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RBSE

**RAJASTHAN BOARD
SECONDARY EXAMINATION**

2022

**CLASS
XII**

Questions & Solutions

Date: 16 April, 2022 | TIME : (9.00 a.m. to 11.45 a.m)

Duration: 2hr, 45 min. | Max. Marks: 56






SUBJECT: Biology

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Roll No.

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Candidates must write the Code on the title page of the answer-book

Biology (Theory) & SOLUTION

Time allowed : 2 hr, 45 Min.

Maximum Marks : 56

General Instructions :

परीक्षार्थियों के लिए सामान्य निर्देश:

1. Candidate must write first his/her Roll No. on the question paper compulsorily
परीक्षार्थी सर्वप्रथम अपने प्रश्न-पत्र पर नामांक अनिवार्यतः लिखें।
2. All the question are compulsory.
सभी प्रश्न करने अनिवार्य है।
3. Write the answer to all question in the given answer-book only.
सभी प्रश्नों के उत्तर, केवल उत्तर-पुस्तिका में ही लिखें।
4. For questions having more than one part, the answers to those parts are to be written together in continuity.
जिन प्रश्नों में आन्तरिक खण्ड है उन सभी के उत्तर एक साथ ही लिखें।
5. If there is any error/ difference/ contradiction in Hindi & English versions of the questions paper, the questions of Hindi version should be treated valid.
प्रश्न-पत्र के हिन्दी व अंग्रेजी रूपान्तरण में किसी प्रकार की त्रुटि/अन्तर/विरोधाभास होने पर हिन्दी भाषा के प्रश्न को ही सही मानें।
6. Write down the serial number of the question before attempting it.
प्रश्न का उत्तर लिखने से पूर्व प्रश्न का क्रमांक अवश्य लिखें।
7. There are internal choices in Questions Nos. 16 to 20.
प्रश्न क्रमांक 16 से 20 में आन्तरिक विकल्प है।

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खण्ड -अ
Section -A

1. Answer the following question by selecting the correct option in answer book.
निम्नलिखित प्रश्नों के उत्तर के सही विकल्प चयन कर उत्तर पुस्तिका में लिखिए
- (i) Number of chromosomes have in meiocytes of human being
मनुष्य के अर्धसूत्राणु में गुणसूत्रों की संख्या है
(A*) 46 (B) 23 (C) 19 (D) 12
- (ii) In which of the following perisperm is found ?
(A*) Beetroot (B) Pea (C) Groundnut (D) Sunflower
निम्नलिखित में से किसमें परिभ्रूणपोष पाया जाता है?
(A*) चुकंदर (B) मटर (C) मूँगफली (D) सूरजमुखी
- (iii) In which chromosomal disorder one X chromosomes is missing and the sex chromosome is as XO?
(A) Down's Syndrome (B) Klinefelter's Syndrome
(C) Thalassemia (D*) Turner's Syndrome
कौन से आनुवंशिक विकार में एक X क्रोमोसोम का अभाव हो जाता है और लिंग क्रोमोसोम XO हो जाते हैं?
(A) डाउन सिंड्रोम (B) क्लाइनफेल्डर सिंड्रोम
(C) थेलेसीमिया (D*) टर्नर सिंड्रोम
- (iv) Purine nitrogenous base is -
(A) Cytosine (B*) Adenine (C) Uracil (D) Thymine
प्यूरीन नाइट्रोजनी क्षार है -
(A) साइटोसीन (B*) एडेनीन (C) यूरेसिल (D) थाइमीन
- (v) The Pathogen of elephantiasis is -
(A) Amoeba (B) Ascaris (C*) Filarial worm (D) Plasmodium
हाथीपाँव रोग का रोगकारक है -
(A) अमीबा (B) ऐस्केरिस (C*) फाइलेरिआई कृमि (D) प्लाज्मोडियम
- (vi) The capacity to generate a whole plant from any cell is called
(A) Micropropagation (B) Somatic hybridization
(C) Hybridisation (D*) Totipotency
किसी कोशिका से पूर्ण पादप उत्पन्न होने की क्षमता कहलाती है
(A) सूक्ष्मप्रवर्धन (B) कायिक संकरण
(C) संकरण (D*) पूर्णशक्तता
- (vii) Which fever could be confirmed by Widal test :
(A) Malaria (B) Dengue (C) Corona (D*) Typhoid
कौन से ज्वर की पुष्टि विडाल परीक्षण से हो सकती है?
(A) मलेरिया (B) डेंगू (C) कोरोना (D*) टाइफॉइड
- (viii) The status of green plants in the food chain is -
(A*) Producer (B) Primary Consumer
(C) Secondary Consumer (D) Decomposer
खाद्य शृंखला में हरे पादपों का स्तर होता है -
(A*) उत्पादक (B) प्राथमिक उपभोक्ता
(C) द्वितीयक उपभोक्ता (D) अपघटक

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(ix) Which protein gene cry is controlled the cotton boll worm ?

कौन सा प्रोटीन जीन क्राई कपास में मुकुल कृमि को नियंत्रित करता है?

(A) I-Ac

(B) I-Ab

(C) II-Ac

(D*) I-Ac and II-Ab

2. Fill in the blanks :

रिक्त स्थानों की पूर्ति कीजिए :

(i) When there is breeding between animals of the same breed, it is called **inbreeding**

एक ही नस्ल के पशुओं के मध्य जब प्रजनन होता है, तो वह **inbreeding** कहलाता है।

(ii) Bt toxin is produced by bacterium **Bacillus thuringiensis**.

बीटी (Bt) जीवविष **Bacillus thuringiensis** जीवाणु से निर्मित होता है।

(iii) If an inheritable mutation is observed in Population at high frequency, it is called DNA

Polymorphism.

यदि एक वंशागत उत्परिवर्तन, जनसंख्या में उच्च आवृत्ति में मिलता है, तो इसे डीएनए **Polymorphism** कहते हैं।

(iv) When a species becomes extinct, the other plant and animal species associated with it is obligatory to extinct, is called **Co-extinction**.

जब एक जाति के विलुप्त होने पर उस पर आधारित दूसरी जंतु व पादप जातियाँ भी अनिवार्य रूप से विलुप्त होने लगती है, यह **Co-extinction** कहलाता है।

3. Give the answer of following questions in a word or a line :

निम्न प्रश्नों के उत्तर एक शब्द अथवा एक पंक्ति में दीजिए।

(i) Define biotechnology.

जैव-प्रौद्योगिक को परिभाषित कीजिए।

Sol. Biotechnology deals with techniques of using live organisms or enzymes from organisms to produce products and processes useful to humans.

(ii) Which will be the blood group of the progeny getting 'I^A' allele from mother and 'i' allele from father?

माता से 'I^A' अलील व पिता से 'i' अलील प्राप्त करने वाली संतति का रूधिर वर्ग कौन सा होगा ?

Sol. Blood group will be 'I^A', as 'i' is recessive and I^A is dominant.

(iii) Write the definition of biopiracy.

बायोपाइरेसी की परिभाषा लिखिए।

Sol. Biopiracy is the term used to refer to the use of bio-resources by multinational companies and other organisations without proper authorisation from the countries and people concerned without compensatory payment.

(iv) Which colours cannot be discriminated by person in 'colour-blindness'?

वर्णांधता में व्यक्ति कौन से रंग (वर्ण) में विभेद नहीं कर पाता है?

Sol. Colour blindness occurs when one or more of the cone types are faulty or defective.

Colour blindness cannot distinguish certain shades of red and green.

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- (v) Define innate immunity.
सहज प्रतिरक्षा को परिभाषित कीजिए।

Sol. Innate immunity is non-specific type of defence, that is present at the time of birth.

- (vi) Define Genetically modified Organisms (GMO)
आनुवंशिकतः रूपांतरित जीव (GMO) को परिभाषित कीजिए।

Sol. Plants, bacteria, fungi and animals whose genes have been altered by manipulation are called Genetically Modified Organisms (GMO).

- (vii) Which type of pyramids if biomass is found in ocean?
समुद्र में जैव मात्रा (भार) के पिरैमिड किस प्रकार के होते हैं?

Sol. The pyramid of biomass in sea is generally inverted because the biomass of fishes far exceeds that of phytoplankton.

- (viii) What is ex situ conservation?
बह्यस्थाने संरक्षण क्या है?

Sol. In this approach, threatened animals and plants are taken out from their natural habitat and placed in special settings where they can be protected and given special care.

खण्ड – ब

Section – B

Short answer type questions (Answer word limit 50 words):

लघु उत्तरीय (उत्तर सीमा 50 शब्द):

4. Write the name of any three contraceptive methods.
किन्ही तीन गर्भनिरोधक साधनों का नाम लिखिए।

Sol. Three contraceptive methods are as follows:

1. Barrier methods, ovum and sperms are prevented from physically meeting with the help of barriers. Such methods are available for both males and females.
2. Oral administration of small doses of either progestogens or progestogen–estrogen combinations is another contraceptive method used by the females. They are used in the form of tablets and hence are popularly called the pills.
3. Another effective and popular method is the use of Intra Uterine Devices (IUDs). These devices are inserted by doctors or expert nurses in the uterus through vagina. These Intra Uterine Devices are presently available as the non-medicated IUDs (e.g., Lippes loop), copper releasing IUDs (CuT, Cu7, Multiload 375) and the hormone releasing IUDs (Progestasert, LNG-20).

5. What is gene gun (biolistic)? Write its one use.
जीन गन (बायोलिस्टिक) क्या है? इसका एक उपयोग लिखिए।

Sol. Gene gun or biolistic is the method of transfer of recombinant DNA in the host cells. In this method (suitable for plants), cells are bombarded with high velocity micro-particles of gold or tungsten coated with DNA in a method known as biolistics or gene gun.

6. Write the three important points of bee-keeping.
मधुमक्खी पालन के कोई तीन महत्वपूर्ण बिन्दु लिखिए।

Sol. The following points are important for successful bee-keeping:

- (i) Knowledge of the nature and habits of bees,
- (ii) Selection of suitable location for keeping the beehives,
- (iii) Catching and hiving of swarms (group of bees),
- (iv) Management of beehives during different seasons, and
- (v) Handling and collection of honey and of beeswax. Bees are the pollinators of many of our crop species such as sunflower, Brassica, apple and pear. Keeping beehives in crop fields during flowering period increases pollination efficiency and improves the yield—beneficial both from the point of view of crop yield and honey yield

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7. What is animals breeding? Explain two aims of animals breeding.

पशु प्रजनन क्या है? पशु प्रजनन के दो उद्देश्य समझाइए।

Sol. The process of creating a new breed with superior characters in the offspring is called animal breeding.

Two aims of animals breeding are:

- (1) Animal breeding aims at increasing the yield of animals.
- (2) It also aims at improving the desirable qualities of the produce.

8. Explain the reason of population growth explosion.

जनसंख्या वृद्धि विस्फोट का कारण समझाइए।

Sol. A rapid decline in death rate, maternal mortality rate (MMR) and infant mortality rate (IMR) as well as an increase in number of people in reproductive age are probable reasons for population growth explosion.

9. Explain any feature required to facilitate cloning into a vector.

संवाहक में क्लोनिंग करने हेतु आवश्यक किसी एक विशेषता को समझाइए।

Sol. Selectable marker is one features that is required to facilitate cloning into a vector.

Selectable marker : It helps in identifying and eliminating non-transformants and selectively permitting the growth of the transformants. Transformation is a procedure through which a piece of DNA is introduced in a host bacterium. Normally, the genes encoding resistance to antibiotics such as ampicillin, chloramphenicol, tetracycline or kanamycin, etc., are considered useful selectable markers for *E. coli*. The normal *E. coli* cells do not carry resistance against any of these antibiotics.

10. Explain any one application of biotechnology in medicine.

चिकित्सा में जैव-प्रौद्योगिकी के किसी एक उपयोग को समझाइए।

Sol. One application of biotechnology in medicine is gene therapy.

Gene therapy is used to treat genetic disorders usually by the insertion of a normal gene or correct gene for the defective or inactive gene into an individual with the help of vectors such as retrovirus.

11. Write any two advantages of production of genetically modified plants. Give any one example of genetically modified plant.

आनुवंशिकतः रूपान्तरित पौधे के उत्पादन के कोई दो लाभ लिखिए। किसी एक आनुवंशिकतः रूपान्तरित पौधे का उदाहरण दीजिए।

Sol. GM plants have been useful in many ways. Genetic modification has:

- (i) made crops more tolerant to abiotic stresses (cold, drought, salt, heat).
- (ii) reduced reliance on chemical pesticides (pest-resistant crops).

Example of a genetically modified plant is Bt cotton.

12. Explain one cause for the loss of biodiversity.

जैव-विविधता की क्षति का एक कारण समझाइए।

Sol. Habitat loss and fragmentation: This is the most important cause driving animals and plants to extinction.

The Amazon rainforest (it is so huge that it is called the 'lungs of the planet') harbouring probably millions of species is being cut and cleared for cultivating soybeans or for conversion to grasslands for raising beef cattle. Besides total loss, the degradation of many habitats by pollution also threatens the survival of many species. When large habitats are broken up into small fragments due to various human activities, mammals and birds requiring large territories and certain animals with migratory habits are badly affected, leading to population declines.

13. Pyramid of energy is always upright, explain.

ऊर्जा पिरामिड सदैव खड़ी अवस्था में होता है, समझाइए।

Sol. Pyramid of energy is always upright, can never be inverted, because when energy flows from a particular trophic level to the next trophic level, some energy is always lost as heat at each step. Each bar in the energy pyramid indicates the amount of energy present at each trophic level in a given time or annually per unit area.

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14. What is the role of transgenic animal in the biological product ?

पारजीवी जन्तु की जैविक उत्पाद में क्या भूमिका है?

Sol. Medicines required to treat certain human diseases can contain biological products, but such products are often expensive to make. Transgenic animals that produce useful biological products can be created by the introduction of the portion of DNA (or genes) which codes for a particular product such as human protein (α -1-antitrypsin) used to treat emphysema. Similar attempts are being made for treatment of phenylketonuria (PKU) and cystic fibrosis. In 1997, the first transgenic cow, Rosie, produced human protein-enriched milk (2.4 grams per litre). The milk contained the human alpha-lactalbumin and was nutritionally a more balanced product for human babies than natural cow-milk.

15. Define species area relationship patterns of biodiversity.

जैव-विविधता के जाति - क्षेत्र संबंध प्रतिरूप को परिभाषित कीजिए।

Sol. The relation between species richness and area for a wide variety of taxa (angiosperm plants, birds, bats, freshwater fishes) turns out to be a rectangular hyperbola. On a logarithmic scale, the relationship is a straight line described by the equation

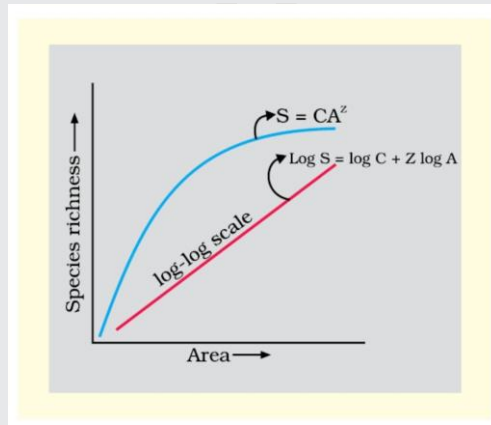


Fig. – Showing species area relationship. Note that on log scale the relationship becomes linear.

$$\log S = \log c + z \log A$$

where

S= Species richness A= Area

z = slope of the line (regression coefficient)

c = Y-intercept.

Section-C

खण्ड-स

Long answer type questions (Answer Work limit 100 words) :

दीर्घउत्तरीय प्रश्न (उत्तर शब्द 100 शब्द)

16. Define asexual reproduction. Write two examples of vegetative propagule in flowering plants.

अलैंगिक जनन को परिभाषित कीजिए। पुष्पीय पादपों में कायिक प्रवर्धन के दो उदाहरण दीजिए।

OR / अथवा

Define sexual reproduction. Explain menstrual cycle.

लैंगिक जनन को परिभाषित कीजिए। ऋतुचक्र को समझाइए।

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Sol. Asexual reproduction produces individuals that are genetically identical to the parent plant. Vegetative propagation is a form of asexual reproduction of a plant. Here, only one plant is involved and the offspring is the result of one parent. The new plant is genetically identical to the parent. Two examples of vegetative propagule in flowering plants are :

1. Bulbs are the round, swollen parts of a stem that are typically found underground. Within these organs of vegetative propagation lies the central shoot of a new plant. Bulbs consist of a bud that is surrounded by layers of fleshy, scale-like leaves. These leaves are a source of food storage and provide nourishment to the new plant. Examples of plants that develop from bulbs include onions, garlic, etc.
2. Vegetative propagation may occur naturally through the development of rhizomes. Rhizomes are modified stems that typically grow horizontally along the surface of or beneath the ground. Rhizomes are storage sites for growth substances such as proteins and starches. As rhizomes extend, roots and shoots may arise from segments of the rhizome and develop into new plants. Edible plant rhizomes include ginger and turmeric.

Or

Sexual reproduction occurs when the sperm from the male parent fertilizes an egg from the female parent, producing an offspring that is genetically different from both parents.

MENSTRUAL CYCLE

The reproductive cycle starting from the one menstruation till the next one in the female primates is called menstrual cycle. The first menstruation which begins at puberty and is called menarche . The cycle is repeated at an interval of 28-29 days. Menstrual cycle involve three phases- menstrual phase, follicular phase and luteal phase.

Menstrual phase-

Menstrual flow occurs and lasts for about 3-5 days. The endometrial lining of the uterus breaks along with the blood vessels which forms a red fluid and results in menstrual flow. If the ovum is fertilized by a sperm menstrual flow does not occur and hence indicates pregnancy.

Follicular phase-

In this phase, the primary follicles in the ovary grow to become a fully matured graafian follicle. Endometrium regenerates through proliferation. Changes in Pituitary hormone and ovarian hormones induce the formation of graafian follicle and regeneration of endometrium. The secretion of gonadotropins like luteinizing hormone and follicular stimulating hormone increases gradually during this phase and stimulates follicular development as well as secretion of estrogens by the growing follicles. Both LH and FSH attain a peak level in the middle of cycle about 14th day. Rapid secretion of LH leading to its maximum level during the mid-cycle called LH surge induces rupture of Graafian follicle and thereby the release of ovum known as ovulation

Luteal phase-

In this phase, the ruptured part of Graafian follicle transforms into yellow body called Corpus luteum. The corpus luteum secretes large amounts of progesterone hormone which maintains the endometrium for implantation of the fertilized ovum. During pregnancy all events of the menstrual cycle stop and there is no menstruation. In the absence of fertilization, the corpus luteum degenerates hence causes disintegration of the endometrium leading to menstruation and a new cycle begins.

In human beings, menstrual cycles ceases around 50 years of age and known as menopause.

17. Explain the law of dominance by the help of Punnett Square.

प्रभाविता के नियम को पनेट वर्ग की सहायता से समझाइए।

OR / अथवा

Explain test cross with the help of an example.

परीक्षार्थ संकरण को उदाहरण द्वारा समझाइए।

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Sol.

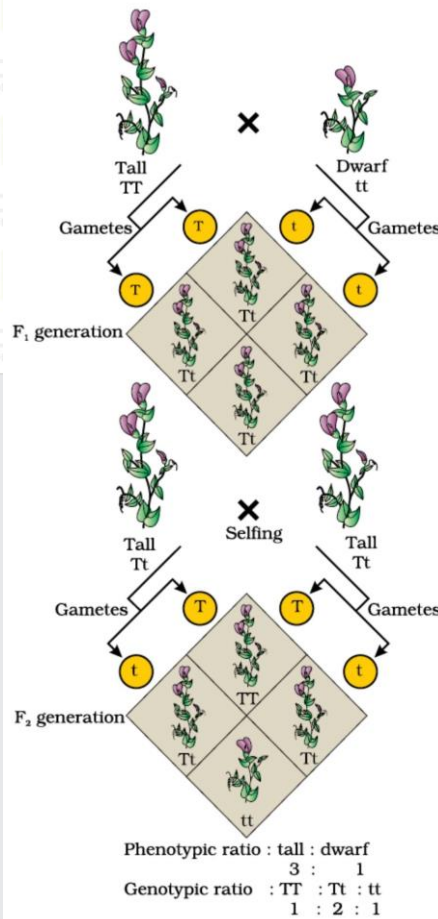


Figure 5.4 A Punnett square used to understand a typical monohybrid cross conducted by Mendel between true-breeding tall plants and true-breeding dwarf plants

Fig. A Punnett square used to understand a typical monohybrid cross conducted by Mendel between true-breeding tall plants and true breeding dwarf plants

The Punnett Square shows the parental tall TT (male) and dwarf tt (female) plants, the gametes produced by them and the F1 Tt progeny. The F1 plants of genotype Tt are self-pollinated.

The F1 plant of the genotype Tt when self-pollinated, produces gametes of the genotype T and t in equal proportion. When fertilisation takes place, the pollen grains of genotype T have a 50 per cent chance to pollinate eggs of the genotype T, as well as of genotype t. Also pollen grains of genotype t have a 50 per cent chance of pollinating eggs of genotype T, as well as of genotype t. As a result of random fertilisation, the resultant zygotes can be of the genotypes TT, Tt or tt.

From the Punnett square it is easily seen that 1/4th of the random fertilisations lead to TT, 1/2 lead to Tt and 1/4th to tt. Though the F1 have a genotype of Tt, but the phenotypic character seen is 'tall'. At F2, 3/4th of the plants are tall, where some of them are TT while others are Tt. Externally it is not possible to distinguish between the plants with the genotypes TT and Tt. Hence, within the genotypic pair Tt only one character 'T' tall is expressed. Hence the character T or 'tall' is said to dominate over the other allele t or 'dwarf' character. It is thus due to this dominance of one character over the other that all the F1 are tall (though the genotype is Tt) and in the F2 3/4th of the plants are tall (though genotypically 1/2 are Tt and only 1/4th are TT). This leads to a phenotypic ratio of 3/4th tall : (1/4 TT + 1/2 Tt) and 1/4th tt, i.e., a 3:1 ratio, but a genotypic ratio of 1:2:1.

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OR

A tall plant from F_1 or F_2 has TT or Tt composition, cannot be predicted. Therefore, to determine the genotype of a tall plant at F_2 , Mendel crossed the tall plant from F_2 with a dwarf plant. This he called a test cross. In a typical test cross an organism (pea plants here) showing a dominant phenotype (and whose genotype is to be determined) is crossed with the recessive parent instead of self-crossing. The progenies of such a cross can easily be analysed to predict the genotype of the test organism.

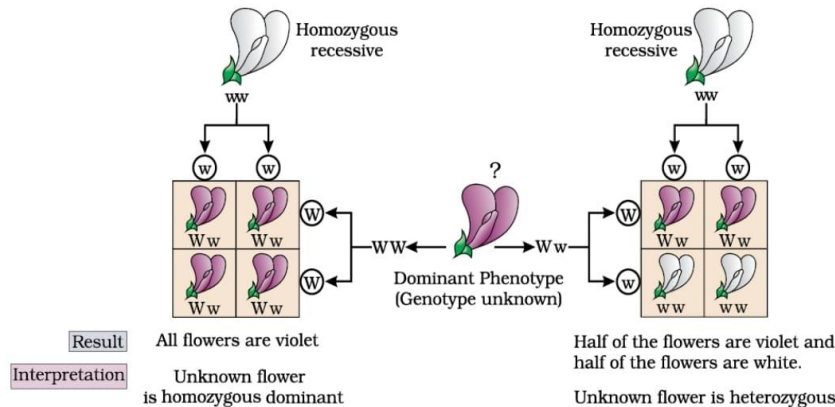


Fig. Diagrammatic representation of a test cross

18. Write the name of a water-borne disease. Explain preventive measures of water borne disease.
किसी एक जल-वाहित रोग का नाम लिखिए। जल-वाहित रोगों की रोकथाम के उपाय समझाइये।

अथवा /OR

Differentiate between active and passive immunity and give the example of each.
सक्रिय एवं निष्क्रिय प्रतिरक्षा में अंतर कीजिए और प्रत्येक का एक उदाहरण दीजिए।

- Sol.** Salmonella typhi is a pathogenic bacterium which causes typhoid fever in human beings. These pathogens generally enter the small intestine through food and water contaminated with them and migrate to other organs through blood. Sustained high fever (39° to 40°C), weakness, stomach pain, constipation, headache and loss of appetite are some of the common symptoms of this disease. Intestinal perforation and death may occur in severe cases. Typhoid fever could be confirmed by the Widal test.

The measures that can be taken to prevent water-borne diseases are as follows:

- One should drink bottled water or boiled or filter water, the water being used for drinking and cooking to ensure all the pathogens are killed.
- Regular cleaning of water containers i.e. Water jars/containers should be washed daily. We should check our water reservoirs regularly.
- Make sure that the pipes and tanks that supply water to your house are properly maintained and clean.
- By maintaining personal hygiene, such as washing your hands and feet on returning home after a walk through the puddles is a must. This can help reduce the chances of contracting water-borne diseases like jaundice, cholera and typhoid fever.
- Eat proper cooked and warm food, wash vegetables and fruits before cooking.
- Maintain cleanliness in surroundings and don't let water accumulate longer at any places & proper disposal of infant and toddler feces.
- Avoid foods and fruit juices from roadside vendors because you may never know if the water they use is safe or not.
- Keep food and drinking water as covered as the preventive measures for water borne diseases.
- Chlorination of drinking water, proper sanitation and hygiene practices to interrupt disease transmission by vector is an effective measure. To prevent water borne diseases we should dispose of sewage, excreta etc properly

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Or

Basis of comparison	Active Immunity	Passive Immunity
Meaning	It refers to the protective immunity where the individual's own immune system stimulates for producing antibodies and lymphocytes.	It refers to the immunity where a person receives antibodies or lymphocytes which another individual's immune system receive.
Production	Produced actively by immune system of the host.	Produced passively by the host's immune system.
Antibodies	Induced by the infection or immunogens.	Not produced but transferred directly.
Immunological Memory	Produced	Not produced
Antigen	Required exposure to a pathogen or to the antigen of a pathogen.	Does not require exposure to an infectious agent or its antigen.
Immunity Type	Involves humoral and cell-mediated immunity	Conferred only by readymade antibodies.
Artificial Acquirement	Through vaccines	Administration of performed antibodies.
Lag period	Present	Absent

खण्ड-द

Section -D

Essay type questions (Answer word limit 100 words)

निबंधात्मक प्रश्न (उत्तर शब्द सीमा 100 शब्द)

19. What is floriculture? Describe the structure of stamen. Draw a labelled diagram of typical stamen. फलोरीकल्चर क्या है? पुंकेसर की संरचना का वर्णन कीजिए। एक प्रारूपिक पुंकेसर का नामांकित चित्र बनाइए।

अथवा / OR

What is post-fertilization events? Describe the structure of plant endosperm. Draw a labelled diagram of dicot embryo.

निषेचन-पश्च घटना क्या है? पादप भ्रूणपोष की संरचना का वर्णन कीजिए। एक द्विबीजपत्री भ्रूण की संरचना का नामांकित चित्र बनाइए।

Sol.

Floriculture, or flower farming, is a discipline of horticulture concerned with the cultivation of flowering and ornamental plants for gardens and for floristry, comprising the floral industry. The development, via plant breeding, of new varieties is a major occupation of floriculturists.

Structure of stamens :

The two parts of a typical stamen – the long and slender stalk called the filament, and the terminal generally bilobed structure called the anther. The proximal end of the filament is attached to the thalamus or the petal of the flower. The number and length of stamens are variable in flowers of different species.

A typical angiosperm anther is bilobed with each lobe having two theca, i.e., they are dithecous. Often a longitudinal groove runs lengthwise separating the theca. The bilobed nature of an anther is very distinct in the transverse section of the anther. The anther is a four-sided (tetragonal) structure consisting of four microsporangia located at the corners, two in each lobe.

The microsporangia develop further and become pollen sacs. They extend longitudinally all through the length of an anther and are packed with pollen grains.

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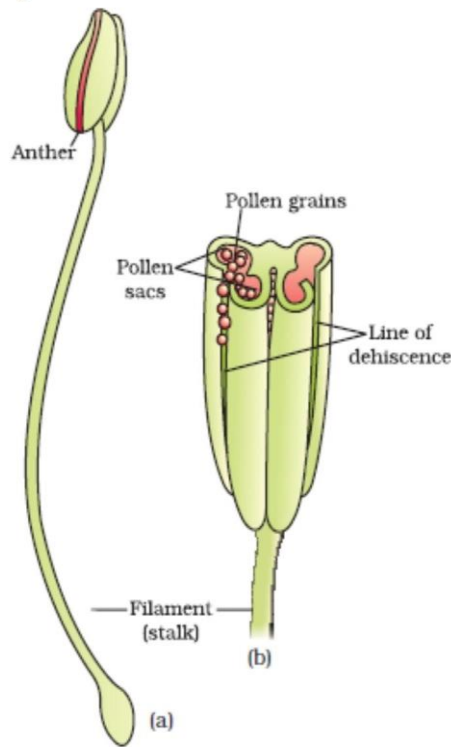


Fig. (a) A typical stamen; (b) three-dimensional cut section of an anther

Or

Embryo develops at the micropylar end of the embryo sac where the zygote is situated. Most zygotes divide only after certain amount of endosperm is formed. This is an adaptation to provide assured nutrition to the developing embryo. Though the seeds differ greatly, the early stages of embryo development (embryogeny) are similar in both monocotyledons and dicotyledons. The zygote gives rise to the proembryo and subsequently to the globular, heart-shaped and mature embryo.

A typical dicotyledonous embryo, consists of an embryonal axis and two cotyledons. The portion of embryonal axis above the level of cotyledons is the epicotyl, which terminates with the plumule or stem tip. The cylindrical portion below the level of cotyledons is hypocotyl that terminates at its lower end in the radicle or root tip. The root tip is covered with a root cap.

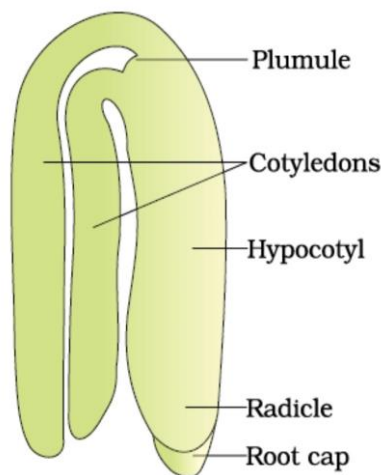


Fig. A typical dicot embryo

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20. Define transcription. Write the name of parts of transcription unit of DNA. Draw a schematic diagram of transcription unit.

अनुलेखन को परिभाषित कीजिए। डीएनए में अनुलेखन इकाई के भागों के नाम लिखिए। अनुलेखन इकाई का आरेखित चित्र बनाइए।

अथवा / OR

Write the components of nucleotide. Write one salient feature of the double helix structure of DNA.

Draw a labelled diagram of double helix of DNA.

न्यूक्लियोटाइड के घटक लिखिए। द्विकुंडली डीएनए की संरचना की एक प्रमुख विशेषता लिखिए। द्विकुंडली डीएनए का नामांकित चित्र बनाइए।

Sol. The process of copying genetic information from one strand of the DNA into RNA is termed as transcription.

Transcription Unit

A transcription unit in DNA is defined primarily by the three regions in the DNA:

(i) A Promoter

(ii) The Structural gene

(iii) A Terminator

There is a convention in defining the two strands of the DNA in the structural gene of a transcription unit. Since the two strands have opposite polarity and the DNA-dependent RNA polymerase also catalyse the polymerisation in only one direction, that is, $5' \rightarrow 3'$, the strand that has the polarity $3' \rightarrow 5'$ acts as a template, and is also referred to as template strand. The other strand which has the polarity ($5' \rightarrow 3'$) and the sequence same as RNA (except thymine at the place of uracil), is displaced during transcription. Strangely, this strand (which does not code for anything) is referred to as coding strand. All the reference point while defining a transcription unit is made with coding strand.

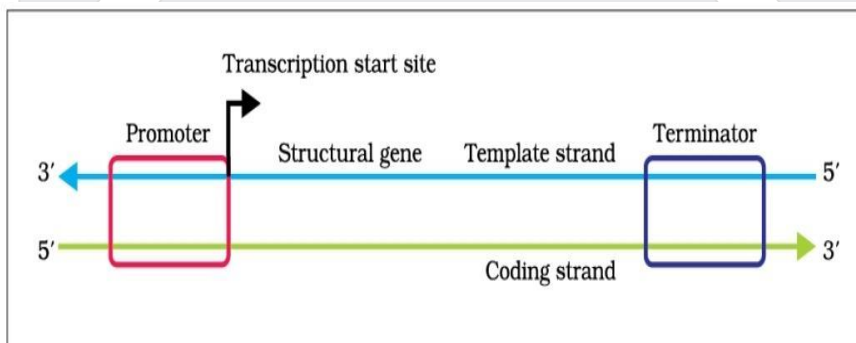


Fig. Schematic structure of a transcription unit

The promoter and terminator flank the structural gene in a transcription unit. The promoter is said to be located towards 5'-end (upstream) of the structural gene (the reference is made with respect to the polarity of coding strand). It is a DNA sequence that provides binding site for RNA polymerase, and it is the presence of a promoter in a transcription unit that also defines the template and coding strands. By switching its position with terminator, the definition of coding and template strands could be reversed. The terminator is located towards 3'-end (downstream) of the coding strand and it usually defines the end of the process of transcription. There are additional regulatory sequences that may be present further upstream or downstream to the promoter.

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Or

A nucleotide has three components – a nitrogenous base, a pentose sugar (ribose in case of RNA, and deoxyribose for DNA), and a phosphate group. There are two types of nitrogenous bases – Purines (Adenine and Guanine), and Pyrimidines (Cytosine, Uracil and Thymine). Cytosine is common for both DNA and RNA and Thymine is present in DNA. Uracil is present in RNA at the place of Thymine. A nitrogenous base is linked to the OH of 1'C pentose sugar through a N-glycosidic linkage to form a nucleoside, such as adenosine or deoxyadenosine, guanosine or deoxyguanosine, cytidine or deoxycytidine and uridine or deoxythymidine. When a phosphate group is linked to OH of 5'C of a nucleoside through phosphoester linkage, a corresponding nucleotide (or deoxynucleotide depending upon the type of sugar present) is formed.

DNA is a long polymer of deoxyribonucleotides. The length of DNA is usually defined as number of nucleotides (or a pair of nucleotide referred to as base pairs) present in it.

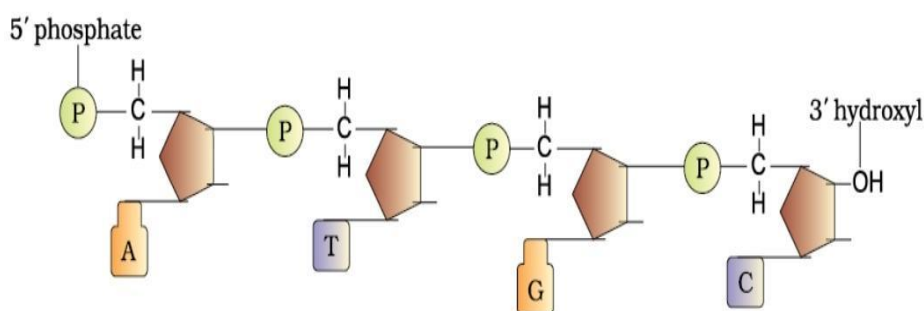


Fig. A polynucleotide chain

Two nucleotides are linked through 3'-5' phosphodiester linkage to form a dinucleotide. More nucleotides can be joined in such a manner to form a polynucleotide chain. A polymer thus formed has at one end a free phosphate moiety at 5'-end of sugar, which is referred to as 5'-end of polynucleotide chain. Similarly, at the other end of the polymer the sugar has a free OH of 3'C group which is referred to as 3' -end of the polynucleotide chain. The backbone of a polynucleotide chain is formed due to sugar and phosphates. The nitrogenous bases linked to sugar moiety project from the backbone.

The salient features of the Double-helix structure of DNA are as follows:

(Any one)

(i) It is made of two polynucleotide chains, where the backbone is constituted by sugar-phosphate, and the bases project inside.

(ii) The two chains have anti-parallel polarity. It means, if one chain has the polarity 5'->3', the other has 3'->5'.

(iii) The bases in two strands are paired through hydrogen bond (H-bonds) forming base pairs (bp). Adenine forms two hydrogen bonds with Thymine from opposite strand and vice-versa. Similarly, Guanine is bonded with Cytosine with three H-bonds. As a result, always a purine comes opposite to a pyrimidine. This generates approximately uniform distance between the two strands of the helix (Figure 6.2).

(iv) The two chains are coiled in a right-handed fashion. The pitch of the helix is 3.4 nm (a nanometre is one billionth of a metre, that is 10^{-9} m) and there are roughly 10 bp in each turn. Consequently, the distance between a bp in a helix is approximately 0.34 nm.

(v) The plane of one base pair stacks over the other in double helix. This, in addition to H-bonds, confers stability of the helical structure (Figure 6.3).

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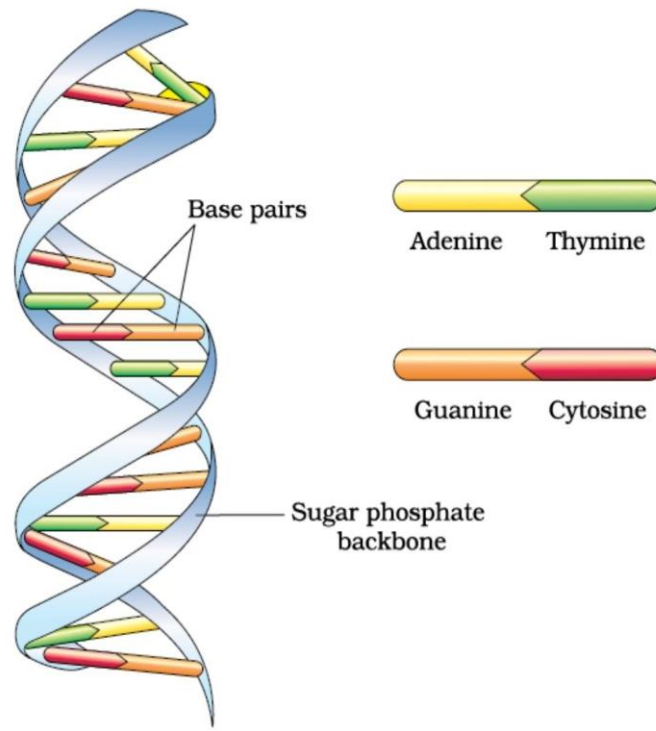


Fig. DNA double helix

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