

Class XII BIOLOGY (Theory)

CBSE Board, Set -1

General Instructions:

- (i) There are total of 26 questions and five sections in the questions paper.
- (ii) Section A contains questions number 1 to 5, Very Short Answer type questions of one marks each.
- (iii) Section B contains questions number 6 to 10, Short Answer type questions of two marks each.
- (iv) Section C contains questions number 11 to 22, Short Answer type II questions of three marks each.
- (v) Section D contains questions number 23, Value Based Questions of four marks.
- (vi) Section E contains questions number 24 to 26, Long Answer type questions of five marks each.
- (vii) There is no overall choice in the questions paper, however, an internal choice is provided in one question of two marks, one question of three marks and all three questions of five marks. AN examinee is to attempt any one of the questions out of the two given in the questions paper with the same question number.

Section-A

- Q1.** A geneticist interested in studying variation and patterns of inheritance in living beings prefer to choose organism for experiments with shorter life cycle. Provide a reason.
- Sol.1** A Geneticist interested in studying variations & patterns of inheritance in living being prefers to choose organism for experiments with shorter life span because they have small growing season & their progenies can be cultivated in lesser time for observation.
- Q2.** Name the transcriptionally active region of chromatin in nucleus.
- Sol.2** Transcriptionally active region of a chromatin is euchromatin.
- Q3.** State a reason for the increased population of dark coloured moths coinciding with the loss of lichens (on tree barks) during industrialization period in England.
- Sol.3** The industrial revolution resulted in large scale smoke which deposited on tree trunks turning them black. This led to loss of gray months & the black forms flourished.
- Q4.** Indiscriminate diagnostic practice using X-rays etc., should be avoided. Give one reason.

Sol.4 Indiscriminate use of X-ray causes mutation in the DNA which can lead to cancer.

Q5. What is Biopiracy ?

Sol.5 **Biopiracy** is a situation where native knowledge of nature, originating with native peoples, is used by others for profit, without any permission.

Section-B

Q6. After a brief medical examination a healthy couple came to know that both of them are unable to produce functional gametes and should look for an 'ART' (Assistant Reproductive Technique). Name the 'ART' and the procedure involved that you can suggest to them to help them bear a child.

Sol.6 Assisted reproductive technology (ART) includes all fertility treatment in which both sperms & eggs are handled. It involves surgically removing eggs from a mother's ovaries, combining them with sperms in the laboratory & returning them to the woman's body or donating them to another woman.

The main ART- techniques include:

(i) ZIFT (Zygote intra fallopian transfer)

(ii) GIFT (gamete intra fallopian transfer)

Q7. Differentiate between male and female heterogamety.

Sol.7 **Heterogametic male:** The female sex has 2 'X' chromosomes (XX) while male has only one 'X' chromosome and at the time of gametes formation produces 2 types of gametes. Half with 'X' chromosome while other half without 'X' chromosome. Because of presence of 2 types of gametes produced by males it is called heterogametic sex (male). E.g. XX-XY type, XX-XO type

Heterogametic females: It is basically identical to the XX-XY mechanism. As females are heterogametic it is represented as ZW. The males being homogametic, they are represented as ZZ. This is referred as ZZ-ZW type instead of XX-XY system. E.g. ZO-ZZ type, ZW-ZZ type.

Q8. How has mutation breeding helped in improving the production of mung bean crop?

Sol.8 Mutation breeding is the process of exposing seeds to chemicals or radiation to produce variety with desirable characters.

- It helps in increasing disease resistance in mungbean plant
- High yield of mungbean is obtained
- It increases genetic variability in plants.

Q9. Mention a product of Human welfare obtained with the help of each one of the following microbes:

- (a) LAB
- (b) Saccharomyces sharmanii
- (c) Propionibacteriumsharmanii
- (d) Aspergillusniger

- Sol.9** (a) LAB are **lactic acid bacteria** or lactobacillus are gram positive bacteria which is used in curd production or **curd making** at our home.
- (b) Sae saccharomyces cervisiae is a species of yeast which is used in **wine making, brewing & baking**
- (c) **Propionibacteriumsharmanii** is used in **cheese-making** where it produces CO₂ bubbles in cheese.
- (d) **Aspergillusniger** is used in industries for production of **citric acid & gluconic acid**.

Q10. Many fresh water animals cannot survive in marine environment. Explain.

Sol.10 Fresh water animals & marine animals live in different environment.

Animals which can survive in just one type of condition, are referred to as stenohaline

Animal which can live in both fresh water & marine water condition are known as euryhaline

A Cell is present in normal condition in dilute water while it shrinks in case of hypertonic water. Same phenomena occur with some animals if they are brought to marine condition from normal water condition.

Most fishes are stenohaline. They will die if exposed to wrong environment

OR

Q10. How are productivity, gross productivity, net primary productivity and secondary productivity interrelated?

Sol.10 Productivity:-

Productivity of the ecosystem refers to the rate of biomass production i.e. the amount of organic matter accumulated per unit area per unit time.

It is generally expressed in g⁻² yr⁻¹ or (kcal m⁻²) yr⁻¹.

There are two types of productivity present primary and secondary.

Primary Productivity:-

Primary productivity is defined as the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis.

Primary productivity can be divided into- gross primary productivity (GPP) and net primary Productivity (NPP).

Secondary productivity:-

Secondary productivity is the rate of formation or new organic matter by consumers.

Section-C

Q11. Double fertilization is reported in plants of both, castor and groundnut. However, the mature seeds of groundnut are non-albuminous and castors are albuminous. Explain the post fertilization events that are responsible for it.

Sol.11 Double fertilization occur in both castor & groundnut. During post fertilization event, when basically two type of seeds are formed which are endospermic & non-endospermic seeds.

In Endospermic or albuminous seeds; food is stored in endosperm. The endospermic tissues in these seeds utilize during the germination of seeds & their cotyledons are thin & membranous

E.g.All monocot seeds (wheat, rice, maize etc.)

Castor (dicot) is endospermic.

In non-endospermic or ex-albuminous seeds, endosperm is absent at maturity.

The endospermic tissues are absorbed during the development of embryo.

The absorbed food materials from endosperm is stored in cotyledons.

E.g.Groundnut.

Q12. Describe the process of parturition in humans.

Sol.12 Parturition:-After 9 months of pregnancy, the fully developed foetus is ready for delivery. The process of childbirth is called parturition.

It is induced by complex neuroendocrine mechanism involving cortisol, estrogen & oxytocin.

Powerful contractions of the uterus in labor are needed for parturition.

Stage of labor in parturition is

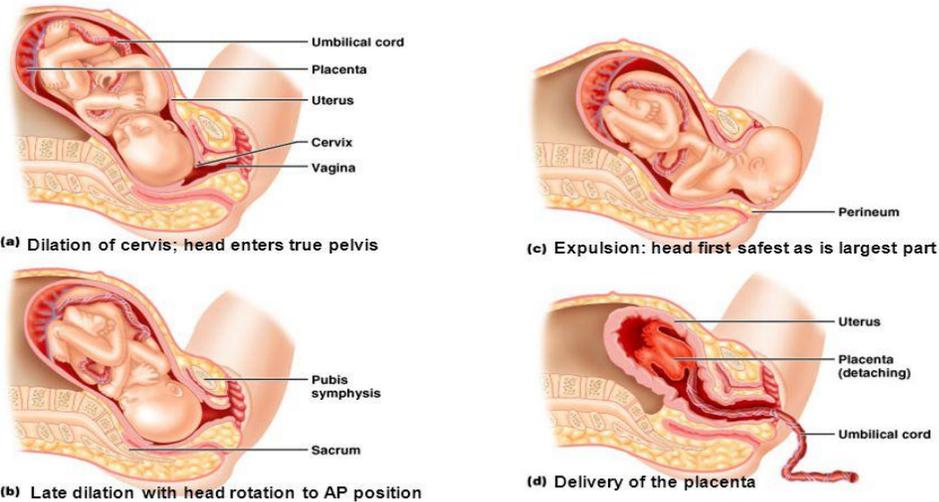
(i) 1st stage:- Dilation of cervix

(ii) 2nd Stage:- Delivery of baby

(iii) 3rd stage:- Delivery of placenta & umbilical cord.

Childbirth

- **Gestational period:** averages 266 days (this is time post conception; 280 days post LMP)
- **Parturition:** the act of giving birth: 3 stages of labor
 1. **Dilation:** 6-12h (or more in first child); begins with regular uterine contractions and ends with full dilation of cervix (10cm)
 2. **Expulsion:** full dilation to delivery – minutes up to 2 hours
 3. **Placental delivery:** 15 minutes



Q13. A teacher wants his/her students to find the genotype of pea plants bearing purple coloured flowers in their school garden. Name and explain the cross that will make it possible.

Sol.13 Student will do the test cross for finding the genotype of plant.

In test cross F₁, progeny is crossed with recessive parent.

1. $Ww \times ww$

| | | |
|---|----|----|
| | W | w |
| w | Ww | ww |
| w | Ww | ww |

If the progeny obtained consist of 50% purple & 50% white means Do the purple flower is heterozygous for aluminous allele.

2. $WW \times ww$

| | | |
|---|----|----|
| | W | w |
| w | Ww | Ww |
| w | Ww | Ww |

If all flower (100%) obtained are purple, it is homozygous for dominant allele.

Q14. (a) A DNA segment has a total of 1000 nucleotides, out of which 240 of them are adenine containing nucleotides. How many pyrimidine bases this DNA segment possesses?

(b) Draw a diagrammatic sketch of a portion of DNA segment to support your answer.

Sol.14 (a) According to Chargaff rule

Amount of A = Amount of T

& Amount of C = Amount of G

As we know 240 of nucleotides are adenine therefore, same amount of thymine will be present.

& now total 1000 nucleotides are present

So $1000 - (A + T) = \text{amount of } C + G$

$1000 - (240 + 240) = C + G$

$C + G = 620$

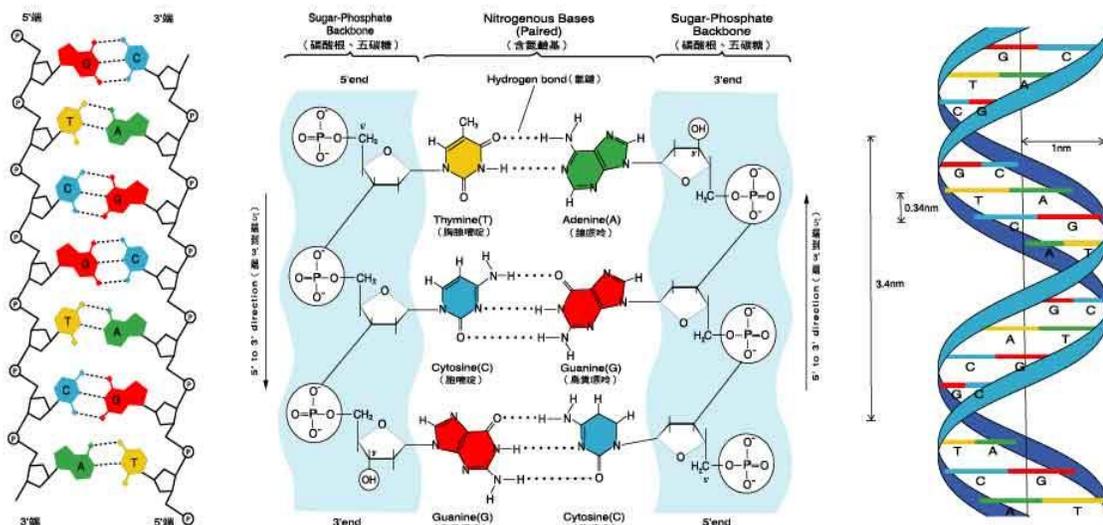
We know that $C = G$

So $\frac{620}{2} = 310$ number of C & G are present.

Now, amount of pyrimidine in DNA = $T + C$

$= 240 + 310 = 550$

(b) Diagrammatic representation of DNA segment

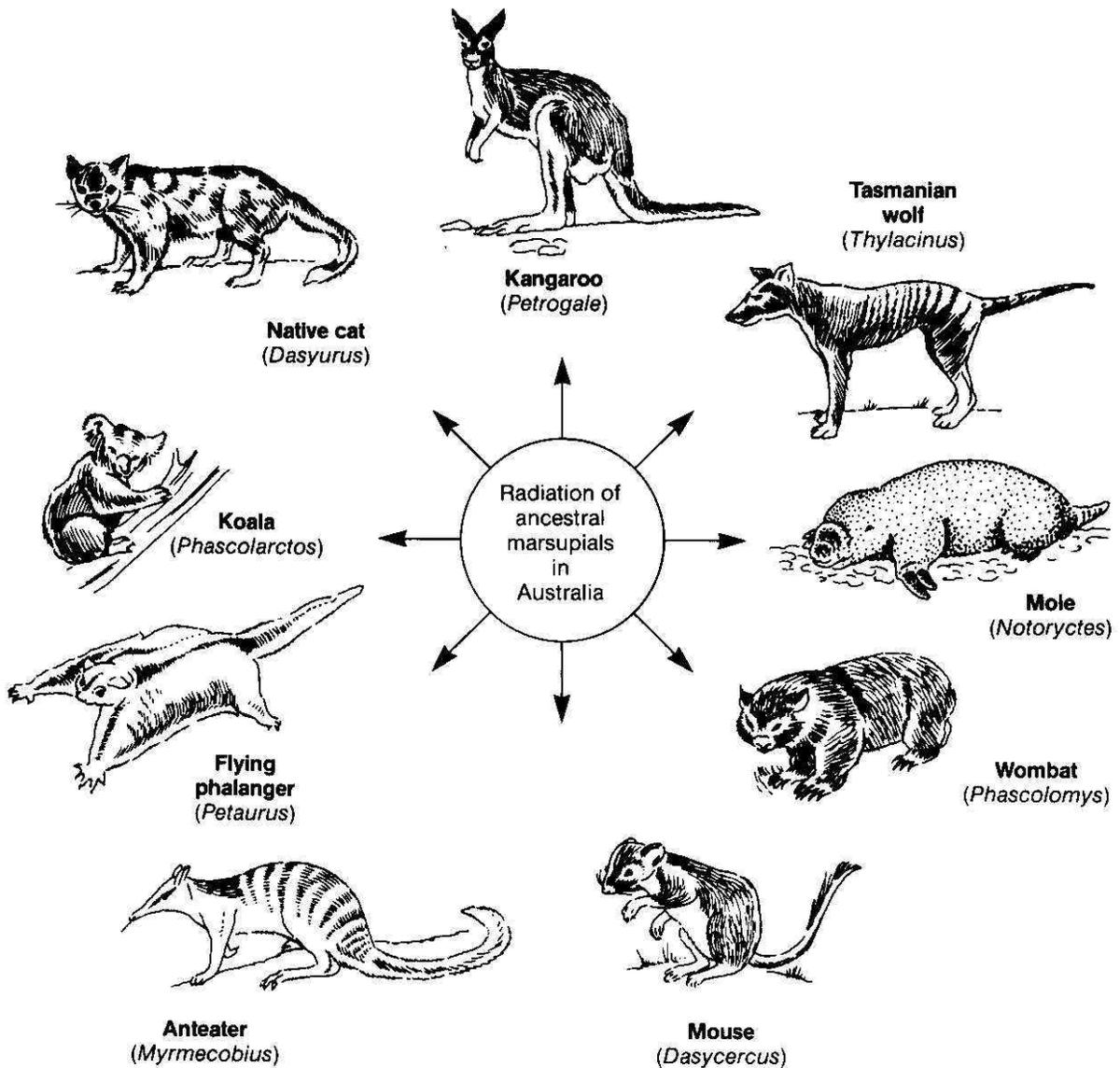


Q15. Explain adaptive radiation with the suitable example.

Sol.15 Adaptive radiation: - Homology found in different animals indicates their evolution from common ancestors. Species which have diverged after origin from common ancestor giving rise to new species adapted to new habitat & ways of life is called **Adaptive radiation**

These species exhibit large number of homologous organ. Homology shows divergent evolution.

E. g. Adaptive radiation gives rise to a variety of marsupials in Australia.



Q16. A team of students are preparing to participate in the interschool sports meet. During a practice session you find some vials with labels of certain cannabinoids.

- (a) Will you report to the authorities? Why?
- (b) Name a plant from which such chemicals are obtained.
- (c) Write the effect of these chemical on human body.

Sol.16 (a) Of course we will tell the authority about the presence of vials. As cannabinoids is a type of drug whose intake is illegal.

(b) It is obtained from cannabis plant.

(c) Cannabinoids possess certain neurotransmitter which give relieve during headache, nausea & pain.

Q17. Enlist the steps involved in inbreeding of cattle. Suggest two disadvantages of this practice.

Sol.17 Inbreeding is the production of organism from breeding of genetically related organism.

Process involves the cross between genetically closely related cattle.

Disadvantage:-(i) It may result in homozygosity & can enhance the chances of offspring being affected from recessive or harmful characters.

(ii) It can cause inbreeding depression in which the ability of offspring to survive & reproduce; decreases.

Q18. Choose any microbes, from the following which are suited for organic farming which is in great demand these days for various reasons. Mention one application of each one chosen.

Mycorrhiza; Monascus; Anabaena; Rhizobium; Methenobacterium; Trichoderma.

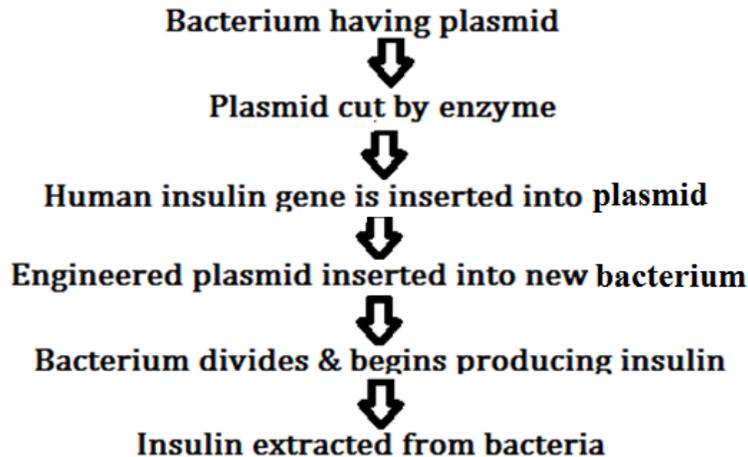
Sol.18 Anabaena:- They form heterocyst which help in nitrogen fixation.

Rhizobium:- It plays a very important role in agriculture by inducing nitrogen – fixing nodules on the roots of legumes such as peas, beans, clover, alfalfa.

Mycorrhiza:- It can be used to suppress several problematic agricultural weeds.

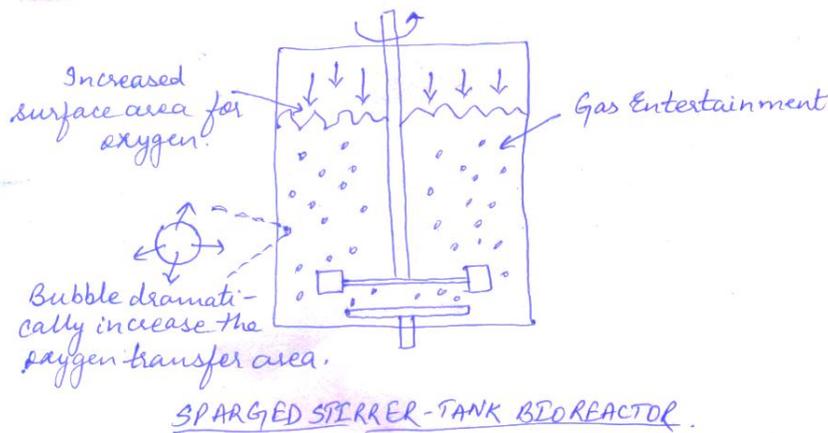
Q19. Recombinant DNA-technology is of great importance in the field of medicine. With the help of flow chart, shows how this technology has been used in preparing genetically engineered human insulin.

Sol.19



Q20. Draw a labeled sketch of sparged-stirred-tank bioreactor. Write its applications.

Sol.20



Applications-

- Larger quantity of culture can be processed.
- Raw materials are biologically converted into specific products.
- It provides optimal conditions for achieving the desired products by providing optimum growth conditions.

Q21. Following the collision of two trains a large number of passengers are killed. A majority of them are beyond recognition. Authorities want to hand over the dead to their relatives. Name a modern scientific method and write the procedure that would help in the identification of kinship.

Sol.21 DNA fingerprinting would help in the identification of Kinship.

Procedure:-

1. Blood sample is taken from the killed passenger
2. DNA is extracted from blood cells.
3. DNA is cut into fragments by restriction enzymes.
4. The DNA fragments are separated into bands during electrophoresis in agarose gel.
5. The DNA band pattern in the gel is transferred to a nylon membrane by a technique known as southern blotting.
6. The radioactive DNA probe is prepared.
7. The DNA probe binds to specific DNA sequences on the membrane.
8. Excess DNA probe is washed.
9. At this stage, the radioactive probe is bound to the DNA pattern on the membrane.
10. X -ray film is placed next to the membrane to detect the radioactive pattern.
11. The X -ray film is developed to make visible the pattern of bands which is known as a **DNA fingerprint**.

Q22. Many plant and animal species are on the verge of their extinction because of loss of forest land by indiscriminate use by the humans. As a biology student what method would you suggest along with its advantage that can protect such threatened species from getting extinct?

Sol.22 By **In - site conservation**, many threatened species can be protected from getting extinct. It is protection & management of important components of biological diversity through a network of protected areas. In in-situ conservations the endangered species are protected in their natural habitat so that the entire ecosystem is protected.

Advantages

1. These areas are ecological areas where biological diversity along with natural & cultural resources are protected, maintained & managed through legal or other effective measures.
2. Cultivation, grazing, forestry & habitat manipulations are not allowed in these areas.

OR

Q22. "Determination of Biological Oxygen Demand (BOD) can help in suggesting the quality of a water body." Explain.

Sol.22 BOD is the amount of oxygen in milligrams required by microorganisms for five days to metabolize waste present in the litre of water at 20°C. The degree of water pollution is directly proportional to BOD.

B.O.D.α. Input of organic wastes.

The more we put organic wastes in the water body, more will be the amount of oxygen required by microorganisms to decompose the waste present in water.

Section-D

Q23. Since October 02,2014 “ Swachh Bharat Abhiyan” has been launched in our country.

(a) Write your views on this initiative giving justification.

(b) As a biologist two problems that you may face while implementing the programme in your locality.

(c) Suggest two remedial methods to overcome these problems.

Sol.23 (a) Swachh Bharat Abhiyan aims to make this country a clean country. This campaign involves the construction of latrines., promoting sanitation programmes in the rural areas , cleaning streets , roads etc. The aim of the mission is to cover all the rural to urban areas of the country, The mission has also targeted aims like eliminating open defecation, converting insanitary toilets into pour flush toilets, eradicating manual scavenging, complete disposal and reuse of solid to liquid wastes, bringing behavioural changes to people & motivate health practices spreading cleanliness awareness among people, strengthening the cleanliness systems in urban & rural areas as well as creating user friendly environment for all private sector interested for investing in India.

(b)1. Partial involvement of the people

2. Open defecation.

(c) 1.Partial involvement can be overcome by awareness and education.

2. Toilets should be built at mega speed and persuade households to actually use them.

Q24. A flower of tomato plant following the process of sexual reproduction produces 240 viable seeds.

Answer the following question giving reasons.

(a) What is minimum number of pollen grains that must have been involved in the pollination of its pistil?

(b) what would have been the minimum number of ovules present in the ovary?

- (c) How many megaspore mother cells were involved?
- (d) what is the minimum number of microspore mother cells involved in the above case?
- (e) How many male gametes were involved in this case?

Sol.24 (a) 240 Pollen grains are involved in this. Because each pollen contains two male gametes one of them fuses with the polar nuclei to form the endosperm. And other fuses with egg to form zygote that eventually develops into ovule. So the no. of viable seeds is equal to no. of pollen grain.

(b) No. of ovules are equal to the no. of seeds produced, hence, number of ovules are 240. Each megaspore mother cell produces a functional female gamete.

(c) 240 megaspore mother cells involved. Each megaspore mother cell undergoes meiosis to form four megaspores. Out of these 3 degenerates and only 1 remain functional.

(d) Minimum number of microspore mother cells = 60. Each microspore mother cell produces 4 microspore that eventually develops into pollen grains.

One microspore mother cell = 4 pollen grains

So, for 240 pollen grains = $240/4 = 60$ microspore mother cells are required.

(e) 240 male gametes are involved.

OR

Q24. During the reproductive cycle of a human female, when, where and how does a placenta develop? What is function of placenta during pregnancy and embryo development.

Sol.24 Placenta is an intimate mechanical connection between foetus and uterus of mother for nutrition, respiration and excretion.

Placenta contains minute finger like projections called villi. The uterine wall forms corresponding depressions called crypts.

Human placenta is haemochorial placenta (in which maternal blood bathes foetal chorionic villi directly), non-deciduous and Meta discoidal.

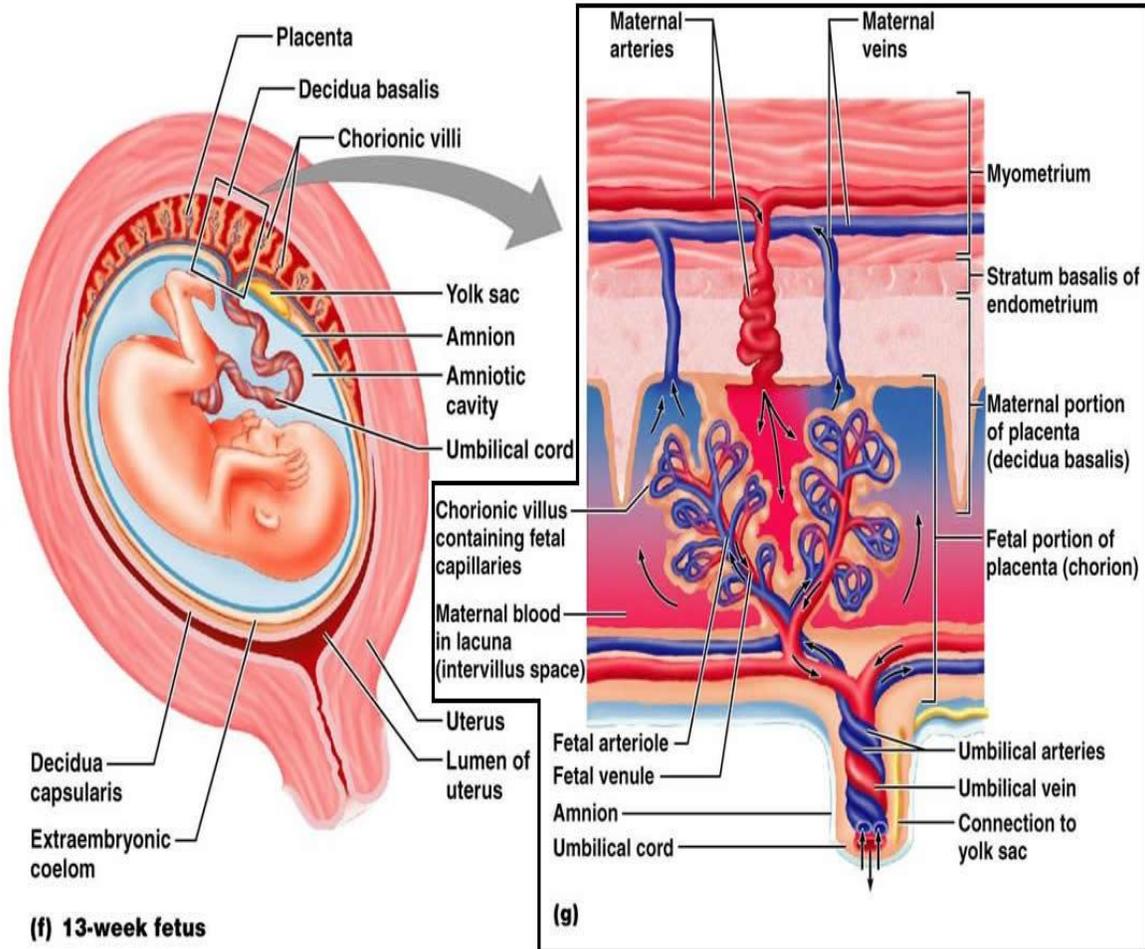
In simplest type of placenta, six barriers separate maternal blood from foetal blood. Three barriers are lost in human placenta.

Umbilical cord is a flexible cord like structure connecting the foetus at the navel with the placenta and containing two umbilical arteries and one vein that nourish foetus and remove its wastes.

Both type of blood vessels in umbilical cord is surrounded by Wharton's jelly.

The placenta facilitate the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory /waste materials produced by the embryo.

Placenta also acts as an endocrine tissue as it secretes several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogens, progesteron, etc that are essential for maintaining maternal physiological conditions appropriate for continued development of the conceptus. In the later phase of pregnancy, a hormone called relaxin is also secreted by the ovary.



Q25. Explain the genetic basis of blood grouping in human population.

Sol.25 Blood grouping in human is a type of codominance in which both the genes are expressed for a particular character in F1 hybrid progeny.

There is no blending of characters.

ABO blood groups are determined by allele I^A , allele I^B & allele I^O

I^A = dominant

I^B = dominant

I^O = recessive.

Possible phenotype – A, B, AB, O.

| Blood group | Antigen(s) present on the red blood cells | Antibodies present in the serum | Genotype(s) |
|-------------|---|---------------------------------|-------------|
| A | A antigen | Anti-B | AA or AO |
| B | B antigen | Anti-A | BB or BO |
| AB | A antigen and B antigen | None | AB |
| O | None | Anti-A and Anti-B | OO |

Possible genotype no. = $\frac{3(3+1)}{2} = 6$ genotype

OR

Q25. How did Hershey and Chase established that DNA is transferred from virus to bacteria?

Sol.25 **Hershey and Chase (1952)** discovered that DNA is the genetic material of bacteriophage.

They conducted their experiment on T_2 bacteriophage, which attacks on E.coli bacterium.

The phage particles were prepared by using radioisotopes of S^{35} and p^{32} in the following steps-

Few bacteriophages were grown in bacteria containing ^{35}S which was incorporated into the cysteine and methionine amino acids of proteins and thus these amino acids with ^{35}S formed the proteins of phage.

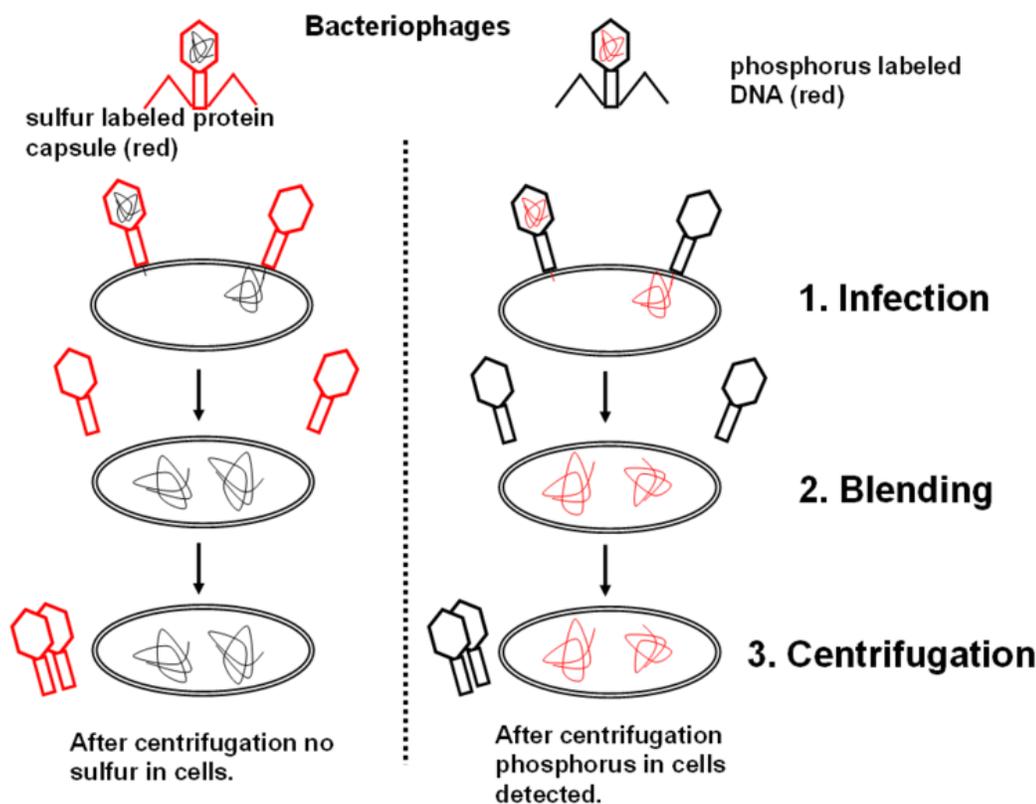
Some other bacteriophages were grown in bacteria having ^{32}p , which was restricted to DNA of phage particles.

These two radioactive phage preparations (one with radioactive proteins and another with radioactive DNA) were allowed to infect the culture of E.coli. The protein coats were separated from the bacterial cell walls by shaking, and centrifugation.

The heavier infected bacterial cells during centrifugation pelleted to bottom. The supernatant had the lighter phage particles and other components that failed to infect bacteria. It was observed that bacteriophages with radioactive DNA gave rise to radioactive

pellets with ^{32}P in DNA. However in the phage particles with radioactive protein (with ^{35}S) the bacterial pellets have almost nil radioactivities indicating that proteins have failed to migrate into bacterial cell. So, it can be safely concluded that during infection by bacteriophage T2' it was DNA, which entered the bacteria. It was followed by an eclipse period during which phage DNA replicates numerous times within the bacterial cell. Towards the end of eclipse period phage DNA directs the production of protein coats assembly of newly formed phage particles.

The above experiment clearly suggests that it is phage DNA and not protein, which contains the genetic information for the production of new bacteriophages. However, in some plant viruses (like TMV), RNA acts as hereditary material (being DNA absent).

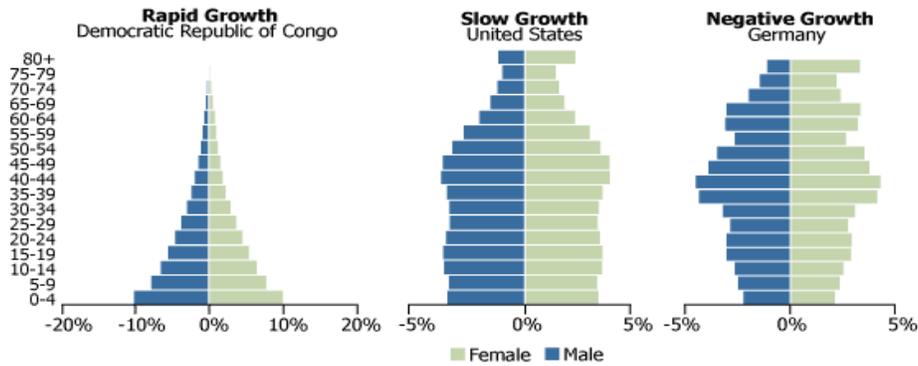


Q26. "Analysis of age-pyramids for human population can provide important inputs for long-term planning strategies." Explain.

Sol.26 Age distribution: Various age groups in a population determine its reproductive status. The three ages referred to as ecological ages in a population are – pre – reproductive, young members grow rapidly, while the declining populations have a large proportion of order individuals.

And also the age-sex structure of a human population can be studied through population pyramids. The overall shape of the pyramid indicates the potential for the future growth.

The four representations of population age-sex structure indicate an overall example of what a pyramid for different levels of population growth would appear like rapid growth, slow growth, zero growth, and negative growth. The horizontal bars represent the percentage (or in some cases the actual numbers) of males and females in each age group.



OR

Q26. Describe the advantages for keeping the ecosystems healthy.

Sol.26 Advantages for keeping the ecosystems healthy

1. Large scale biodiversity is very much useful to maintain ecosystem healthy.
2. It maintains buoyancy between food web & food chain.
3. It satisfies human needs.
4. The evolution in the gene pool of species through number of generation has produced substances that offer us significant health & other benefits.
5. By maintaining ecosystem, our future remains secured.