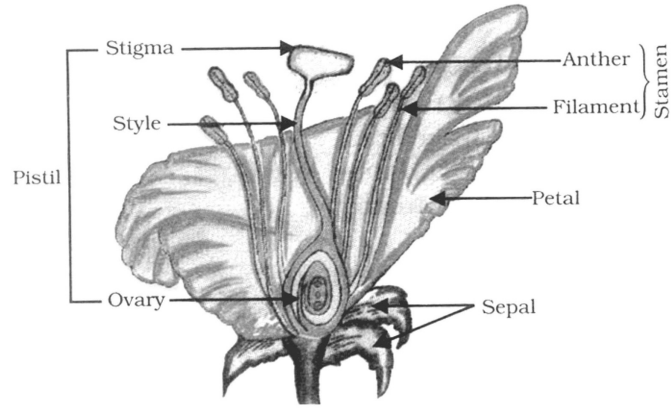


Fig. Longitudinal section of flower

- In the fertilization process **primary endospermic nucleus** is formed.
- After the fertilization process, ovary develops into the fruit whereas ovules into the seed.

Reproduction in Human Beings

- The reproductive organs of human beings become functional after attaining puberty stage. It occurs in between the age group of 13 – 14 years in male and 10 – 12 years in female.
- The sex organ in males are testes and ova in females.
- Male reproductive organ consist of a pair of testes, vas deferens, a pair of epididymis, a pair of ejaculatory duct, urethra, pairs of accessory gland.
- Leydig's cells secrete male sex hormone **testosterone** which is concerned with the production of male sexual characters.

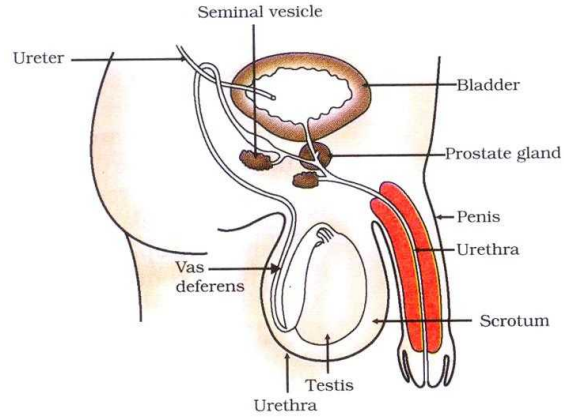


Fig. Human-male reproductive system

- Penis transfers the sperms to female reproductive tract.
- Female reproductive part consist of a pair of ovaries, a pair of fallopian tube, uterus, vagina, external genitalia, mammary glands and accessory glands.
- If sperms are present, fertilization of ovum takes place in the upper end of the **fallopian tube**.
- In the uterus, embryo gets implanted and develops for nine months during pregnancy. **Cervix** is the lower tip of uterus.

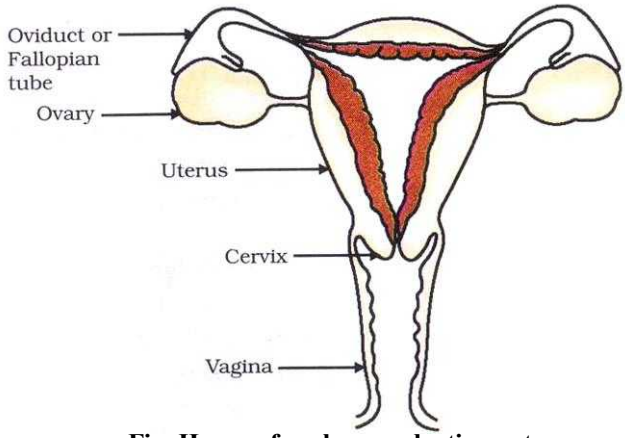


Fig. Human-female reproductive system

- **Vagina** acts as a birth canal during **child birth**.
- Fertility phase lies between tenth and sixteenth days from onset of menses and there is viability of ovum.
- **Fertilization** process occurs in **fallopian tube**. In this process zygote is formed. **Umbilical cord** is produced which is attached to foetus. During this process two hormones are produced which are **estrogen** and **progesterone**. Progesterone stops mensturation and prevents ovulation.
- If the egg is not fertilized, it lives for about one day. Since the ovary releases one egg every month, the uterus also prepares itself every month to recieve a fertilized egg.

Reproductive Health

Barrier methods

(i) Mechanical barrier method:- They prevent contraception by preventing either sperms from entering uterus or preventing implantation if fertilization has occurred. The instruments are condom, cervical cap, diaphragms & IUDs method.

(ii) Hormonal method: They are used by women for suppresing the production of ovum. *i.e*, oral pills.

(iii) Surgical techniques:–

1. **Vasectomy –** A small part of the vas deferens is removed or tied up through a small incision on the scrotum. This prevents the passage of sperms from testes to semen.
2. **Tubectomy–** A portion of both the fallopian tubes is excised to ligated to block the passage of ovum.

- **Sexually Transmitted Diseases (STDs) :** It is a group of infections caused by different types of pathogens that are transmitted by sexual contact between a healthy person and an infected person. Some sexually transmitted diseases (STDs) are Gonorrhoea, Syphilis, Trichomoniasis, Genital worts and AIDS *etc.*

Exercise 1

DIRECTIONS : This section contains multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which only one is correct.

1. Plants that grow in the desert are called
   (1) hydrophytes (2) mesophytes
   (3) xerophytes (4) epiphytes
2. Binomial system of a nomenclature means that every organism has
   (1) two names, one scientific and one popular.
   (2) one scientific name consisting of a generic and a specific part.
   (3) one name given by two scientists.
   (4) two names, one denoting the latinised name of the place and the other of the person, who determined it.
3. The main plant body of pteridophyte is
   (1) sporophyte (2) epiphyte
   (3) saprophyte (4) gametophyte
4. 'The Origin of Species' was written by
   (1) Linnaeus (2) Whittaker
   (3) Parasara (4) Darwin
5. The kingdom Protista is primarily made up of organisms that are
   (1) eukaryotic and multicellular
   (2) prokaryotic and multicellular
   (3) prokaryotic and single-celled
   (4) eukaryotic and single-celled
6. What were the key evolutionary innovations of the Plantae ?
   (1) Seeds, organelles, flowers
   (2) Roots, cuticle, seeds, flowers
   (3) Roots, hyphae, flowers
   (4) Hyphae, cuticle, organelles
7. Choose the correct combination
   (1) Aves and Chordata – Classes
   (2) Annelida and Porifera – Phyla
   (3) Mollusca and Hydrozoa – Classes
   (4) Oligochaeta and Arthropoda – Phyla
8. Five kingdom classification was proposed by
   (1) Woese (2) Haeckel
   (3) Darwin (4) Whittaker
9. The unique feature of bryophytes being member of kingdom plantae is that
   (1) they lack roots.
   (2) they produce spores.
   (3) they lack vascular tissue.
   (4) their sporophyte is attached to gametophyte.
10. 'Sanjeevani booti' is
    (1) *Selaginella kraussiana*
    (2) *Selaginella chrysocaulos*
    (3) *Selaginella bryopteris*
    (4) None of the above
11. A plant having vascular supply, producing spores but lacking seeds can be grouped under
    (1) bryophyta (2) pteridophyta
    (3) gymnosperms (4) angiosperms

12. Mycoplasma belongs to:
(1) Protista (2) Monera
(3) Thallophyta (4) Nematoda

13. Which of the following are absent in gymnosperms ?
(1) Xylem vessels
(2) Xylem fibres
(3) Tracheids and fibres
(4) All of these

14. Porifers are
(1) generally marine, but few are found in fresh water.
(2) generally found in fresh water, but few are marine.
(3) marine only.
(4) found in fresh water only.

15. If a *Hydra* is cut into two pieces it will result in
(1) growth of mouth and disc according to their position in the parent.
(2) growth without mouth and basal disc.
(3) no regeneration.
(4) growth of mouth and disc at any end.

16. Amphibians of the plant kingdom is
(1) angiosperms (2) bryophyta
(3) gymnosperms (4) pteridophyta

17. Which is not a feature of Annelida ?
(1) Metameric segmentation
(2) Nephridia
(3) Pseudocoelom
(4) Clitellum

18. Which of the following is an edible 'Fungi' ?
(1) *Mucor* (2) *Penicillium*
(3) *Agaricus* (4) *Rhizopus*

19. Radial symmetry is found in
(1) *Hydra* (2) Starfish
(3) Sponge (4) Spider

20. Notochord, Dorsal nerve chord and Gill-slits are features seen in :
(1) vertebrata (2) protozoa
(3) mollusca (4) porifera

21. Which of the following pairs is correctly matched ?
(1) Water-vascular system - Sponge
(2) Flame cell-Flat worm
(3) Blubber-Kangaroo
(4) Marsupium-*Platypus*

22. Asexual reproduction takes place through budding in
(1) *Amoeba* (2) *Yeast*
(3) *Plasmodium* (4) *Leishmania*

23. Which of the following is not a part of the female reproductive system in human beings?
(1) Ovary (2) Uterus
(3) Vas deferens (4) Fallopian tube

24. The structures that carry information for inheritance is
(1) chromosomes
(2) nucleolus
(3) endoplasmic reticulum
(4) mitochondria

25. The anther contains
(1) sepals (2) ovules
(3) carpel (4) pollen grain

26. In the list of organisms given below, those that are reproduced by the asexual method are
(i) banana (ii) dog
(iii) *Yeast* (iv) *Amoeba*
(1) (ii) and (iv) (2) (i), (iii) and (iv)
(3) (i) and (iv) (4) (ii), (iii) and (iv)

27. In a flower, the parts that produce male and female gametes (germ cells) are
(1) stamen and anther (2) filament and stigma
(3) anther and ovary (4) stamen and style

28. The capacity of organisms to reproduce after being cut into many pieces is called
(1) budding (2) fission
(3) regeneration (4) reproduction

29. Which of the following is the correct sequence of events of sexual reproduction in a flower?
(1) Pollination, fertilisation, seedling, embryo
(2) Seedling, embryo, fertilisation, pollination
(3) Pollination, fertilisation, embryo, seedling
(4) Embryo, seedling, pollination, fertilisation

30. Offspring formed by asexual method of reproduction have greater similarity among themselves because
(i) asexual reproduction involves only one parent.
(ii) asexual reproduction does not involve gametes.
(iii) asexual reproduction involves two parents.
(iv) asexual reproduction occurs before sexual reproduction.
(1) (i) and (ii) (2) (i) and (iii)
(3) (ii) and (iv) (4) (iii) and (iv)

31. Characters transmitted from parents to offspring are present in
(1) cytoplasm (2) ribosome
(3) Golgi bodies (4) genes

32. The main method of propagation of banana, orange, rose and jasmine is
(1) sexual reproduction
(2) vegetative reproduction
(3) fission
(4) fusion

33. Characters that are transmitted from parents to offspring during reproduction show
(1) only similarities with parents.
(2) only variations with parents.
(3) both similarities and variations with parents.
(4) neither similarities nor variations.

34. A feature of reproduction that is common to Amoeba, *Spirogyra* and Yeast is that
(1) they reproduce asexually.
(2) they are all unicellular.
(3) they reproduce only sexually.
(4) they are all multicellular.

35. Which among the following has specialised tissue for conduction of water?
(i) Thallophyta (ii) Bryophyta
(iii) Pteridophyta (iv) Gymnosperms
(1) (i) and (ii) (2) (ii) and (iii)
(3) (iii) and (iv) (4) (i) and (iv)

36. The reptile with a four chambered heart is
(1) crocodile (2) turtle
(3) lizards (4) snakes

37. Which among the following have scales?
(i) Amphibians (ii) Pisces
(iii) Reptiles (iv) Mammals
(1) (i) and (iii) (2) (iii) and (iv)
(3) (ii) and (iii) (4) (i) and (ii)

38. Which among the following have open circulatory system?
(i) Arthropoda (ii) Mollusca
(iii) Annelida (iv) Coelenterata
(1) (i) and (ii) (2) (iii) and (iv)
(3) (i) and (iii) (4) (ii) and (iv)

39. Organisms without nucleus and cell organelles belong to
(i) fungi (ii) protista
(iii) cyanobacteria (iv) archae bacteria
(1) (i) and (ii) (2) (iii) and (iv)
(3) (i) and (iv) (4) (ii) and (iii)

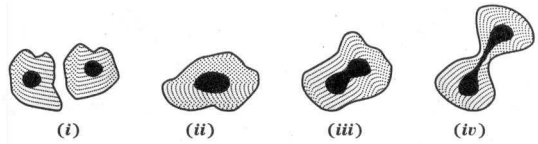
40. The fertilized egg or the zygote gets implanted in the
(1) fallopian tube (2) ovary
(3) uterus (4) vagina

41. Meena and Hari observed an animal in their garden. Hari called it an insect while Meena said it was an earthworm. Choose the character from the following which confirms that it is an insect.
(1) Bilateral symmetrical body
(2) Body with jointed legs
(3) Cylindrical body
(4) Body with little segmentation

42. Factors responsible for the rapid spread of bread mould on slices of bread are
(i) large number of spores.
(ii) availability of moisture and nutrients in bread.
(iii) presence of tubular branched hyphae.
(iv) formation of round shaped sporangia.
(1) (i) and (iii) (2) (ii) and iv)
(3) (i) and (ii) (4) (iii) and (iv)

43. Which of the following statements are true for flowers?
(i) Flowers are always bisexual.
(ii) They are the sexual reproductive organs.
(iii) They are produced in all groups of plants.
(iv) After fertilisation they give rise to fruits.
(1) (i) and (iv) (2) (ii) and (iii)
(3) (i) and (iii) (4) (ii) and (iv)

44. The following figures illustrate binary fission in *Amoeba*



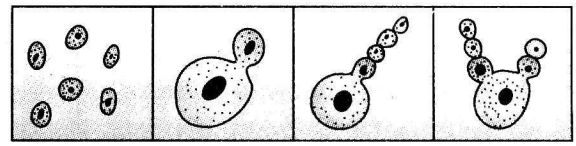
The correct sequence is
(1) (i), (iii), (iv), (ii) (2) (ii), (iii), (iv), (i)
(3) (iv), (iii), (ii), (i) (4) (iii), (iv), (ii), (i)

45. Which among the following statements are true for unisexual flowers?
(i) They possess both stamen and pistil.
(ii) They possess either stamen or pistil.
(iii) They exhibit cross pollination.
(iv) Unisexual flowers possessing only stamens cannot produce fruits.
(1) (i) and (iv) (2) (ii), (iii) and (iv)
(3) (iii) and (iv) (4) (i), (iii) and (iv)

46. Which among the following statements are true for sexual reproduction in flowering plants?
(i) It requires two types of gametes.
(ii) Fertilisation is a compulsory event.
(iii) It always results in formation of zygote.
(iv) Offspring formed are clones.
(1) (i) and (iv) (2) (i), (ii) and (iv)
(3) (i), (ii) and (iii) (4) (i), (ii) and (iv)

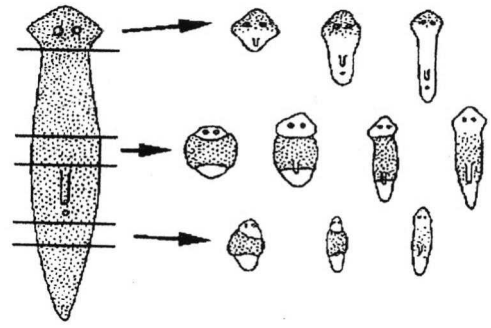
47. Which among the following is not the function of testes at puberty?
(i) Formation of germ cells.
(ii) Secretion of testosterone.
(iii) Development of placenta.
(iv) Secretion of estrogen.
(1) (i) and (ii) (2) (ii) and (iii)
(3) (iii) and (iv) (4) (i) and (iv)

48. Four students were asked to draw the diagram after viewing a prepared slide of 'Budding in Yeast' under a compound microscope. The diagrams are given below. Mark the correct diagram which is not depicting budding in yeast.



(1) A (2) B
(3) C (4) D

49. Following figure represents :



(1) Budding in *Hydra*
(2) Budding in *Planaria*
(3) Regeneration in *Planaria*
(4) None of these

50. The organ modified for flight in birds is
(1) hindlimbs (2) neck
(3) forelimbs (4) fingers

51. Mucus glands in the skin and three chambered heart are seen in
(1) Reptilia (2) Aves
(3) Pisces (4) Amphibia

52. Cartilaginous skeleton is seen in
(1) Tuna (2) Sharks
(3) Mandarin fish (4) Pterois volitans

53. Calcium carbonate structures form the skeleton of
(1) Mollusca (2) Echinodermata
(3) Protochordata (4) Nematodes

54. The largest group of animals is seen in
(1) Porifera (2) Annelida
(3) Arthropoda (4) Nematoda

55. *Marsilea* and Horse-tails belong to
(1) thallophyta (2) angiosperms
(3) pteridophyta (4) bryophyta

56. Naked seeds, perennial, evergreen, woody plants are characteristic features of
(1) gymnosperms (2) bryophyta
(3) angiosperms (4) pteridophyta

57. The highest taxon in the hierarchy of classification is
(1) kingdom (2) class
(3) phyllum (4) genus

58. Unicellular organisms divide due to
(1) fusion (2) fission
(3) budding (4) sexual reproduction

59. *Plasmodium* divides by
(1) budding (2) fusion
(3) multiple fission (4) binary fission

60. Advantage of vegetatively reproduced organism is
(1) dissimilar organisms
(2) genetic similarity in offsprings
(3) genetic variation
(4) varied offsprings

61. Vegetative propagation in *Bryophyllum* is due to
(1) buds in the notches of leaves
(2) corm
(3) stem
(4) root

62. The structures involved in asexual reproduction of *Rhizopus* is
(1) buds (2) sporangia
(3) callus (4) cell

63. Variations in a population is due to
(1) DNA copying (2) error in DNA copying
(3) cell division (4) budding

64. The germ cell in plants are seen in
(1) stem (2) leaves
(3) root (4) stamens and carpels

65. The embryo gets nutrition from the mothers blood with the help of
(1) placenta (2) ovary
(3) corpus luteum (4) fallopian tube

66. The formation of germ cells in males occur in
(1) testes (2) ovary
(3) ureter (4) urethera

Exercise 2

Matching Based MCQ

DIRECTIONS (Qs. 1 to 10) : Match Column-I with Column-II and select the correct answer using the codes given below the columns.

1.

	Column I	Column II
(A)	Animals which give birth to young one	(p) *Hydra*
(B)	Animal which produces bud	(q) *Planaria*
(C)	An animal which shows regeneration	(r) Viviparous
(D)	Provides nutrition to the developing embryo from the mother	(s) Placenta

(1) A – (p); B – (r); C – (q); D – (s)
(2) A – (r); B – (p); C – (q); D – (s)
(3) A – (r); B – (p); C – (s); D – (q)
(4) A – (r); B – (s); C – (p); D – (q)

2.

	Column I	Column II
(A)	The pollen transferred from one flower to another	(p) Germination
(B)	The process in which embryo develops into seedling	(q) Pollination
(C)	Fertilised egg in humans gets implanted in	(r) Menstruation
(D)	When egg in humans is not fertilised process occur	(s) Uterus

(1) A – (q); B – (p); C – (s); D – (r)
(2) A – (p); B – (q); C – (s); D – (r)
(3) A – (p); B – (q); C – (r); D – (s)
(4) A – (p); B – (r); C – (q); D – (s)

3.

	Column I	Column II
(A)	Algae	(p) *Chalmydomonas*
(B)	Fungi	(q) *Rosa indica*
(C)	Angiosperm	(r) *Adiantum*
(D)	Pteridophyte	(s) *Rhizopus*

(1) A – (s); B – (p); C – (r); D – (q)
(2) A – (p); B – (s); C – (r); D – (q)
(3) A – (p); B – (s); C – (q); D – (r)
(4) A – (p); B – (q); C – (s); D – (r)

4.

	Column I	Column II
(A)	Theophratus	(p) New systematics
(B)	J. Huxley	(q) Systematics
(C)	Carlous Linnaeus	(r) Father of Botany
(D)	Lamarck	(s) Dynamic concept of species

(1) A – (s); B – (r); C – (p); D – (q)
(2) A – (r); B – (s); C – (p); D – (q)
(3) A – (r); B – (p); C – (s); D – (q)
(4) A – (r); B – (p); C – (q); D – (s)

5.

	Column I	Column II
(A)	Flatworms	(p) Nematoda
(B)	Round worms	(q) Platyhelminthes
(C)	Segmented worms	(r) Porifera
(D)	Sponges	(s) Annelida

(1) A – (q); B – (p); C – (s); D – (r)
(2) A – (p); B – (q); C – (s); D – (r)
(3) A – (p); B – (q); C – (r); D – (s)
(4) A – (p); B – (r); C – (q); D – (s)

6.

	Column I	Column II
(A)	Thallophyta	(p) Algae
(B)	Phanerogam	(q) Mosses
(C)	Bryophyta	(r) Microphyllus
(D)	Pteridophyta	(s) Gymnosperm

(1) A – (q); B – (r); C – (t); D – (p)
(2) A – (p); B – (s); C – (q); D – (r)
(3) A – (s); B – (r); C – (q); D – (p)
(4) A – (s); B – (q); C – (p); (D) – (r)

7.

	Column I	Column II
(A)	Protozoan	(p) Jointed legs
(B)	Chordata	(q) Spiny skeleton
(C)	Echinoderms	(r) Primitive organism
(D)	Arthropoda	(s) Notochord present

(1) A – (s); B – (q); C – (p); D – (r)
(2) A – (s), B – (r), C – (q); D – (p)
(3) A – (q); B – (r); C – (p); D – (s)
(4) A – (r); B – (s); C – (q), D – (p)

8.

Column I		Column II	
(A)	Virus	(p)	Fungus which used to make a drug
(B)	Cyanobacteria	(q)	A kind of protozoan
(C)	*Plasmodium*	(r)	They are bacteria having chlorophyll
(D)	*Spirogyra*	(s)	An ultramicroscopic organism that is visible only through electron microscope
(E)	*Penicillium*	(t)	Green filamentous alga commonly found in fresh water habitats

(1) A – (s); B – (r); C – (q); D – (t); E – (p)
(2) A – (r); B – (p); C – (q); D – (t), E – (s)
(3) A – (p); B – (q), C – (r); D – (s); E – (t)
(4) A – (q); B – (t), C – (p), D – (r), E – (s)

9.

Column I		Column II	
(A)	Naked seed	(p)	Angiosperms
(B)	Covered seed	(q)	Gymnosperms
(C)	Flagella	(r)	Bryophytes
(D)	*Marchantia*	(s)	*Euglena*
(E)	*Marsilea*	(t)	Pteridophyta

(1) A – (q); B – (p); C – (s); D – (r); E – (t)
(2) A – (q); B – (s); C – (p); D – (r); E – (t)
(3) A – (q); B – (s); C – (p); D – (t); E – (r)
(4) A – (q); B – (p); C – (s); D – (t); E – (r)

10.

Column I		Column II	
(A)	Seminal vesicle	(p)	Latex sheath
(B)	Urinogenital duct	(q)	Semen plasma
(C)	Condom	(r)	Protozoan
(D)	*Trichomoniasis*	(s)	Corpus spongiosum

(1) A – (s); B – (q); C – (r); D – (p)
(2) A – (q); B – (s); C – (r); D – (p)
(3) A – (q); B – (s); C – (p); D – (r)
(4) A – (q); B – (p); C – (s); D – (r)

Statement Based MCQ

11. Consider the following statements :
(a) The binomial nomenclature is a way to identify vast diversity of life around us.
(b) Species is the lowest taxonomic category having minimum similarities.
(c) Homologous structures are structures sharing an evolutionary origin.
Which of these statement(s) is/are correct ?
(1) (a) and (b) (2) (b) and (c)
(3) (a) and (c) (4) All are correct

12. Consider the following statements :
(a) Plants are divided into five groups: Thallophytes, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.
(b) Lichens are examples of liverworts.
(c) The algae are vascular plants.
(d) Angiosperm is the least diversified form than any other plant groups.
Which of these statement(s) is/are correct ?
(1) (a), (b) and (c) (2) (b), (c) and (d)
(3) (a) and (d) (4) All are correct

13. Consider the following statements :
(a) The kingdom Animalia includes single-celled and multicellular organisms.
(b) Notochord is present in all adult vertebrates.
Which of these statement(s) is/are correct ?
(1) (a) only (2) (b) only
(3) Both (a) and (b) (4) Neither (a) nor (b)

14. Consider the following statements :
(a) Stamens are male reproductive part whereas carpels are female reproductive parts.
(b) In Spirogyra, asexual reproduction takes place by fragmentation.
(c) Vegetative propagation by leaves occurs in sweet potato.
Which of these statement(s) is/are correct ?
(1) (a) and (b) (2) (b) and (c)
(3) (a) and (c) (4) All are correct

15. Consider the following statements :
(a) Testes produces sperm and hormone called testosterone.
(b) The only function of the testes is to produce sperm.
(c) Fertilization is the fusion of sperm and ovum.
Which of these statement(s) is/are correct ?
(1) (a) and (b) (2) (b) and (c)
(3) (a) and (c) (4) All are correct

16. Consider the following statements :
(a) One advantage of sexual reproduction is that it allows for genetic sameness.
(b) Animal development is limited to the period prior to birth hatching.
(c) Onset of menstruation is termed as menopause.
Which of these statement(s) is/are correct ?
(1) (a) and (b) (2) (b) and (c)
(3) All are correct (4) All are wrong

17. Consider the following statements :
(a) Basic event in reproduction is creation of DNA copy.
(b) Plasmodium multiplies by binary fission.
(c) Bryophyllum propagates through spore formation.
(d) Hibiscus has unisexual flowers.
Which of these statement(s) is/are correct ?
(1) (a) and (b) (2) (b) and (c)
(3) (c) and (d) (4) (a) only

18. Consider the following statements :
(a) Copper–T is a contraceptive device used by women.
(b) Sexually transmitted diseases can be prevented by using condoms.
(c) The ovulation takes place 10-12 days after the start of mensuration.
(d) In human-beings, male can produce sperms upto the age of 45-50 years.
Which of these statement(s) is/are correct ?
(1) (a) and (b) (2) (b) and (c)
(3) (a) only (4) (a), (b) and (c)

Assertion Reason Based MCQ

DIRECTIONS (Qs. 19 to 25) : Following questions consist of two statements, one labelled as the **'Assertion'** and the other as **'Reason'**. You are to examine these two statements carefully and select the answer to these items using the code given below.

Code :

(1) Both A and R are individually true and R is the correct explanation of A:
(2) Both A and R are individually true but R is not the correct explanation of A.
(3) A is true but R is false
(4) A is false but R is true.

19. **Assertion :** Whittaker's classification for algae is not acceptable.
Reason : Whittaker grouped algae in different kingdoms.
20. **Assertion :** Systematics is the branch of biology that deals with classification of living organisms.
Reason : The aim of classification is to group the organisms.
21. **Assertion :** Root hairs are present on whole root surface.
Reason : Root hairs absorb water.
22. **Assertion :** Runners are underground stem.
Reason : Runners bear nodes and internodes.
23. **Assertion :** Sponges are less specialized ones.
Reason : Sponges show a high power of regeneration.
24. **Assertion :** Bats and whales are classified as mammals.
Reason : Bats and whales have four chambered heart.
25. **Assertion :** Sponges belong to Porifera.
Reason : Sponges have canal system.

Passage Based MCQ

DIRECTIONS (Qs. 26 to 31) : Read the passage(s) given below and answer the questions that follow.

PASSAGE - 1

Seed is a ripened ovule having a dormant embryo and food reserve for subsequent development of embryo into a plantlet. It is covered by one or two seed coats. It contains an embryo or future plant. A separate food laden tissue or endosperm is present in some seeds. In other, the food is stored in the cotyledon part of the embryo. Embryo has an axis called tigellum. One end of embryo axis or tigellum bears radicle or future root. The other end bears plumule or future shoot. Under favourable conditions, the seed absorbs water. The radicle and plumule resume growth. The seed coats break. The growing radicle passes into soil. It forms root system. The growing plumule comes above the soil. It forms shoot system.

26. Seed is formed from
(1) unfertilised ovary (2) fertilised ovary
(3) fertilised ovule (4) unfertilised ovule
27. Embryo has an axis called
(1) tigellum (2) radicle
(3) plumule (4) cotyledon

PASSAGE - 2

Sponges are the lowest multicellular animal but they have simple structures. Organs and tissues are absent. The constitution cells perform their functions more or less independently exhibiting division of labour performing specialized functions. Hence they possess cellular level of organization.

28. Sponges are
(1) sessile (2) planktonic
(3) free swimming (4) pelagic
29. Sponges are porifers because their bodies have
(1) spicules in skeleton (2) several pores
(3) canal system (4) All the above

PASSAGE - 3

The body temperature is constant in homeothermal (warm blooded) animals such as Birds and Mammals. These animals don't change their body temperature according to environmental temperature.
Vertebrate animals who can't change their body temperature according to environmental temperature are called cold blooded animals.

30. Temperature regulation is found in
(1) rat (2) fish
(3) frog (4) lizard
31. Which one is a poikilothermic (cold blooded) animal?
(1) Penguin (2) Whale
(3) Otter (4) Tortoise

Correct Definition Based MCQ

32. Herbs are
(1) plants have branched, and hard stem.
(2) plants with very tall and have hard and thick brown stem.
(3) plants with green and tender stem.
(4) plants with tall and have soft and brown stem.
33. Autotrophs are
(1) organism which make food themselves from simple substances.
(2) organism which take ready made food prepared by the plants.
(3) organism which take food from the host plant.
(4) organism which take food from the dead and decaying matter.
34. Choose the best definition of 'Cross pollination'–
(1) the pollen grains are transferred from one flower to another flower, of another plant of different species.
(2) the pollen grains are transferred from one flower to another flower, of another plant of the same species.
(3) the pollen grains of male flower are transferred to the stigma of the female flower of another plant.
(4) the pollen grains of one flower are transferred to the stigma of the same flower.
35. Thallophyta is a
(1) group of plants, where body is not differentiated into stem, root and leaves but is in the form of thallus.
(2) group of plant, where body is differentiated into stem, root and leaves.
(3) group of plants, where body is flat and lack true leaves and roots.
(4) group of plants, where body is differentiated into stem, root leaves and having flowers, seeds, etc.

Feature Based MCQ

36. Identify the plant which indicates the following features ?
(I) Auto-trophic in nature
(II) Grow in water logged swampy soils
(III) They capture and digest insect to fulfill the requirement of nitrogen compound.
(1) Saprophytic plants
(2) Parasitic plants
(3) Semi-parasitic plants
(4) Insectivorous plants

37. Identify the phylum of animal which indicates the following features ?
(I) Body possess a chitinous exoskeleton.
(II) A pair of jointed appendages.
(III) Compound eyes present.
(1) Porifera (2) Annelida
(3) Mammalia (4) Arthropoda

38. On the basis of following features identify correct option.
(I) Spikes present on skin.
(II) Free living marine animals.
(III) Triploblastic and have a coelomic cavity.
(IV) Have peculiar water driven tube system that is used as a skeleton.
(1) Echinodermata (2) Arthropoda
(3) Mollusca (4) Platyhelminthes

39. On the basis of following features identify correct option.
(I) They are cold blooded.
(II) Heart is three chambered.
(III) Fertilization is external.
(IV) Respiration through lungs on land and through moist skin when in water.
(1) Amphibian (2) Aves
(3) Reptiles (4) Mammals

40. On the basis of following features identify correct option.
(I) Streamlined body.
(II) Hollow and light bones.
(III) Forelimbs are modified into wings.
(IV) Warm blooded animals, heart with four chambers.
(1) Echinodermata (2) Arthropoda
(3) Mollusca (4) Aves

41. On the basis of following features identify correct option.
(I) Water living animals.
(II) Body is made of two layers of cells.
(III) Some of them live in colonies corals, while others have solitary life-span (*Hydra*).
(IV) Body cavity present.
(1) Platyhelminthes (2) Echinodermata
(3) Coelenterata (4) Arthropoda

Hints & SOLUTIONS

Exercise 1

1. (3) 2. (2) 3. (1)

4. (4) Charles Darwin's Origin of Species is a seminal work in scientific literature and arguably the pivotal work in evolutionary biology. It introduced the theory that populations evolve over the course of generations through a process of natural selection.

5. (4) 6. (2) 7. (2)

8. (4) Whittaker was most active in the areas of plant community analysis, succession, and productivity. He also first proposed the five-kingdom taxonomic classification of the world's biota into the Animalia, Plantae, Fungi, Protista, and Monera.

9. (3) 10. (3) 11. (2)

12. (2) Monera is an obsolete biological kingdom of the former five-kingdom system of scientific classification. It comprised most organisms with a prokaryotic cell organization. For this reason the kingdom was sometimes called Prokaryota or Prokaryotae.

13. (1) 14. (1) 15. (1)

16. (2) The bryophytes are those embryophyte plants ('land plants') that are non-vascular they have tissues and enclosed reproductive systems, but they lack vascular tissue that circulates liquids. Although they are land plants they require water for the process of reproduction

17. (3) 18. (3) 19. (4)

20. (1) The defining characteristic of a vertebrate is considered the backbone or spinal cord, a brain case, and an internal skeleton, but the latter do not hold true for lampreys, and the former is arguably present in some other chordates.

21. (2) 22. (2) 23. (3)

24. (1) A chromosome is a single large macromolecule of DNA, and constitutes a physically organized form of DNA in a cell. It is a very long, continuous piece of DNA (a single DNA molecule), which contains many genes, regulatory elements and other intervening nucleotide sequences.

25. (4) 26. (2) 27. (3)

28. (3) In biology, regeneration is an organism's ability to replace body parts. It is a specific method of healing that is ability to regrow lost limbs, severed nerve connections, and other wounds. It can be seen in the organisms of *Planaria* and starfish.

29. (3) 30. (1) 31. (4)

32. (2) When an individual organism increases in size via cell multiplication and remains intact, the process is called "vegetative growth". However, in vegetative reproduction, the new plants that result are new individuals in almost every respect except genetically.

33. (3) 34. (1) 35. (3)

36. (1) A crocodile is any species belonging to the family Crocodylidae sometimes classified instead as the subfamily Crocodylinae. Its a reptile with four chambered heart.

37. (3) 38. (1) 39. (2)

40. (3) The fertilized egg or zygote gets implanted in the uterus after the process of fertilization. The uterus is a bag like structure that holds the embryo till the birth of the child.

41. (3) 42. (3) 43. (4)

44. (2) When Amoeba undergoes fission nucleus divides first and then the cytoplasm.

45. (2) 46. (3) 47. (3)

48. (1) There is no bud on the parent cell.

49. (3)

50. (3) The forelimbs of the birds are modified as the flight organs. The Aves have been able to specialize in the art of flight due to the wings they have developed.

51. (4) Amphibians are a taxon of animals that include all living tetrapods that do not have amniotic eggs, are ectothermic and generally spend part of their time on land. Amphibians are able to breathe through their skin.

52. (2) Cartilage is another common component of skeletal systems, supporting and supplementing the skeleton. The human ear and nose are shaped by cartilage. Some organisms have a skeleton consisting entirely of cartilage and without any calcified bones at all, for example sharks.

53. **(2)** All echinoderms exhibit five fold radial symmetry in portions of their body at some stage of life, even if they have secondary bilateral symmetry. They also have a mesodermal endoskeleton made of tiny calcified plates and spines, that forms a rigid support contained within tissues of the organism.

54. **(3)** Arthropods are the largest phylum of animals and include the insects, arachnids, crustaceans, and others. More than 80% of described living animal species are arthropods, with over a million modern species described and a fossil record reaching back to the late proterozoic era.

55. **(3)** The term pteridophytes has traditionally been used to describe all seedless vascular plants so is synonymous with "ferns and fern allies". *Marsilea and Horse-tails belong to Pteridophytes.*

56. **(1)** Gymnosperms are a group of Spermatophyte seed-bearing plants with ovules on the edge or blade of an open sporophyll, the sporophylls usually arranged in cone-like structures. The term gymnosperm, meaning "naked seeds" and referring to the unenclosed condition of the seeds, as when they are produced they are found naked on the scales of a cone or similar structure.

57. **(1)** A taxon is assigned a rank and can be placed at a particular level in a systematic hierarchy reflecting evolutionary relationships.The Kingdom is the highest taxon in the hierarchy of classification.

58. **(2)** Binary fission is the form of asexual reproduction in single-celled organisms by which one cell divides into two cells of the same size, used by most prokaryotes.

59. **(3)** Merogony is an asexual replication process used by some Protozoan parasites that increases the number of infective cells by multiple fission. It is the process by which the *Plasmodium* increases the infective cells.

60. **(2)** Vegetatively reproduced organisms show genetic similarity in offsprings. This genetic similarity is because the offsprings are produced from a single parent.

61. **(1)** The *Bryophyllum* is a section in the plant genus Kalanchoe of the Crassulaceae family. There are about twenty to thirty species in the group, native originally of South Africa, Madagascar, Australia and Asia. The group is notable for vegetatively growing small plantlets on the fringes of the leaves; these eventually drop off and develop into new plants.

62. **(2)** A sporangium (pl., sporangia) is a plant or fungal structure producing and containing spores. Sporangia occur on angiosperms, gymnosperms, ferns, fern allies, mosses, algae, and fungi.Microsporangia are the structures on the stamens of flowers called anthers, and the pollen-producing structures on the microsporophylls of male conifer cones.Megasporangia are the comparable "female" structures on these plants, associated with the flower carpel and the megasporangial cone.

63. **(2)** Variations are caused due to errors resulting the DNA copying during the process of meiosis.Crossing over is the process seen during meiosis resulting in the genetic variations.An error during crossing over results in an error in the DNA copying.

64. **(4)** Androecium possess one or two whorls of stamens, each a filament topped by an anther where pollen is produced. Pollen contains the male gametes. Gynoecium possess one or more pistils. The female reproductive organ is the carpel: this contains an ovary with ovules which contain female gametes.

65. **(1)** Placenta is a structure that is formed out of the fingerlike projection both from the mother and child. It later on becomes like a tube like structure that has both arteries and veins. The embryo gets the nutrition from the mothers blood with the help of the placenta.

66. **(1)** The testicle is the male generative gland in animals. Male mammals have two testicles, which are often contained within an extension of the abdomen called the scrotum. It produces the germ cells.

Exercise 2

1.	**(2)**	**2.**	**(1)**	**3.**	**(3)**	**4.**	**(4)**
5.	**(1)**	**6.**	**(2)**	**7.**	**(4)**	**8.**	**(1)**
9.	**(1)**	**10.**	**(3)**				

11. **(3)** Species is the lowest taxonomic category. It is one or more potentially interbreeding natural populations of morphologically similar individuals which is genetically distinct and reproductively isolated from others.

12. **(3)** Some fungal species live in permanent mutually dependent relationship with blue-green algae (or cyanobacteria) such relationships are called symbiotic. These symbiotic life forms are called lichens. Algae are non-vascular plants, with simple and little differentiation of body design.

13. **(4)** Animalia includes all organisms which are multicellular eukaryotes without cell wall. Among the vertebrates, notochord is retained by the adults of the lower vertebrates of class Agnatha, in higher vertebrates it is replaced by the vertebral column.

14. **(1)** Vegetative propagation by buds or notches occurs in potato.

15. **(3)** Testes are male gonads or primary sex organs which produce sperms and secrete the male sex hormone testosterone.

16. **(4)** Advantage of sexual reproduction is that it allows for genetic variation. Stoppage of menstruation is termed as menopause. Animal development is not limited to the period prior to birth hatcting but it occurs throughout different stages of their life.

17. **(4)** Merogony is an asexual replication process used by some protozoan parasites that increses the number of infective cells by multiple fission. It is the process by which the *Plasmodium* increases the infective cells. Buds produced in the notches along the margin of *Bryophyllum* fall on the soil and develop into new plants. *Hibiscus* has bisexual flowers.

18. **(4)** **19.** **(1)** **20.** **(2)**

21. **(4)** Root hairs are present on the region of maturation formed by some of the epidermal cells.

22. **(4)** Runners ae special, narrow, green, above ground horizontal or prostrate branches which develop at the bases of erect shoots.

23. **(2)** Sponges are non-motile animals attached to some solid support. The body design involves very minimal differentiation and division into tissues.

24. **(2)** Mammals have mammary glands for the production of milk to nourish their young ones. Their skin has hairs as well as sweat and oil glands.

25. **(2)** Sponges belong to Porifera means organism with holes. These are non-motile animals attached to some solid-support.

26. **(3)** Seed is formed from fertilised ovule having a dormant embryo and food reserve for subsequent development of embryo.

27. **(1)**

28. **(1)** Sponges are sessile because they are non-motile animals attached to some solid support.

29. **(2)** Sponges are porifers because their bodies have holes or 'pores' all over the body.

30.	**(1)**	**31.**	**(4)**	**32.**	**(3)**	**33.**	**(1)**
34.	**(2)**	**35.**	**(1)**	**36.**	**(4)**	**37.**	**(4)**
38.	**(1)**	**39.**	**(1)**	**40.**	**(4)**	**41.**	**(3)**