Annexure 'G'

SYLLABUS
BIOLOGY (044)
CLASS-XII (2013-2014)

The present syllabus reinforces the ideas introduced till the secondary classes. It provides the students with new concepts along with an extended exposure to contemporary areas of the subject. The syllabus also aims at emphasizing on the underlying principles that are common to both animals and plants as well as highlighting the relationship of biology with other areas of knowledge. The format of the syllabus allows a simple, clear, sequential flow of concepts without any jarring jumps. The syllabus also stresses on making better connections among biological concepts. It relates the study of biology to real life through the use of technology. It links the discoveries and innovations in biology to everyday life such as environment, industry, health and agriculture. The updated syllabus also focuses on reducing the curriculum load while ensuring that ample opportunities and scope for learning and appreciating basic concepts of the subject continue to be available within its framework.

The prescribed syllabus is expected to:

- promote understanding of basic principles of Biology
- encourage learning of emerging knowledge and its relevance to individual and society
- promote rational/scientific attitude to issues related to population, environment and development
- enhance awareness about environmental issues, problems and their appropriate solutions
- create awareness amongst the learners about diversity in the living organisms and developing respect for other life forms
- appreciate that most complex biological phenomena are built on essentially simple processes

It is expected that the students would get an exposure to various branches of Biology in the syllabus in a more contextual and friendly manner as they study its various units.

(180 Periods)

SYLLABUS

One Paper **Time: 3 Hours Max.** **Maximum Marks: 70**

Unit	Title	Marks
6.	Reproduction	14
7.	Genetics and Evolution	18
8.	Biology and Human Welfare	14
9.	Biotechnology and its Applications	10
10.	Ecology and Environment	14
Total		**70**

The question paper will include Value Based Question(s) to the extent of 3-5 marks.

6. Reproduction (35 Periods)

Reproduction in organisms: reproduction, a characteristic feature of all organisms for continuation of species; modes of reproduction asexual and sexual; modes of asexual reproduction; binary fission, sporulation, budding, gemmule, fragmentation; vegetative propagation in plants.

Sexual reproduction in flowering plants: flower structure; development of male and female gametophytes; pollination - types, agencies and examples; outbreeding devices; pollen-pistil interaction; double fertilization; post fertilization events - development of endosperm and embryo, development of seed and formation of fruit; special modes- apomixis, parthenocarpy, polyembryony; Significance of seed and fruit formation.

Human Reproduction: male and female reproductive systems; microscopic anatomy of testis and ovary; gametogenesis - spermatogenesis and oogenesis; menstrual cycle; fertilisation embryo development upto blastocyst formation, implantation; pregnancy and placenta formation (elementary idea); parturition (elementary idea); lactation (elementary idea).

Reproductive health: need for reproductive health and prevention of sexually transmitted diseases (STD); birth control – need and methods, contraception and medical termination of pregnancy (MTP); amniocentesis; infertility and assisted reproductive technologies – IVF, ZIFT, GIFT (elementary idea for general awareness).

7. Genetics and Evolution (45 Periods)

Heredity and variation: Mendelian inheritance; deviations from Mendelism – incomplete dominance, co-dominance, multiple alleles and inheritance of blood groups, pleiotropy; elementary idea of polygenic inheritance; chromosomal theory of inheritance; chromosomes and genes; Sex determination - in humans, birds and honey bee; linkage and crossing over; sex linked inheritance - haemophilia, colour blindness; Mendelian disorders in humans - Thalassemia; chromosomal disorders in humans; Down syndrome, Turner and Klinefelter syndrome.

Molecular basis of inheritance: search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central dogma; transcription, genetic code, translation; gene expression and regulation - Lac Operon; Genome and human genome project; DNA fingerprinting.

Evolution: origin of life; biological evolution and evidences for biological evolution (paleontology, comparative anatomy, embryology and molecular evidence); Darwin's contribution, modern synthetic theory of evolution; mechanism of evolution - variation (mutation and recombination) and natural selection with examples, types of natural selection; Gene flow and genetic drift; Hardy - Weinberg's principle; adaptive radiation; human evolution.

8. Biology and Human Welfare (35 Periods)

Health and disease: pathogens; parasites causing human diseases (malaria, filariasis, ascariasis, typhoid, pneumonia, common cold, amoebiasis, ring worm); Basic concepts of immunology -vaccines; cancer, HIV and AIDs; Adolescence, drug and alcohol abuse.

Improvement in food production: Plant breeding, tissue culture, single cell protein, Biofortification, Apiculture and Animal husbandry.

Microbes in human welfare: In household food processing, industrial production, sewage treatment, energy generation and as biocontrol agents and biofertilizers.

9. Biotechnology and Its Applications (30 Periods)

Principles and processes of biotechnology: genetic engineering (recombinant DNA technology).

Applications of biotechnology in health and agriculture: human insulin and vaccine production, gene therapy; genetically modified organisms - Bt crops; transgenic animals; biosafety issues, biopiracy and patents.

10. Ecology and Environment (35 Periods)

Organisms and environment: habitat and niche, population and ecological adaptations; population interactions - mutualism, competition, predation, parasitism; population attributes - growth, birth rate and death rate, age distribution.
Ecosystems: patterns, components; productivity and decomposition; energy flow; pyramids of number, biomass, energy; nutrient cycles (carbon and phosphorous); ecological succession; ecological services - carbon fixation, pollination, oxygen release.
Biodiversity and its conservation: concept of biodiversity; patterns of biodiversity; importance of biodiversity; loss of biodiversity; biodiversity conservation; hotspots, endangered organisms, extinction, Red Data Book, biosphere reserves, national parks and sanctuaries.

Environment issues: Air pollution and its control; water pollution and its control; agrochemicals and their effects; solid waste management; radioactive waste management; green house effect and global warming; ozone depletion; deforestation; any three case studies as success stories addressing environmental issues.

PRACTICALS

60 Periods

Evaluation scheme	**Maximum Marks: 30**
One major experiment	5
One minor experiment	4
Slide preparation	5
Spotting	7
Practical record + viva voce	4
Project record + viva voce	5
Total	**30 marks**

A. List of Experiments

1. Study pollen germination on a slide.
2. Collect and study soil from at least two different sites and study them for texture, moisture content, pH and water holding capacity of soil. Correlate with the kinds of plants found in them.
3. Collect water from two different water bodies around you and study them for pH, clarity and presence of any living organisms.
4. Study the presence of suspended particulate matter in air at two widely different sites.
5. Study of plant population density by quadrat method.
6. Study of plant population frequency by quadrat method.
7. Prepare a temporary mount of onion root tip to study mitosis.
8. Study the effect of different temperatures and three different pH on the activity of salivary amylase on starch.

B. Study/observation of the following (Spotting)

1. Flowers adapted to pollination by different agencies (wind, insect).
2. Pollen germination on stigma through a permanent slide.
3. Identification of stages of gamete development i.e. T.S. of testis and T.S. of ovary through permanent slides (from any mammal).
4. Meiosis in onion bud cell or grasshopper testis through permanent slides.
5. T.S. of blastula through permanent slides.
6. Mendelian inheritance using seeds of different colours/sizes of any plant.

7. Study prepared pedigree charts of any one of the genetic traits such as rolling of tongue, blood groups, ear lobes, widow's peak and colour blindness.
8. Exercise on controlled pollination - emasculation, tagging and bagging.
9. Identification of common disease causing organisms like Ascaris, Entamoeba, Plasmodium, ringworm through permanent slides or specimens. Comment on symptoms of disease that they cause.
10. Two plants and two animals found in xeric conditions. Comment upon the morphological adaptations.
11. Plants and animals are found in aquatic conditions. Comment upon their morphological adaptations.

SAMPLE QUESTION PAPER

BIOLOGY (044)

CLASS XII (2013-14)

Design of Question paper

Time: 3 hrs. **Maximum Marks: 70**

A. Weightage to different Units

S. No.	Unit No.	Unit Name	Weightage of marks
1	I	Reproduction	14
2	II	Genetics and Evolution	18
3	III	Biology in human welfare	14
4	VI	Biotechnology and its applications	10
5	V	Ecology and environment	14
		Total	70

B. Weightage to different forms of questions

S. No.	Type of question	Marks per Question	Total number of Questions	Total marks
1	VSA	1	8	8
2	SA I	2	10	20
3	SA II/Value Based Question	3	9	27
4	LA	5	3	15
Total			30	70

C. Typology of Questions

S. No.	Typology	Weightage in marks	Weightage in percentage
1	**Knowledge Based**	14	20%
2	**Conceptual Understanding**	21	30%
3	**Inferential Type**	14	20%
4	**Reasoning Based**	11	15%
5	**Skill Based**	10	15%
	Total	70	100%

D. Scheme of options

There will be no overall choice. However, internal choice in any one question of two marks, any one question of three marks and all the three questions of five marks weightage has been provided.

E. Difficulty level of questions

S. No.	**Estimated difficulty level**	**Percentage of marks**
1	**Easy**	**15**
2	**Average**	**70**
3	**Difficult**	**15**

The question paper will include value based question(s) to the extent of 3 – 5 marks.

SAMPLE QUESTION PAPER

BIOLOGY (044)

CLASS XII (2013-14)

BLUE PRINT

Unit No.	Weightage	LA(5 Marks)	SA II (3 Marks)/Value Based Question	SA I (2 Marks)	VSA (1 Marks)	Total
I (Reproduction)	14	5 (1)	6 (2)	2 (1)	1 (1)	14(5)
II (Genetics and Evolution)	18	5 (1)	6 (2)	6 (3)	1 (1)	18(7)
III (Biology in human welfare)	14	5(1)	3* (1) 3 (1)	2 (1)	1 (1)	14(5)
IV (Biotechnology and its applications)	10	-	3 (1)	4 (2)	3 (3)	10(6)
V (Ecology and environment)	14	-	6 (2)	6 (3)	2 (2)	14(7)
Total	70	15 (3)	27 (9)	20 (10)	8 (8)	70(30)

*** Value based question**

NOTE:

- **Value Based Question may be asked from any unit/ chapter/topic.**
- **It will carry 3 – 5 marks.**

SAMPLE QUESTION PAPER

BIOLOGY (044)

CLASS XII (2013-14)

Time: 3 hrs. **Maximum Marks.: 70**

General Instructions:

i) All questions are compulsory.

ii) This question paper consists of four sections A, B, C and D. Section A contains 8 questions of one mark each, section B contains 10 questions of two marks each, section C contains 9 questions of three marks each and section D contains 3 questions of five marks each.

iii) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks weightage. A student has to attempt only one of the alternatives in such questions.

iv) Wherever necessary, the diagrams drawn should be properly labelled.

Section A **(1×8 = 8)**

1. If the stamens are well exposed, usually which mode of pollination the plant is expected to follow?

2. If the frequency of one allele is 'p' and for another, it is 'q' for one gene, what will be the formula to calculate allele frequency in future generations according to Hardy - Weinberg genetic equilibrium?

3. "Pranay suffered from measles at the age of 10 years. There are rare chances of his getting infected with the same disease for the rest of his life." Give reason for the statement.

4. Why EtBr is used in gel electrophoresis inspite of it being highly carcinogenic?

5. Which main technique and instrument is used to isolate DNA from any plant cell?

6. How is the action of restriction endonucleases different from that of normal endonucleases?

7. Eutrophication is the natural aging of a lake; mention any other feature which defines this term.

8. Standing crop and biomass are related to each other, how?

Section B

(2 × 10 = 20)

9. What does amniocentasis test? On what basis does it work? Is it justified to put is a statutory ban on this process? Give reason.

10. A non-haemophilic couple was informed by their doctor that there is possibility of a haemophilic child be born to them. Draw a checker board and find out the percentage of possibility of such child in the progeny.

11. How do Darwin's finches illustrate adaptive radiation?

12. In a particular plant species, majority of the plants bear purple flowers. Very few plants bear white flowers. No intermediate colours are observed. If you are given a plant bearing purple flowers, how would you ascertain that it is a pure breed for that trait? Explain.

13. Why the introduction of genetically engineered lymphocytes into an ADA deficiency patient is not a permanent cure? Suggest a possible permanent cure.

14. Where and why do we use Taq polymerase enzyme when it works exactly as DNA polymerase?

15. Differentiate between a detrivore and a decomposer giving one example of each.

16. DDT content in the water of a lake that supplies drinking water to the nearby villages is found to be 0.004 ppm. The pelicans of that area are reported to have 2.6 ppm of DDT. Why has the concentration increased in these birds? What possible harm can this cause to the bird population? Also give the name the phenomenon.

17. The gradual and predictable change in the species composition of a given area is called ecological succession. Define the pioneer and climax community in this context?

18. Write the biological (binomial) names of causal organisms of the following diseases:

    a) Typhoid

    b) Pneumonia

OR

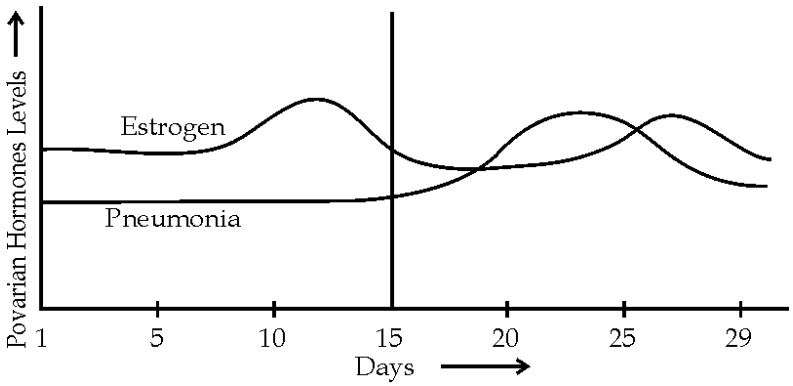
Write the biological (binomial) names of causal organisms of the following diseases:

a) Elephantiatis (Filariasis)

b) Amoebiasis

Section - C (3 × 9 = 27)

19.



Study the graph given above showing the levels of ovarian hormones during menstruation and correlate the uterine events that take place according to the hormonal levels on:

(i) 6-15 days

(ii) 16 - 25 days

(iii) 26 - 28 days (if the ovum is not fertilized)

20. Expand the following and explain any one of them.

a) IVF b) ZIFT

c) IUI d) MTP

21. "The codon is a triplet and is read in a contiguous manner without punctuations."Provide the genetic basis for the statement.

22. What is satellite DNA in a genome? Why is it important in DNA fingerprinting.

23. "Microbes play a dual role when used for sewage treatment as they not only help to retrieve usable water but also generate fuel". Explain.

24. Aditya participated in a group discussion in his school on "The ill effects of Tobacco on Human Health". In the evening he goes with his family for a dinner

and insists on sitting in the "Non-Smoking Area" to which his father (who is a heavy smoker) objects.

(a) In this situation, whose argument wins your support - Aditya's concern for health and environment or his father's objection? Justify giving two reasons.

(b) Suggest any one of the effective propaganda campaigns for anti-tobacco awareness.

25. A vector is engineered with three features which facilitate its cloning within the host cell. List the three features and explain each one of them.

26. Interspecific interactions of two species of any population may be beneficial, detrimental or neutral. Explain each of them with the help of suitable examples.

27. Water is very essential for life. List any three features, each of plants and animals that enable them to survive in water scarce environment.

OR

(a) What will happen if the electrostatic precipitator of a thermal plant fails to work?

(b) Mention any four methods by applying which the vehicular air pollution can be controlled.

Section D

(5 × 3 = 15)

28. (a) Draw a labelled diagram of sectional view of human ovary showing different stages of oogenesis.

(b) Where is morula formed in humans? Draw a flow chart to explain the process of its development from zygote.

OR

(a) Draw a labelled diagram of the sectional view of a typical anatropous ovule.

(b) Mention the fate of all the components of the embryo sac after fertilization?

29. (a) Explain what DNA replication refers to.

(b) State the properties of DNA replication model.

(c) List any three enzymes involved in the process along with their functions.

OR

Inheritance patterns of flower colour in garden pea plant and snap dragon differs. Why is the difference observed? Explain the difference in their inheritance patterns with the help of crosses.

30. Malarial parasite 'Plasmodium' completes its life cycle in two hosts. Draw its complete life cycle and explain various stages it follows throughout its life.

OR

Explain the following in context of cancer –

a) Benign tumor

b) Malignent tumor

c) Oncogens / Carcinogens

d) Oncogenes

e) Contact inhibition

MARKING SCHEME

SAMPLE QUESTION PAPER

BIOLOGY (044)

CLASS XII (2013-14)

1. Wind pollination 1

2. $(p+q)^2 = p^2 + 2pq + q^2 = 1$ 1

3. First exposure to the infection works as vaccination, the immune system of the body gets familiar with the nature of microorganisms and specific antibodies can be produced against infection whenever encountered with. ½+½=1

4. Ethidium bromide (EtBr) exchanges its visible range of wavelength with the invisible wavelength of DNA to make it visible under UV light. 1

5. Centrifugation and centrifuge ½+½=1

6. Normal Endonuclease : makes cuts at <u>random positions within</u> a DNA sequence. ½

   Restriction endonuclease: makes cuts only at <u>specific positions within</u> a DNA sequence. ½

7. (Any one) 1

   - Depletion of dissolved oxygen in water

   - Nutrient enrichment

8. The standing crop is measured as the mass of living organisms or the number in a unit area. The biomass of a species is expressed in terms of fresh or dry weight. 1

9. Amniocentasis – A foetal sex diagnostic test based on the chromosomal pattern in the amniotic fluid surrounding the developing embryo is called amniocentasis.

It is justified to ban the process for diagnosis of sex to legally check the increasing female foeticides. ½+½+1

10.

	X	Y
X	X X	X Y
$\bar{X}$	X $\bar{X}$	$\bar{X}$ Y

Phenotypes : 50% daughter normal (XX)

50% daughter carrier (X $\bar{X}$)

50% son normal (XY)

50% son haemophilic ($\bar{X}$ Y) ½ ×4=2

11. Original stock of seed eating finches migrated to different habitats (of Galapagos Islands), adapted to different feeding methods, by altered beak structure, evolved into different types of finches. ½ ×4=2

12. By Testcross , Cross purple flower plant with a (homozygous) recessive plant with white flowers, if all the flowers of the progeny of the above are purple , the plant is homozygous dominant i.e. pure breed. ½ ×4=2

13. Lymphocytes are not immortal but are short lived , hence patient requires periodic infusion of such genetically engineered lymphocytes, however if a gene producing ADA is isolated from marrow cells, and introduced into the cells at early embryonic stages it could be a permanent cure. ½ ×4=2

14. In PCR, because it is a thermostable DNA polymerase enzyme, gets isolated from bacteria *Thermus aquaticus* from hot water springs, and it does not get denatured at

high temperature which is required during PCR and works as normal DNA polymerase enzyme (whereas the normal DNA polymerase gets denatured at high temperature). ½ ×4=2

15. Detrivore feeds on dead plants and animals / detritus. ½

Example : Earthworm / Nematodes ½

Decomposer breaks down complex (organic) matter into simpler (inorganic) matter. ½

Example : Fungus / Bacteria ½

16. DDT neither gets excreted nor gets metabolized and keeps accumulating in the food chain, interferes with Calcium metabolism, concentration increases in the birds due to intake of such water, causes bird population to decline - due to thinning of egg shell / premature breaking of eggs. The phenomenon is called bio-magnification. ½ ×4=2

17. Pioneer Community (Species) – Community that invades a bare area 1

Climax community – Last sustainable community that is in near equilibrium with the environment 1

18. a) *Salmonella typhi* ½×2=1

b) *Streptococcus pneumoniae*

OR

a) *Wuchereria bancrofti* and *Wuchereria malayi*

b) *Entamoeba histolytica* ½×2=1

19. (i) Regeneration of endometrium.

(ii) Uterus gets highly vascularised, ready for embryo implantation

(iii) Disintegration of the endometrium leading to menstruation 1×3=3

20. IVF – In Vitro Fertilization

ZIFT – Zygote Intra Fellopian Transfer

IUI - Intra – Uterine Insemination

MTP – Medical Termination of Pregnency ½×4=2

Explanation about any one 1

21. Since there are only four bases which code for twenty amino acids, the code should be made up of three bases i.e. (4 x 4 x 4) = 64 codons; a number more than the required.

1

If the codon consists of four letters, only (4 x 4), only sixteen codons are possible, which is less than the required. Hence the codon is a triplet. 1

As the ribosome moves on mRNA, continuously without break, the codons are read in a contiguous manner. 1

22. DNA sequences which are repeated many times, show a high degree of polymorphism, and form a bulk of DNA in a genome, called satellite DNA. 1½

DNA from every tissue from an individual, shows the same degree of polymorphism and is heritable, hence very useful in DNA finger printing. 1½

23. ½ x 6=3

- Microbes naturally present in the sewage are employed in the secondary treatment of the sewage.
- The effluent from the primary treatment is passed into large aeration tanks.

- This allows the rapid growth of aerobic microbes into flocs which consumes the organic matter of the sewage and reduces the BOD.
- Then the effluent is passed into a settling tank, where the flocs are allowed to sediment forming the activated sludge.
- Major parts of this activated sludge is pumped into anaerobic sludge digesters, where the anaerobic bacteria digest microbes in the activated sludge.
- During this digestion bacteria produce a mixture of gases like methane, hydrogen sulphide and carbon dioxide, which forms the biogas and can be used as a source of energy. The effluent is generally released into rivers and streams.

24. (a) I will support Aditya's concern for the health of his family. Both Active as well as Passive smoking is injurious to health as smoking is associated with increased incidences of cancers of lungs, urinary bladder, throat and oral cavity, bronchitis, emphysema / coronary heart disease / gastric ulcer etc. 2

(b) (i) By printing statutory warning on cigarette packets.

(ii) As advertisement in mass media such as Television, Newspaper, Internet etc.

(iii) Designating Non smoking Zones in public areas such as Restaurants, Airports etc. (Any one) 1

25. (i) Origin of replication / ori site – From here the replication starts (and any piece of DNA when linked, can be made to replicate within the host cell)

(ii) At least two Selectable markers – Helpful in identifying and eliminating non transformants

(iii) Unique Restriction sites for more than one restriction enzymes– The foreign DNA links to this region of the plasmid

1×3=3

26. Population interactions:

Species A	Species B	Name of interaction
+	+	Mutualism
-	-	Competition
+	-	Predation
+	-	Parasitism
+	0	Amensalism

(i) '+' Beneficial - Both species get benefitted in Mutualism e.g. lichens.

(ii) '-' Detrimental – Both species get adversely affected in competition.

In Predation and Parasitism, the predator and the parasite get benefitted but it is detrimental to the host and prey respectively.

(iii) '0' Neutral – In commensalism one species gets benefitted but the other is neither at harm nor gets benefitted. 3

27. Plants: Ephemeral mode (complete life cycle in short period) / Deep tap roots / Deciduous leaves / Waxy cuticle / sunken stomata / Succulence to store water / C_4 Pathway of Photosynthesis. (Any three) 1½

Animals: No sweating / uricotelic / deposition of fat in sub epidermal layer / burrowing nature / thick skin / body covered with scales (Any three)

3

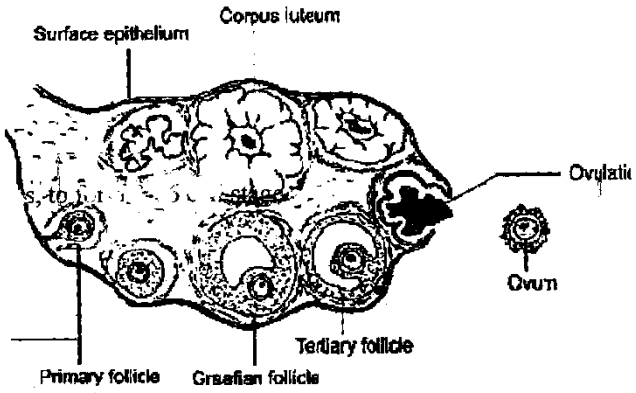
1½

OR

Ans. (i) Particulate matter will pollute the air 1

(ii) Use of CNG / Phasing out of old vehicles / Use of unleaded petrol / Use of low sulphur fuel / Use of catalytic converters / Application of stringent pollution level norms (Any four) 2

28. (a)



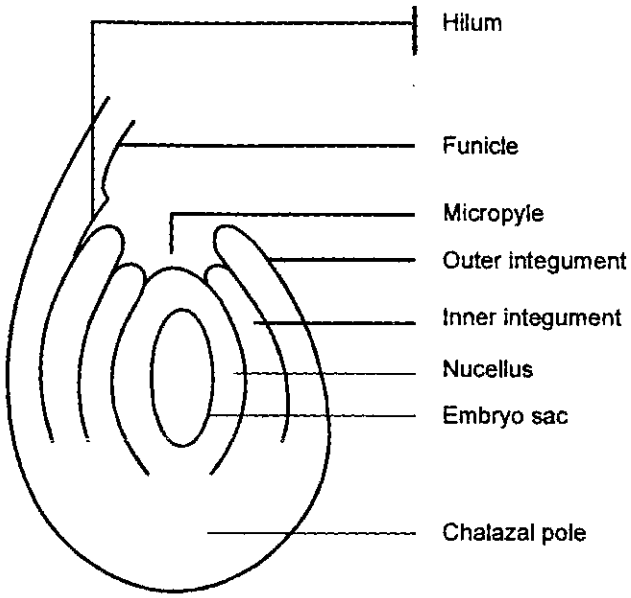
½ ×6=3

(b) Fallopian tube 1

Zygote undergoes, cleavage to form, blastomeres and develops into 8-16 cell stage- the morula. ½+½

OR

(a)



(b) Egg cell - Forms zygote (2n)

Polar nuclei - Primary endosperm nucleus (3n)

Antipodals – Degenerate

½×7=3½

5

½×3=1½

29. (a) DNA synthesis ½

(b) i) Semi conservative

ii) Semi discontinuous

iii) Unidirectional

1½

(c) DNA polymerase III – adds nucleotides

DNA polymerase I – fills the gaps

RNA primase – brings primer

Helicase – breaks hydrogen bond

Toisomerase – Causes unwinding

Gyrase – relaxes supercoiling

DNA ligase – joins Okazaki fragments

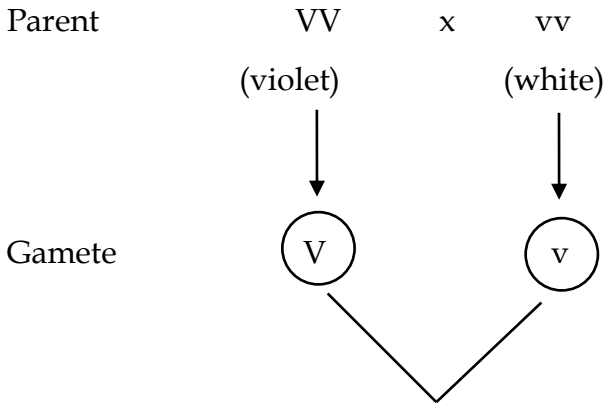
Any 3 enzymes and their function

1 x 3 = 3

OR

Inheritance of flower colour in Pisum sativum

Pea Plant

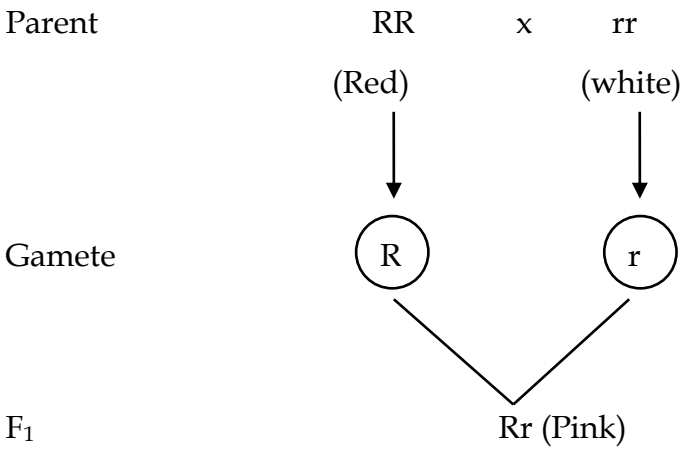


1½

This inheritance pattern follows law of dominance, that is, between the two alleles of the flower colour (gene) the dominant allele is expressed (phenotypically), over the recessive. 1

In the case of *Antirrhinum* (snap dragon) the dominant flower colour is red, white is recessive. ½

Antirrhinum



This is the case of incomplete dominance, it is because the allele for red colour is not completely dominant over its recessive allele; law of dominance not exhibited here.

1

30. Life cycle from NCERT text book Biology class XII 2

Stages: ½ each

a) The stage in which the parasite enters in the body of humans through saliva of mosquito – sporozoite stage.

b) Asexual reproduction of sporozoites in liver cells, resulting into bursting of those cells and releasing outside into the blood.

c) Sporozoites infect RBCs, cause them to get burst and represented by repeated cycles of fever. Released parasites also infect other RBCs.

d) Parasites then follow sexual stage in RBCs which is called as ring signet stage and appears as a ring inside the RBCs under microscope. Usually presence of malarial parasite in humans is identified by pathologists by this stage.

e) Female mosquito takes up gametocytes with the blood of host. Fertilization and development takes place in the intestine of mosquito.

f) From intestine, parasite comes to the salivary glands from where it reaches to human body and that is how the cycle continues.

OR

1x5=5

1) Benign tumors are the masses of cells which remain confined to their original location and do not spread to other parts of the body and cause little damage.

2) Malignant tumors are the masses of proliferating cells called neoplastic or tumor cells. These grow very rapidly, invading and damaging the surrounding normal tissue.

3) Transformation of normal cells into cancerous, neoplastic cells may be induced by physical, chemical or biological agents. These agents are called carcinogens. For example X-rays, gamma rays, UV radiations and some chemicals like EtBr.

4) The genes which may lead to oncogenic transformations of the cells are called oncogenes.

5) Contact inhibition – Whenever normal cells come in contact with each other, after a definite time they inhibit each others' excess growth and multiplication, this property of normal cells is called contact inhibition which maintains the normal shape and size of the body. But cancer cells appear to have lost this property which results in their uncontrolled growth and multiplication.