

SAMPLE QUESTION PAPERS BIOLOGY

CBSE CLASS 12

ALL PAPERS STRICTLY ON REDUCED SYLLABUS AND
AS PER LATEST CBSE SAMPLE PAPER PROVIDED ON 9th OCT 2020

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WITH

**TIME MANAGEMENT
CHART**

+

**IMPORTANT Q's
RELATED THEORY**

+

**2021
TOPPER TIP'S**

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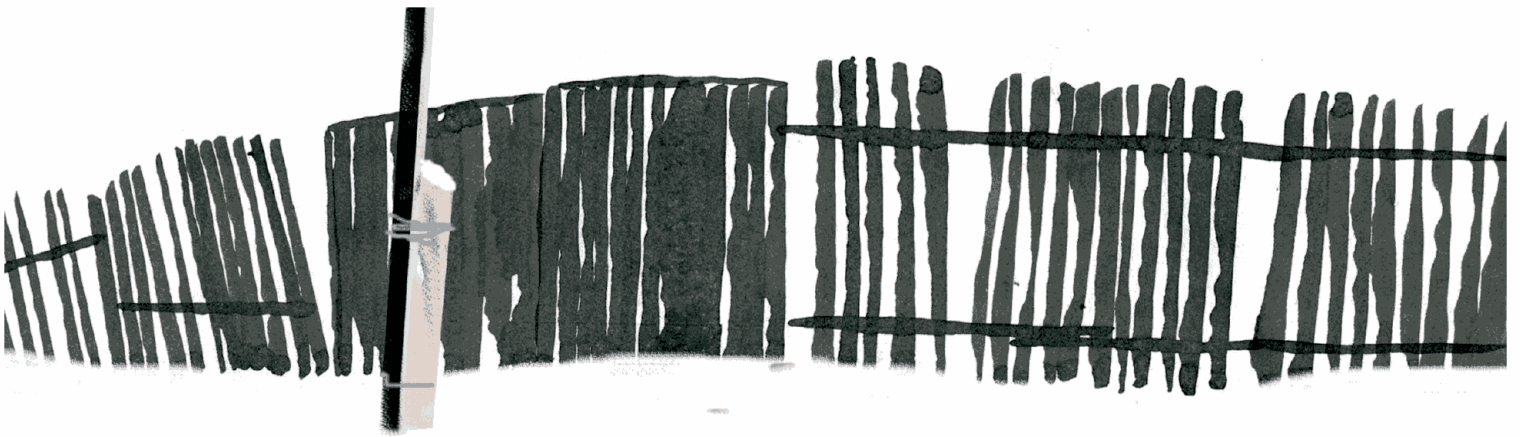
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AGP contributes Rupee One on every book purchased by you to the **Friends of Tribals Society** Organization for better education of tribal children.





Hello!

Friends, this year is all about keeping caution, strengthening determination and smart learning. CBSE has made sweeping changes in the paper pattern of all subjects and we at Educart have adhered 100% to those changes.

After the record breaking sales and acceptance of our sample papers last year pan-india, we have launched class 12 books with some critical value additions. This is our special self-prep version for 2021 with the new objective section included.

EduCart has also roped in CBSE Biology experts and most experienced teachers, to analyse the new pattern and prepare a fine XIIth Class Biology Sample Papers Book for 2021.

Go break a leg!



Reviews



★★★★★ **Read carefully what I am writing**

By Sathya Raji on 2 October, 2020



Guys, this is a very emotional review who has gone through a lot. I lost confidence because of the lack of interest in studies. Dad said focus only on studies but I only like TikTok and PUBG. Now both got banned and I had no other option but to study effectively as mid-terms were near. Now 4 months has passed and I had no preparation of boards at all. So I decided to change things and bought EDUCART.

Their maps (mind maps rather) for the first time in life helped me understand that what all comes in the chapters & what's important in those chapters. I was actually being able to study. I mean how can someone put so much effort in writing the book. So that definately helped me figure some topics well. Today, I finished 2 chapters of chemistry from Educart book and managed to make my father proud.



★★★★★ **Worth for 💰**

By Malika on 3 September, 2020



It's a very good book for the candidates appearing in 2021.... very nice explanation and also very nice editing 👍👍 Go for itt!!!!!!



5★ **Great product**

Student



I recommend this book.... magnificent book for revision...so many good questions are there... My God! the mind maps are super cool... A must buy book ...for class 10 students...just a little mistakes are there but it doesn't matter as those are check points of your learning Mustbuy 👍👍👍👍👍



★★★★★ **Wonderful book 😊**

By S S on 10 September, 2020



Every paper has CBSE questions written in neat way with explanations and related theory. My father purchased this book for me as i m weak in science but i am so happy with it that im posting the review myself to thank educart personally. Edcart, please continue to make such books, in this covid time, this book is what we needed reallly!



Dear Sir 🗣️

6.77M Subscribers



India ki pehli atma-nirbhar self prep book that really no publisher can match with. Educart question bank is a must buy for all students!



T S Sudhir

(Author of Saina Nehwal's Biography | Journalist | Educator)

To: quickreply@agpgroup.in



Educart Exemplar is my suggested book for this year and I rarely recommend books. This one I have thoroughly read and liked for my students.



RC Chauhan

HOD of Mathematics - DPS

To: quickreply@agpgroup.in



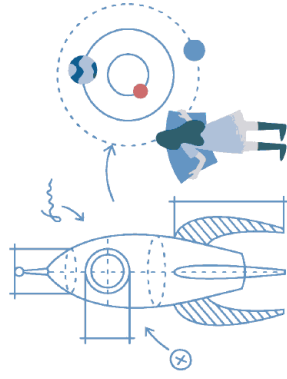
We have reviewed countless Xth Class Maths books but Educart's Sample papers is our top recommendation. Educart has done their homework well on how CBSE students nowadays want to learn solving of maths standard questions.



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* Self-assessment papers' solution are available on our website (www.educart.net).



Question Paper Design

Sections ↓	←←← TYPOLOGY OF QUESTIONS →→→					Total Marks	
	VSA 1m each	Assertion Reason 1m each	Case-based 4m each	SA I 2m each	SA II 3m each		LA 5m each
Section A	10Q	4Q (1 choice)	2Q (4 MCQ and 1 choice per Q)	-	-	-	22m
Section B	-	-	-	9Q (2 choice)	-	-	18m
Section C	-	-	-	-	5Q (1 choice)	-	15m
Section D	-	-	-	-	-	3Q (3 choice)	15m
Total Marks	10Q (10m)	4Q (4m)	2Q (8m)	9Q (18m)	5Q (15m)	3Q (15m)	70m

(vi)

Note: This blueprint is prepared for simplicity purpose, based on the CBSE Sample Paper provided on 9th October 2020.



Time Management

The 3 hour long board paper needs to be attempted strategically so that you are not cut short for time on any question at the end. This means you need to complete each section of the paper within a pre-defined duration. Our experts have figured out the optimum time duration for each section for you to keep in mind. Please see below the time management chart for all subjects:

BIOLOGY				
Sections	Question Type	Questions	Time To Be Spent (Per Question)	Total Time
Section A	VSA	10Q (1m each)	2 min per question + 10 min for reading the passage	$(10 + 4 + 8) \times 2$ + 10 min = 54 min ≈ 55 min
	Assertion Reason	4Q (1m each)		
	Case-based	2Q (8MCQ) (6m each)		
Section B	SA I	9Q (2m each)	4 min per question	$9 \times 4 = 36$ min ≈ 35 min
Section C	SA II	5Q (3m each)	7 min per question	$5 \times 7 = 35$ min
Section D	LA	3Q (5m each)	12 min per question	$3 \times 12 = 36$ min ≈ 35 min
				Total Time: 2 hours 40 min
				Revision Time: 20 min



Topper Tips

(on cracking new pattern)

Friends, on request of the Educart team, followed below are some points I've prepared for you to keep in mind whilst attempting the Class 12 Board Exams on the new pattern:

Notes and Diagrams driven practice

- This year the Biology objective section has various types of conceptual questions from Assertion Reason to VSA to Case Based MCQs. Preparing notes helps in the process of remembering the terms and last minute preparation strategies. Objective Section Maps given in this book can also serve you that purpose.
- Biology is heavy on theory so to facilitate your consistent interest, I'd suggest draw neat diagrams when possible as they can help you perceive the information easily. Base the preparation structure around them. Moreover, representing a specific information in the form of a well labeled and neat diagram can get you more marks instead of writing the big paragraphs.

Select your MCQ options wisely (Hindi and English Core)

50% paper is now MCQs based. Do not rush into choosing a particular option. If unable to find the answer; use the rule of elimination to reach the most appropriate answer. Usually ruling out other 3 options works out faster.

Cracking Case-based Questions

Here is the trick. CBSE cannot ask any MCQ in case-based questions that is going to take you more than 1-2 minutes to solve as it will be a 1m MCQ each. So don't worry about the length of the question, treat it like a normal value input or understanding or remembering based question and move ahead. Time is of the essence.

New Pattern MCQs (English)

CBSE has made a complete overhaul of MCQ's style of questioning in Reading and Literature comprehensions of English Section A. They are not direct but inference based and analytical thinking driven. Educart has provided detailed explanations in this book for such MCQs to help understand how to come to a conclusive option.

15 minutes reading time hack

- There is 30-50% internal choice this time in each section. You get good 15 minutes in the beginning to read the question paper. Use this time to mark the choice questions you are more confident in attempting to avoid wasting critical thinking time while writing the exam.
- Mark the tough questions you definitely don't know the answer to or where you feel you will struggle, and remember to leave space to come back to answering them.

Prioritise your Sections order

Decide which Section you would want to attempt first and which Section at last. Always attempt the easy questions first. This way your confidence will grow and you will be mentally ready to take on the more challenging questions.

Answers Structure has to be right

- Write most of the answers in bullet points (with headings) or in a tabular form where possible to save time and stick to the point. CBSE paper checkers prefer such format to make it easy to allot full marks.
- Underline key (value) points for all answers and follow word count to save on time.
- Explain lengthy answers with examples and diagrams.
- Recheck for all logics and calculations in case of numerical.



Syllabus

(Reduced)

Units	Unit Name	Marks
VI	Reproduction	14
VII	Genetics and Evolution	18
VIII	Biology and Human Welfare	14
IX	Biotechnology and its Applications	12
X	Ecology and Environment	12
TOTAL		70
Practicals		30

Unit-VI Reproduction

Chapter-2: 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 dispersal and fruit formation.

Chapter-3: 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).

Chapter-4: Reproductive Health

Need for reproductive health and prevention of Sexually Transmitted Diseases (STDs); birth control - need and methods, contraception and medical termination of pregnancy (MTP); amniocentesis; infertility and assisted reproductive technologies - IVF, ZIFT, GIFT (elementary Prac%als 30 idea for general awareness). CRR, SLR, Repo Rate and Reverse Repo Rate, Open Market Operations, Margin requirement.

Unit-VII Genetics and Evolution

Chapter-5: Principles of Inheritance and Variation

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; chromosome theory of inheritance; chromosomes and genes; Sex determination - in human being, birds and honey bee; linkage and crossing over; sex linked inheritance - haemophilia, colour blindness; Mendelian disorders in humans -thalassemia; chromosomal disorders in humans; Down's syndrome, Turner's and Klinefelter's syndromes.

Chapter-6: 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, Human and rice genome projects; DNA fingerprinting.

Unit-VIII Biology and Human Welfare

Chapter-8: Human Health and Diseases

Pathogens; parasites causing human diseases (malaria, dengue, chikungunya, filariasis, ascariasis, typhoid, pneumonia, common cold, amoebiasis, ring worm) and their control; Basic concepts of immunology - vaccines; cancer, HIV and AIDS; Adolescence - drug and alcohol abuse.

Chapter-10: Microbes in Human Welfare

Microbes in food processing, industrial production, sewage treatment, energy generation and microbes as bio-control agents and bio-fertilizers. Antibiotics; production and judicious use.

Unit-IX Biotechnology and its Applications

Chapter-11: Biotechnology - Principles and Processes

Genetic Engineering (Recombinant DNA Technology).

Chapter-12: Biotechnology and its Application

Application of biotechnology in health and agriculture: Human insulin and vaccine production, stem cell technology, gene therapy; genetically modified organisms - Bt crops; transgenic animals; biosafety issues, biopiracy and patents.

Unit-X Ecology and Environment

Chapter-13: Organisms and Populations

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.

Chapter-15: Biodiversity and its Conservation

Biodiversity - Concept, patterns, importance; loss of biodiversity; biodiversity conservation; hotspots, endangered organisms, extinction, Red Data Book, Sacred Groves, biosphere reserves, national parks, wildlife, sanctuaries and Ramsar sites.

PRACTICALS

Evaluation Scheme		Marks
One Major Experiment 5, 6		5
One Minor Experiment 2, 3		4
Slide Preparation 1, 4		5
Spotting		7
Practical Record + Viva Voce	Credit to the students' work over the academic session may be given	4
Investigatory Project and its Record + Viva Voce		5
TOTAL		30

A. List of Experiments

1. Prepare a temporary mount to observe pollen germination.
2. Collect and study soil from at least two different sites and study them for texture, moisture content, pH and water holding capacity. 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 organism.
4. Prepare a temporary mount of onion root tip to study mitosis.
5. Study the effect of different temperatures or three different pH on the activity of salivary amylase on starch.
6. Isolate DNA from available plant material such as spinach, green pea seeds, papaya, etc.

B. Study/observation of the following (Spotting)

1. Flowers adapted to pollination by different agencies (wind, insects, birds).
2. Identification of stages of gamete development, i.e., T.S. of testis and T.S. of ovary through permanent slides (from grasshopper/mice).
3. Meiosis in onion bud cell or grasshopper testis through permanent slides.
4. T.S. of blastula through permanent slides (Mammalian).
5. 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.
6. Common disease causing organisms like Ascaris, Entamoeba, Plasmodium, any fungus causing ringworm through permanent slides, models or virtual images. Comment on symptoms of diseases that they cause.
7. Two plants and two animals (models/virtual images) found in xeric conditions. Comment upon their morphological adaptations.
8. Two plants and two animals (models/virtual images) found in aquatic conditions. Comment upon their morphological adaptations.

Deleted

(For 2021 Exam)

Unit-VI Reproduction

Chapter-1: Reproduction in Organism

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

Unit-VII Genetics and Evolution

Chapter-7: Evolution

Origin of life; biological evolution and evidences for biological evolution (paleontology, comparative anatomy, embryology and molecular evidences); 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..

Unit-VIII Biology and Human Welfare

Chapter 9: Strategies for Enhancement in Food Production

Animal husbandry, Plant breeding, tissue culture, single cell protein.

Unit-X Ecology and Environment

Chapter-14: Ecosystem

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, seed dispersal, oxygen release (in brief).

Chapter 16: Environmental Issues

Air pollution and its control; water pollution and its control; agrochemicals and their effects; solid waste management; radioactive waste management; greenhouse effect and climate change impact and mitigation; ozone layer depletion; deforestation; exemplifying case study as success story addressing environmental issue(s).

PRACTICAL

A: List of Experiments

1. Study the presence of suspended particulate matter in air at two widely different sites.
2. Study the plant population density by quadrat method.
3. Study the plant population frequency by quadrat method.

B. Study/Observer of the following (spotting)

1. Pollen germination on stigma through a permanent slide or scanning electron micrograph.
2. Mendelian inheritance using seeds of different colour/sizes of any plant.
3. Controlled pollination - emasculation, tagging and bagging.



FAQs

1. Can we use black pen in CBSE board exam 2021?

As per last year's CBSE guideline, students appearing for CBSE Board Exams can write answers ONLY with a Blue color pen (blue or royal blue). It should be a ball point, gel or fountain pen.

If the students want to use a black pen to highlight or bold the points in answers or for writing titles or headlines then it is allowed.

2. Will the CBSE 2021 paper on reduced syllabus come based on the sample paper CBSE released? Will the difficulty level be the same?

Yes, it will be exactly as per the paper pattern and type of questions introduced by CBSE in the 9th October 2020 uploaded Sample paper. As far as the difficulty level is concerned, expect an easier paper than the provided sample paper as CBSE will not want to reduce chances of students to pass considering COVID-19 has made things a bit difficult. However, this Educart book is prepared keeping a medium difficulty level to prepare students fully for the upcoming new pattern paper.

3. When will CBSE provide datesheet for 2021 boards?

Exact dates for all subjects' exams is usually provided in the month of December of the ongoing academic session. Last year it came on 16th December 2019. Expect the same in the month of December and expect the exams start date to be later than March for the 2020-21 session.

4. How shall I prepare when there is not much time left?

When in shortage of time, less material to study from, is better. This can be done by focusing on only NCERT books (for theory) and our Educart sample papers for practice and nothing else. Educart Sample papers book is 100% designed on the upcoming 2021 paper to help you cover questions on all possible topics with detailed explanations.

5. What is the Pass Marks Cut-off and Criteria?

A candidate has to obtain a grade higher than E (i.e. atleast 33% marks) in all the five subjects of external examination in the main or at the compartmental examinations.

6. How do I access latest CBSE circulars and announcements?

You can always email us on quickreply@agpgroup.in for any update you want. As far as official source is concerned, refer: www.cbseacademic.nic.in/circulars.html.

7. What is the process of applying for a recheck of Marks in a particular subject?

Any student has the right to do so within a week from date of declaration of CBSE board exam result.

The whole process of verification of marks is done online. Steps to apply for verification/rechecking of the answer sheet, are as follows: Apply for rechecking of marks on the CBSE's website www.cbse.nic.in by filling in your details and paying Rs. 500 per subject online (only). The result of verification of marks will be uploaded on the website automatically.

Overall, the verification will be restricted to checking whether all the answers have been checked, there has been no mistake in totalling of marks for each question and the marks have been transferred correctly on the title page of the answer book. A candidate may also apply for obtaining a copy of the evaluated answer book(s) at a later stage if not satisfied with the evaluation

8. What is the best way to practice from this book to score good marks?

In order to crack the board exam, this book is custom made to start with Topper Tips and Time management. This includes an explanation of how to smartly structure your 3 hours during the paper.

Once, you have covered the basics, you can go through the exclusive CBSE last year Topper hand-written solutions and CBSE papers to get a feel of what is normally asked and how to answer them.

Then you start with our most likely 6 solved sample papers, where you time yourself to complete each paper and cross-check your performance with our detailed solutions.

Lastly, the unsolved papers help you self-assess without the temptation of looking at the back and fine-tune your preparation. These are solid papers that, if done well will fully prepare you to do well in the 2021 board exam.

9. Who should I reach out to for any issue related to examination, re-evaluation of copy or any serious matter?

Ideally your only point of contact should be your school and they will take action on your behalf by submitting a request to CBSE regional office. However, we have managed to source some useful contacts in CBSE. Please **refer to the next page** for more information.



IMPORTANT CBSE CONTACTS

Lots of students and parents face the problem of not knowing how best to contact CBSE for matters related to *Examination, admission fees, last-minute change of subject, direct admissions, passing criteria, examination centre related issue, unfair means or even re-evaluation of results* if not satisfactory. This list is not exhaustive.

We have compiled a comprehensive list of contacts of your nearest CBSE Regional Offices for various issues depending on the region you belong to. CBSE prefers any request to be sent to Regional Offices only and that also via the head of your school ideally. It is, therefore, advised to make the request accordingly through a proper channel for prompt and timely action.

Your School Location/Region	CBSE Regional Office (RO) Contact Details
General	Dr. Sanyam Bhardwaj (Controller of Examinations) sanyamb.cbse@nic.in 011-22515828 Dr. Joseph Emmanuel (Director (Academics)) directoracad.cbse.nic.in 011-23212603
Delhi, Foreign Schools	CBSE, PS-1-2, Institutional Area, I.P. Extn, Patparganj, Delhi - 110092 rodelhi.cbse@nic.in 91-11-22239177-80, 22235948, 22235904
Uttar Pradesh, Uttarakhand	CBSE, 35 B, Civil Station, M.G. Marg, Civil Lines, Allahabad - 211001 roallahabad.cbse@nic.in 91-532-2407970-72
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Rajasthan, Gujarat, M.P, Dadra and Nagar Haveli	CBSE, Todarmal Marg, Ajmer - 305001 rojmer.cbse@nic.in 91-145-2627460
Bihar and Jharkhand	CBSE, Ambika Complex, Behind State Bank Colony, Near Brahmsthan, Sheikhpura, Raza Bazar, Bailey Road, Patna-800014 ropatna.cbse@nic.in 91-612-2295048, 2295080
West Bengal, Orissa, Chhattisgarh	CBSE, 6 th Floor, Alok Bharti Complex, Shaheed Nagar, Bhubaneswar-751007 robhubaneshwa.cbse@nic.in 91-674-2542312

CBSE

SAMPLE PAPER

9th October 2020

BIOLOGY

Time Allowed: 3 Hours

Maximum Marks: 70

General Instructions:

- (i) All questions are compulsory.
- (ii) The question paper has four sections : Section A, Section B, Section C and Section D. There are 33 questions in the question paper.
- (iii) **Section A** has 14 questions of 1 mark each and 02 case-based questions. **Section B** has 9 questions of 2 marks each. **Section C** has 5 questions of 3 marks each and **Section D** has 3 questions of 5 marks each.
- (iv) There is no overall choice. However, an internal choice have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
- (v) Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION - A

22 marks

1. Why does endosperm development precede embryo development? 1
2. How many meiotic divisions are required to produce 76 seeds in a Guava fruit? 1
3. How does pollination take place in water hyacinth and water lily? 1
4. Name the glands that contribute to human seminal plasma. 1
5. A snapdragon plant with violet flowers was crossed with another such plant with white flowers. The F₁ progeny obtained had pink flowers. Explain, in brief, the inheritance pattern seen in offsprings of F₁ generation? 1
6. Differentiate between aneuploidy and polyploidy. 1
7. Predict the effect if, the codon UAU coding for an amino acid at the 25th position of a polypeptide of 50 amino acids, is mutated to UAA. 1
8. Differentiate between pro-insulin and mature insulin. 1
9. Name the commonly used vector for cloning genes into higher organisms. 1
10. Which of the three forests- Temperate, Mangroves and Tropical Evergreen is more vulnerable to invasion by outside animals and plants? 1



- 11. Assertion:** Primary transcripts in eukaryotes are nonfunctional.
Reason: Methyl guanosine triphosphate is attached to 5' – end of hnRNA.
- (a) Both assertion and reason are true, and reason is the correct explanation of assertion.
 - (b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
 - (c) Assertion is true but reason is false.
 - (d) Both assertion and reason are false.

OR

Assertion: An organism with lethal mutation may not even develop beyond the zygote stage.

Reason: All types of gene mutations are lethal.

- (a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.
- (b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
- (c) Assertion is true but reason is false.
- (d) Both assertion and reason are false.

1

- 12. Assertion:** *E. coli* having pBR322 with DNA insert at BamHI site cannot grow in medium containing tetracycline.

Reason: Recognition site for Bam HI is present in tet^R region of pBR322.

- (a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.
- (b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
- (c) Assertion is true but reason is false.
- (d) Both assertion and reason are false.

1

- 13. Assertion:** A community with more species is more stable than that with less species.

Reason: More the number of species, lesser the variation in the total biomass production year after year.

- (a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.
- (b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
- (c) Assertion is true but reason is false.
- (d) Both assertion and reason are false.

1

- 14. Assertion:** In *Ophrys* one petal of the flower bears an uncanny resemblance to the female bee.

Reason: Two closely related species competing for the same resource can coexist simultaneously.

- (a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.
- (b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
- (c) Assertion is true but reason is false.
- (d) Both assertion and reason are false.

1

- 15. Read the following passage and answer any four questions from 15(A) to 15(E) given below:**

1 × 4 = 4

Ecological Indicators

The presence of dragonflies can reveal changes in the water ecosystems more quickly than studying other animals or plants. In fact, from the nymph to the adult stage, the



dragonfly has a significant, positive ecological impact. Dragonfly eggs are laid and hatched in or near water, so their lives impact both water and land ecosystems. Once hatched, dragonfly nymphs can breathe underwater which enables them to eat mosquito larvae, other aquatic insects and worms, and even small aquatic vertebrates like tadpoles and small fish and in the air. Adult dragonflies capture and eat adult mosquitoes.

Community wide mosquito control programs that spray insecticides to kill adult mosquitoes also kill dragonflies.

- (A) The approach to biological control includes:
- (a) Import and release of an insect pest to a new area to provide hosts for natural enemies
 - (b) Import and release of natural enemies from the native home of an alien insect pest that has invaded a new area
 - (c) Preservation of natural enemies (predators & parasitoids) that are already established in an area
 - (d) Use of insecticides to reduce alien insect pests to establish new equilibrium position.
- (B) Two diseases less likely to occur in a region with plenty of dragonflies are
- (a) Yellow fever and amoebic dysentery
 - (b) Malaria and Yellow fever
 - (c) Anthrax and typhoid
 - (d) Cholera and typhoid
- (C) Dragonflies indicate positive ecological impact as:
- (a) The presence of dragonflies indicates polluted water.
 - (b) Dragonfly nymphs selectively eat mosquito larvae.
 - (c) They help to decrease the probability of diseases spread by vectors.
 - (d) Dragonfly do not cause any harm to beneficial species.
- (D) The most effective stages in the life cycle of dragonfly that eradicate mosquitoes are:
- (a) Larvae and Adult
 - (b) Caterpillar and Adult
 - (c) Nymph and Adult
 - (d) Pupa and Adult
- (E) **Assertion:** Releasing dragonflies in areas where there is an outbreak of malarial diseases can be an environment friendly method of control.
- Reason:** Dragon flies are dominant species and will not allow mosquitoes to reproduce
- (a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.
 - (b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
 - (c) Assertion is true but reason is false.
 - (d) Both assertion and reason are false

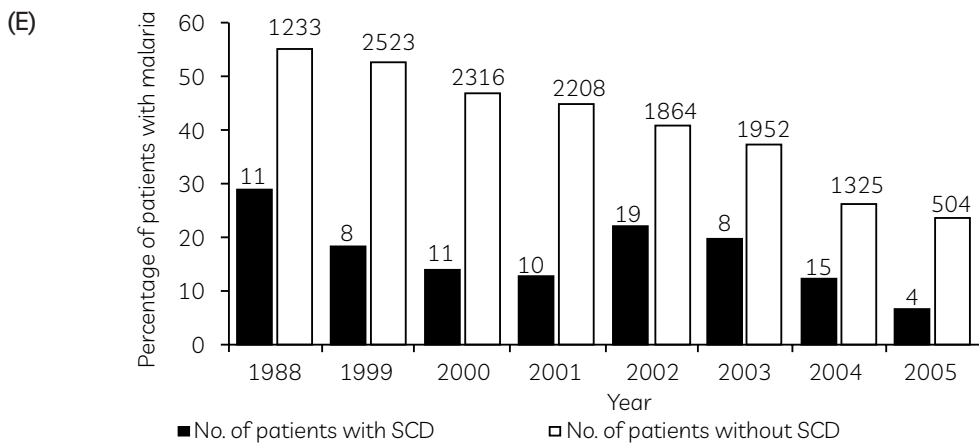
16. Read the following passage and answer any four questions from 16(A) to 16(E) given below:

1 × 4 = 4

Sickle cell anemia is a genetic disorder where the body produces an abnormal hemoglobin called hemoglobin S. Red blood cells are normally flexible and round, but when the hemoglobin is defective, blood cells take on a "sickle" or crescent shape. Sickle cell anemia is caused by mutations in a gene called HBB. It is an inherited blood disorder that occurs if both the maternal and paternal copies of the HBB gene are defective. In other words, if an individual receives just one copy of the defective HBB gene, either from mother or father, then the individual has no sickle cell anemia but has what is called "sickle cell trait". People with sickle cell trait usually do not have any symptoms or problems but they can pass the mutated gene onto their children. There are three inheritance scenarios that can lead to a child having sickle cell anemia:



- Both parents have sickle cell trait
 - One parent has sickle cell anemia and the other has sickle cell trait
 - Both parents have sickle cell anemia
- (A) Sickle cell anemia is a/an disease.
- (a) X linked (b) autosomal dominant
(c) autosomal recessive (d) Y linked
- (B) If both parents have sickle cell trait, then there is of the child having sickle cell anemia.
- (a) 25% risk (b) 50% risk
(c) 75% risk (d) No risk
- (C) If both parents have sickle cell trait, then there is of the child having sickle cell trait.
- (a) 25% risk (b) 50% risk
(c) 75% risk (d) No risk
- (D) If one parent has sickle cell anemia and the other has sickle cell trait, there is that their children will have sickle cell anemia and will have sickle cell trait.
- (a) 25% risk, 75% risk (b) 50% risk, 50% risk
(c) 75% risk, 25% risk (d) No risk



- The following statements are drawn as conclusions from the above data (Kenya).
- (I) Patients with SCD (Sickle Cell Disease) are less likely to be infected with malaria.
 - (II) Patients with SCD (Sickle Cell Disease) are more likely to be infected with malaria.
 - (III) Over the years the percentage of people infected with malaria has been decreasing.
 - (IV) Year 2000 saw the largest percentage difference between malaria patients with and without SCD.

- Choose from below the correct alternative.
- (a) only (I) is true (b) (I) and (IV) are true
(c) (III) and (II) are true (d) (I) and (III) are true

SECTION – B **18 marks**

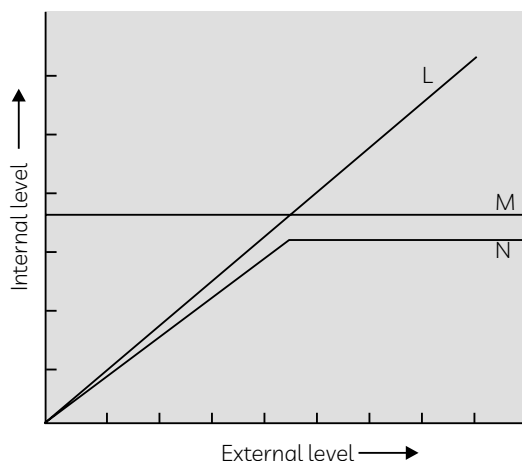
- 17.** State the composition and principle of oral pills as a contraceptive measure taking the example of Saheli. 2
- 18.** Karyotype of a child shows trisomy of chromosome number 21. Identify the disorder and state the symptoms which are likely to be exhibited in this case. 2

- 19.** Explain four advantages of mycorrhizal association to plants. 2
- 20.** Explain the method to increase the competency of the bacterial cell membrane to take up recombinant DNA? 2
- OR**
- What are bioreactors? How are large volumes of cultures maintained and processed in them? 2
- 21.** Explain the role of enzymes in the extraction of DNA from *Rhizopus* in its purest form. 2
- 22.** What are sticky ends? State their significance in recombination DNA technology. 2
- OR**
- Explain the procedure by which PCR aids in early detection of cancer. 2
- 23.** Explain how advanced ex-situ conservation techniques assist in preserving threatened species of plants and animals. 2
- 24.** Define interference competition. Give one example that supports competitive exclusion occurring in nature. 2
- 25.** The Tropical regions are likely to have more biological diversity than the Temperate ones. Give two reasons to justify the statement. 2

SECTION – C

15 marks

- 26.** A fully developed foetus initiates its delivery from the mother's womb. Justify the statement. 3
- 27.** How would you find out the genotype of a pea plant with violet flowers? Explain with the help of Punnett's square showing crosses. 3
- 28.** Define flocs and state their importance in biological treatment of waste water. 3
- 29.** A farmer noticed that nematode infection in tobacco plants has resulted in the reduction in the yield. Suggest a strategy which provides cellular defense for providing resistance to this pest. Explain the technique. 3
- 30.** The graph given below represents three categories of organismic responses - L, M and N to cope with stressful conditions. Identify the categories L and M.



Given below are examples of some of the activities performed by animals. Categorise these activities into the appropriate kind of the organismic response (L, M or N) as shown in the graph with reasons.



- (A) In summers we sweat profusely.
- (B) Sometimes desert lizards bask in the sun and sometimes they move into shade.

OR

Give reasons for the following:

- (A) Very small animals are rarely found in polar regions.
- (B) Mammals from colder climate generally have shorter ear and limbs.
- (C) Initially we feel nausea and fatigue when we reach a high altitude such as Rohtang Pass and then, gradually, we feel normal.

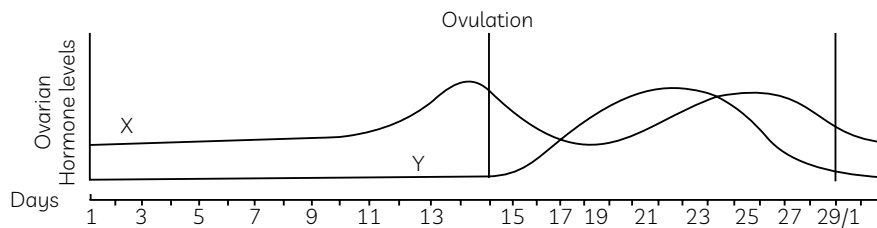
3

SECTION - D

15 marks

31. Study the graph given below related with menstrual cycle in females:

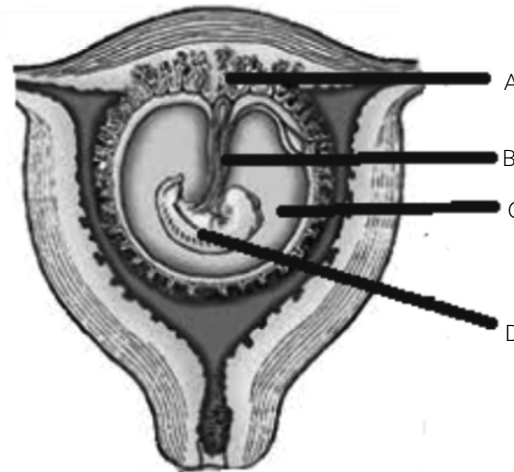
- (A) Identify ovarian hormones X and Y mentioned in the graph and specify their source.



- (B) Correlate and describe the uterine events that take place according to the ovarian hormone levels X and Y mentioned in the graph on:
 - (i) 6 – 15 days
 - (ii) 16 – 25 days
 - (iii) 26 – 28 days (when ovum is not fertilized)

OR

The following figure shows a foetus within the uterus. On the basis of the given figure, answer the questions that follow:



- (A) In the above figure, choose and name the correct part (A, B, C or D) that act as a temporary endocrine gland and substantiate your answer. Why is it also called the *functional junction*?
- (B) Mention the role of B in the development of the embryo.
- (C) Name the fluid surrounding the developing embryo. How is it misused for sex-determination?

5



- 32.** Evaluate the suitability of DNA and RNA as genetic material and justify the suitability of the one that is preferred as an ideal genetic material.

OR

Explain the mechanism of DNA replication as suggested by Watson and Crick.

5

- 33.** Identify and name the disease in which the patient's cells lose the property of contact inhibition. State its possible causes and explain any three methods to accurately detect the pathological and physiological changes that take place due to the disease in living tissues.

OR

A patient had tested positive to ELISA Test. Identify the disease and the pathogen responsible, give reasons for the reduced/ weak immunity of the patient and trace the path, spread and effects of this pathogen in the human body.

5



SOLUTION

WITH CBSE MARKING SCHEME

Note: The text in grey boxes are solutions given in the CBSE Marking Scheme 2020-2021.

SECTION - A

1. The cells of endosperm are filled with reserve food materials and are used for the nutrition of the developing embryo.

2. 95

Explanation: In angiosperms,

one meiotic division of Megaspore mother cell leads to the formation of one egg cell. So 76 egg cells are formed from 76 meiotic division. But one meiotic division of sperm mother cell leads to the formation of four haploid cells. So 76 functional gametes will be formed by $\frac{76}{4} = 19$.
So, total meiotic divisions required is $76 + 19 = 95$.



Related Theory

Megasporogenesis : The process of formation of megaspores from the megaspore mother cell is called megasporogenesis. Ovules generally differentiate a single megaspore mother cell (MMC). The MMC undergoes meiotic division. Meiosis results in the production of 4 megaspores. In a majority of flowering plants, 1 of the megaspores is functional while the other 3 degenerate. Only the functional megaspore develops into the female gametophyte (embryo sac). This method of embryo sac formation from a single megaspore is termed monosporic development.

3. In water hyacinth and water lily, the flowers emerge above the level of water and are pollinated by insects or wind as in most of the land plants.

Explanation: Wind or Animals transfer the pollen grains amongst flowers in case of the Water hyacinth and Water lily.



Related Theory

Transfer of pollen grains from the anther to the stigma of a pistil is known termed as pollination.

4. Prostate, Seminal vesicle and Bulbourethral gland. (any two)



Related Theory

Seminal plasma is rich in fructose, Calcium and several enzymes. Secretions of bulbourethral glands also provide penis lubrication.

5. The inheritance is incomplete dominance. In this, a new intermediate phenotype between the two original phenotypes is obtained. One allele for a specific trait is not completely expressed over the other allele for the same trait.

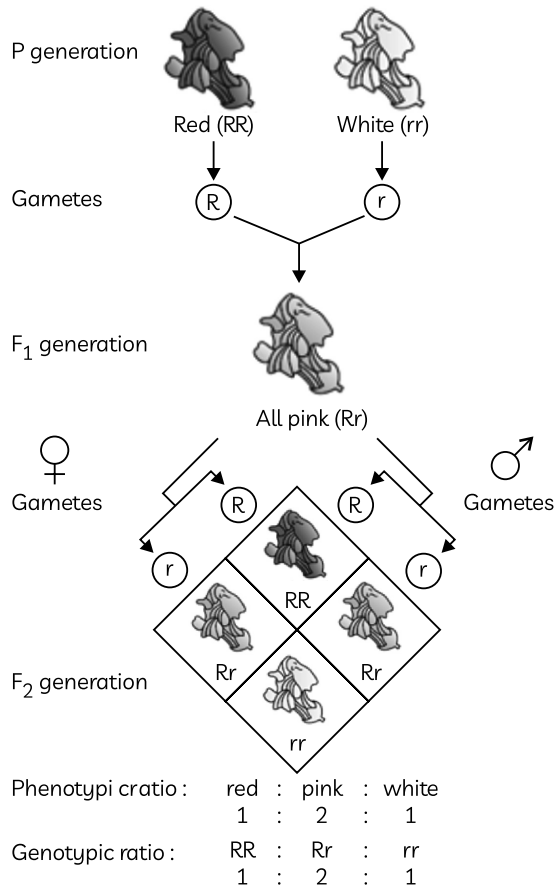
Explanation: The results of a monohybrid cross in the dog flower or snapdragon. When red flower RR and white flower plants rr, were crossed, the F_1 (Rr) Was pink. When the F_1 was self-pollinated the F_2 resulted in the following ratio- 1 (RR) Red: 2 (Rr) Pink: 1 (rr) White. Here, the phenotype ratio is changed from 3:1 dominant : recessive. It shows that R was not completely dominant over r.





Related Theory

Example:



- Aneuploidy is chromosomal abnormality in which one or more chromosomes are gained or lost. Polyploidy is when an entire extra set of chromosomes is added. (It may be triploid or tetraploid.)
- A polypeptide of 24 amino acids will be formed as UAA is a stop codon which will prevent further translation.



Related Theory

UAA, UAG, UGA are stop or terminator codons.

- Pro-insulin contains an extra stretch called the C peptide which is not present in the mature insulin.

Explanation: Insulin consists of two short polypeptide chains: chain A and chain B, These are linked together by disulphide bridges. In mammals, including humans, insulin is synthesised as a pro-hormone (like a pro-enzyme, the pro-hormone also needs to be processed before it becomes a fully mature and functional hormone) which contains an extra stretch called the C peptide. This C peptide is not present in the mature insulin and is removed during maturation into insulin.



9. Retrovirus/ Adenoviruses/Papilloma virus/Cauliflower mosaic virus/Tobacco mosaic virus virus these are some commonly used vectors which are used for cloning genes into higher organisms

10. Tropical Evergreen Forests

Explanation: The tropical forests are immensely rich in flora and fauna. They provide all the necessary requirements for survival in bulk to the organisms. Hence, an invasive species can easily multiply and become a threat to the native species in these forests.

11. (b) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

Explanation: The primary transcripts contain both the exons and the introns and are non-functional. Hence, it is subjected to a process called splicing where the introns are removed and exons are joined in a defined order. That explains why the primary transcripts are non-functional.

Also, hnRNA undergoes additional processing called as capping and tailing. In capping an unusual nucleotide (methyl guanosine triphosphate) is added to the 5' -end of hnRNA. In tailing, adenylate residues (200-300) are added at 3' -end in a template independent manner. It is the fully processed hnRNA, now called mRNA, that is transported out of the nucleus for translation.



Related Theory

In eukaryotes, the monocistronic structural genes have interrupted coding sequences – the genes in eukaryotes are split. The coding sequences or expressed sequences are defined as exons. Exons are said to be those sequence that appear in mature or processed RNA. The exons are interrupted by introns. Introns or intervening sequences do not appear in mature or processed RNA.

OR

(c) Assertion is true statement but reason is false.

Explanation: Mutation is a phenomenon which results in alteration of DNA sequences and consequently results in changes in the genotype and the phenotype of an organism. In addition to recombination, mutation is another phenomenon that leads to variation in DNA.

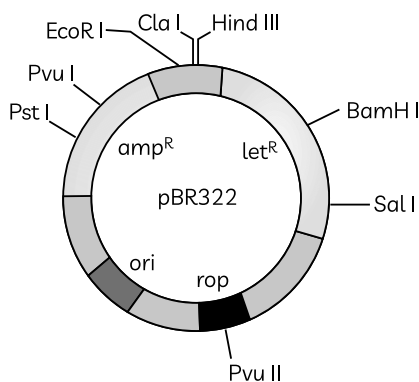
A lot of mutations can cause the organism to not develop even beyond the zygote stage. But all genetic mutations are not lethal. Some of them may not even have any effect on the organism's life, while some can make him dysfunctional on a lot of parameters.



Related Theory

DNA helix runs continuously from one end to the other in each chromatid, in a highly supercoiled form. Therefore, loss (deletions) or gain (insertion or duplication) of a segment of DNA, results in alteration in chromosomes. Since genes are known to be located on chromosomes, alteration in chromosomes results in abnormalities or aberrations. Chromosomal aberrations are commonly observed in cancer cells. In addition to the above, mutation also arise due to change in a single base pair of DNA. This is known as point mutation. A classic example of such a mutation is sickle cell anemia. Deletions and insertions of base pairs of DNA, causes frame-shift mutations.

12. (a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.



Explanation: In the above diagram, you can see the various recognition sites in p^{BR322} along with site for BamHI in the region for tet^R resistance. p^{BR322} has recognition sites for several commonly used restriction enzymes. Recognition site for BamHI is present in tet^R region i.e., region responsible for tetracycline resistance. When an insert is added at the BamHI recognition site the gene for tetracycline resistance becomes non-functional and the recombinant bacteria with plasmid p^{BR322} that has DNA insert at BamHI lose tetracycline resistance.

13. (a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.

Explanation: A stable community should not show too much variation in productivity from year to year; it must be either resistant or resilient to occasional disturbances (natural or man-made). David Tilman's long-term ecosystem experiments using outdoor plots attested weight to the aforementioned argument. Tilman found that plots with more species showed less year-to-year variation in total biomass. He also showed that in his experiments, increased diversity contributed to higher productivity.



Related Theory

Paul Ehrlich's rivet popper hypothesis also lent weight to the link between species richness and ecosystem stability. He proposed-

Let's suppose that in an airplane (ecosystem) all parts are joined together using thousands of rivets (species). If every passenger travelling in it starts popping a rivet to take home (causing a species to become extinct), it may not affect flight safety (proper functioning of the ecosystem) initially, but as more and more rivets are removed, the plane becomes dangerously weak over a period of time. Furthermore, which rivet is removed may also be critical. Loss of rivets on the wings (key species that drive major ecosystem functions) is obviously a more serious threat to flight safety than loss of a few rivets on the seats or windows inside the plane.

14. (c) Assertion is true statement, but reason is false.

Explanation: Here, the co-evolution of the *Ophrys* with a bee species has nothing to do with the competition for the same resource.

Actually, the orchid *Ophrys* employs 'sexual deceit' to get pollination done by a species of bee. One petal of its flower bears an uncanny resemblance to the female of the bee. The male bee is attracted to what it perceives as a female, 'pseudocopulates' with the flower, and during that process is dusted with pollen from the flower. When this same bee 'pseudocopulates' with another flower, it transfers pollen to it and thus, pollinates the flower.

Two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated eventually.



Related Theory

MacArthur showed that five closely related species of warblers living on the same tree were able to avoid competition and co-exist due to behavioural differences in their foraging activities.

15. Ecological Indicators (Any four)

(A) (c) Preservation of natural enemies (predators & parasitoids) that are already established in an area.

Explanation: Dragonfly eggs, once hatched, gives rise to dragonfly nymphs who can breathe underwater enabling them to eat mosquito larvae, other aquatic insects and worms, and even small aquatic vertebrates like tadpoles and small fish. Adult dragonflies capture and eat adult mosquitoes. So, the pests are being killed by conserving or introducing their natural enemies.

Chemical control or Insecticides can kill them both, along with the introduction of unwanted chemicals into the ecosystem.

(B) (b) Malaria and Yellow fever

Explanation: Dragonflies and their larva proliferate by feeding on the causative agents of these diseases.



(C) (c) They help to decrease the probability of diseases spread by mosquitoes, horseflies and deer flies (vectors).

Explanation: Dragonfly nymphs can breathe underwater enabling them to eat mosquito larvae, other aquatic insects and worms, and even small aquatic vertebrates like tadpoles and small fish. Adult dragonflies capture and eat adult mosquitoes. So, the pests are being killed by conserving or introducing their natural enemies. Hence, they reduce the diseases spread through these vectors

(D) (c) Nymph and Adult

Explanation: Dragonfly nymphs can breathe underwater enabling them to eat mosquito larvae, other aquatic insects and worms, and even small aquatic vertebrates like tadpoles and small fish. Adult dragonflies capture and eat adult mosquitoes.

(E) (a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.

Explanation: Dragonfly nymphs and adults can consume mosquito larvae, adults can consume mosquitoes. Thus, they will definitely impact the reproduction probabilities of the mosquito species, preventing their proliferation.

16. Sickle cell anemia (Any four)

(A) (c) autosomal recessive

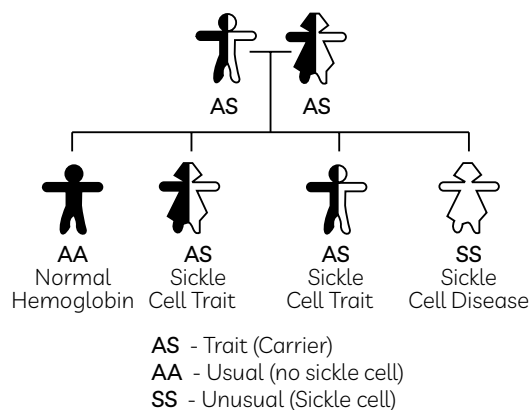
Explanation: An autosomal recessive disorder means two copies of an abnormal gene must be present in order for the disease or trait to develop. "Autosomal" means that the gene discussed in question is located on one of the non-sex chromosomes.



Related Theory

Sickle-cell anemia is an autosomal linked recessive trait that can be transmitted from parents to the offspring when both the partners are carrier for the gene (or heterozygous). This disease is controlled by a single pair of allele, Hb^A and Hb^S . Out of the three possible genotypes only homozygous individuals for Hb^S ($Hb^S Hb^S$) show the diseased phenotype. Heterozygous ($Hb^A Hb^S$) individuals appear apparently unaffected but they are carrier of the disease as there is 50 per cent probability of transmission of the mutant gene to the progeny, thus exhibiting sickle-cell trait.

(B) (a) 25 % risk



Explanation: If both parents have sickle cell trait ($HbAS$) there is a one in four (25%) chance that any given child could be born with sickle cell anemia.

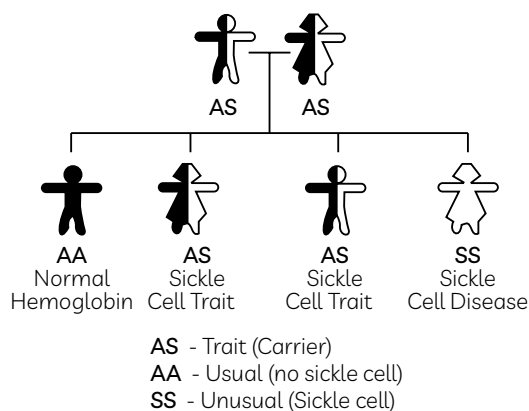


Related Theory

- Following scenarios can be possible-
- (1) Sickle Cell Trait and Unaffected
 - (2) Sickle Cell Trait and Sickle Cell Trait
 - (3) Sickle Cell Trait and Sickle Cell Anaemia
 - (4) Sickle Cell Anaemia and Unaffected



(C) (b) 50 % risk



Explanation: There is a one in two (50%) chance that any given child will get the sickle cell trait.

(D) (b) 50 % risk, 50% risk

Explanation: If one parent has sickle cell trait (HbAS) and the other has sickle cell anaemia (HbSS) there is a 1 in 2, (50%) chance that any child will get the sickle cell trait and a 1 in 2 (50% chance that any child will get sickle cell anaemia. No unaffected progenies would be possible.

(E) (d) I and III are true

Explanation: With the progress in medical sciences and availability of drugs for treatment, there has been a decrease in the percentage of people infected with malaria over the years. Though the exact mechanism with which people with sickle cell anemia get protection from Malaria, its proven that malaria doesn't have any adverse impact on people with SCA (Sickle cell anemia).



Related Theory

Sickle cell anemia results in abnormal hemoglobin, giving the blood cell a rigid, sticky, sickle-like shape that hinders its oxygen-binding properties. These irregularly shaped cells can get stuck in small blood vessels, which can slow or block blood flow and oxygen to parts of the body. A blood and bone marrow transplant is currently the only cure for sickle cell disease, but only a small number of patients are eligible.

SECTION - B

- 17.** The composition of oral pills comprises: Either progesterone alone or progesterone- estrogen combination

Saheli is a Non-steroidal preparation. It inhibits ovulation and implantation. It also alters the quality of cervical mucus to prevent/ retard the entry of sperms.

- 18. Disorder:** Down's Syndrome

Symptoms: The affected individual is short statured with small round head; has furrowed tongue; partially open mouth; Palm is broad with characteristic palm crease; Physical, psychomotor and mental development is retarded.

(any three symptoms)



Related Theory

The cause of Down's syndrome is the presence of an additional copy of the chromosome number 21 (trisomy of 21). This disorder was first described by Langdon Down (1866).

- 19.** The fungal symbiont in mycorrhizal associations with plants:

- (1) absorbs phosphorus from soil and passes it to the plant.
- (2) provides resistance to root-borne pathogens,



- (3) enhances tolerance to salinity and drought,
- (4) induces an overall increase in plant growth and development.

- 20.** The Recombinant DNA can be forced into the bacterial cell treated with divalent cations and incubating it with recombinant DNA on ice. This is to be followed by placing it briefly at 42°C (heat shock), and then putting it back on ice. This process would enable the bacteria to take up the recombinant DNA.



Related Theory

There are more ways to introduce alien DNA into host cells. In a method known as micro-injection, recombinant DNA is directly injected into the nucleus of an animal cell. In another method for plants, cells are bombarded with high velocity micro-particles of gold or tungsten coated with DNA in a method known as biolistic or gene gun. And the last method uses 'disarmed pathogen' vectors, which when allowed infecting the cell, transferring the recombinant DNA into the host.

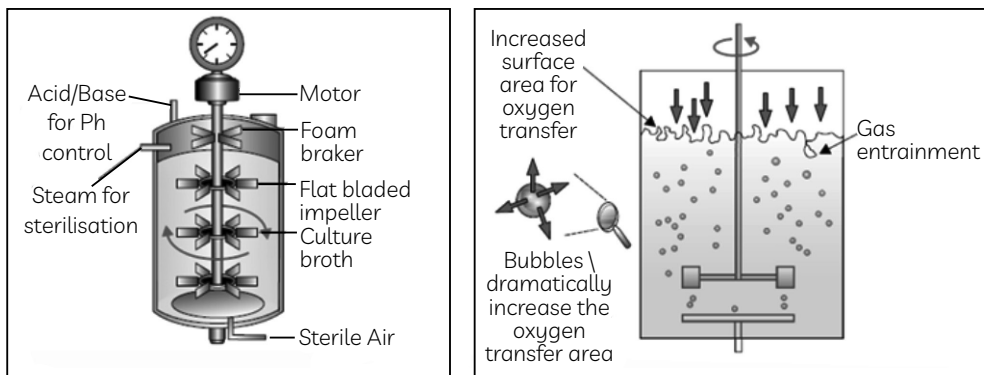
OR

Bioreactors are vessels in which raw materials are biologically converted into specific products such as enzymes using microbial, plant, animal or human cells. A bioreactor provides the optimal conditions for achieving the desired product by providing optimum growth conditions like temperature, pH, substrate, salts, vitamins and oxygen



Related Theory

Commonly used bioreactors- (a) Simple stirred-tank bioreactor; (b) Sparged stirred-tank bioreactor through which sterile air bubbles are sparged.



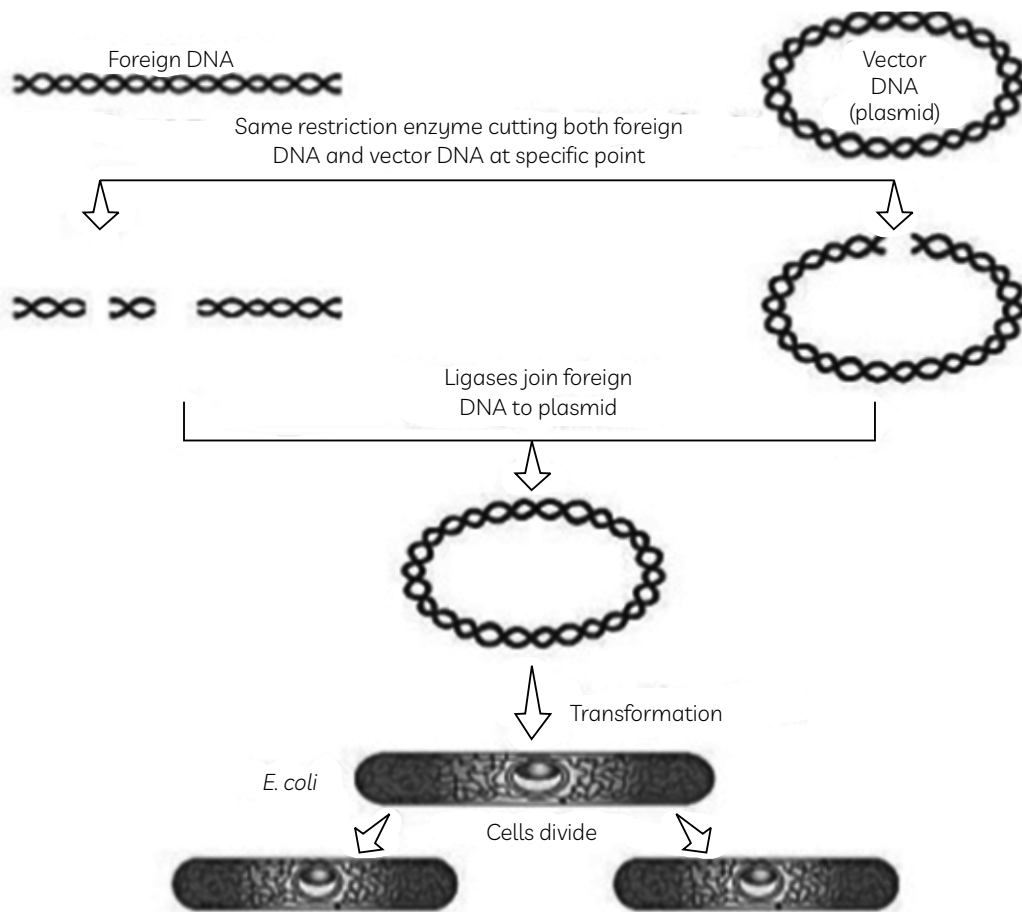
- 21.** The extraction of DNA from *Rhizopus* in its purest form can be done by treating the fungal cells with enzymes such as Chitinase which will dissolve the cell wall. The RNA can be removed by treatment with ribonuclease whereas proteins can be removed by treatment with protease. Other molecules can be removed by appropriate treatments thereby purifying DNA.

- 22.**
- (1) Restriction enzymes cut the strand of DNA a little away from the centre of the palindrome sites, but between the same two bases on the opposite strands. This leaves single stranded portions at the ends. These overhanging stretches on each strand are called sticky ends.
 - (2) They form hydrogen bonds with their complimentary counterparts and facilitate the action of DNA ligase enzyme.



Related Theory

When cut by the same restriction enzyme, the resultant DNA fragments have the same kind of 'sticky-ends' and, these can be joined together (end-to-end) using DNA ligases.
Diagrammatic representation of the recombinant DNA technique-



OR

- (1) A single stranded DNA or RNA is tagged with a radioactive molecule (probe)
 - (2) It is allowed to hybridize to its complementary DNA in a clone of cells followed by detection using autoradiography.
 - (3) The clone having the mutated gene will hence not appear on the photographic film,
 - (4) because the probe will not have complementarity with the mutated gene.
- Hence, cancer induced mutation can be detected.

- 23.** (1) Advanced techniques are being used now for *ex situ* conservation. Gametes of threatened species can be preserved in viable and fertile condition for long periods using cryopreservation techniques. Eggs can, thus, be fertilized *in vitro*.
- (2) In plants, the explants can be propagated using tissue culture methods and can be kept for long periods in seed banks.



Related Theory

Seeds of different genetic strains of commercially important plants can be kept for long periods in seed banks.

- 24.** Interference competition is the feeding efficiency of one species which might be reduced due to the interfering and inhibitory presence of the other species, even if resources (food and space) are abundant. Examples that support competitive exclusion occurring in nature are:
- (1) The Abingdon tortoise became extinct within a decade after goats were introduced on the island, apparently due to the greater browsing efficiency of the goats.



- (2) The larger and competitively superior barnacle *Balanus* dominates the intertidal area and excludes the smaller barnacle *Chathamalus* from that zone. (any 1 example)

25. Some possible reasons are:

- (1) Speciation is generally a function of time, unlike temperate regions subjected to frequent glaciations in the past, tropical latitudes have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification.
- (2) Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity.
- (3) There is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity.

(Any two reasons)

SECTION - C

26. (1) The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex.
- (2) This triggers the release of oxytocin from the maternal pituitary.
- (3) Oxytocin acts on the uterine muscle and causes stronger uterine contractions, which in turn stimulates further secretion of oxytocin.
- (4) The stimulatory reflex between the uterine contraction and oxytocin secretion continues resulting in stronger and stronger contractions.
- (5) Parturition is induced by a complex neuroendocrine mechanism involving cortisol, oestrogens and oxytocin.
- (6) This leads to expulsion of the baby out of the uterus through the birth canal – parturition.



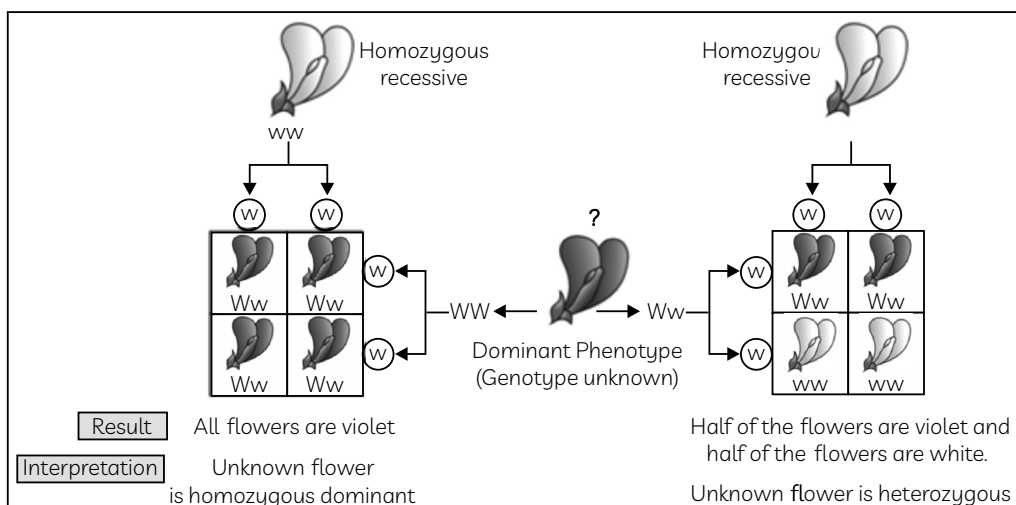
Related Theory

The average duration of human pregnancy is about 9 months which is called the gestation period. Soon after the infant is delivered, the placenta is also expelled out of the uterus.

Mammary glands differentiate during pregnancy and secrete milk after child-birth. The new-born baby is fed milk by the mother (lactation) during the initial few months of growth.

The placenta facilitates the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory or waste materials produced by the embryo. The placenta is connected to the embryo through an umbilical cord which helps in the transport of substances to and from the embryo. Placenta also acts as an endocrine tissue and produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogen, progesterone, etc.

27. We will perform a test cross in which the 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. The results of genotype through a test cross where violet colour flower (W) is dominant over white colour flower (w) is shown below:





Related Theory

The genotypic ratios can be calculated using mathematical probability, by simply looking at the phenotype of a dominant trait, but it is not possible to know the genotypic composition. That is, for example, whether 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. He called it a test cross.

28. (1) Flocs are masses of semi-decayed organic matter along with decomposer microbes which are surrounded by slime. They separate the organic matter from waste water.
- (2) Flocs settle down in secondary tanks and take part in the formation of sludge.
- (3) They can be used as inoculum in biological treatment of waste water as well as source of biogas and manure.



Related Theory

Flocs are masses of bacteria associated with fungal filaments to form mesh like structures. Secondary treatment of the sewage involves the primary effluent being passed into large aeration tanks where it is constantly agitated mechanically and air is pumped into it. This allows vigorous growth of useful aerobic microbes into flocs. While growing, these microbes consume the major part of the organic matter in the effluent. This significantly reduces the BOD (biochemical oxygen demand) of the effluent. BOD refers to the amount of the oxygen that would be consumed if all the organic matter in one liter of water were oxidised by bacteria. The sewage water is treated till the BOD is reduced.

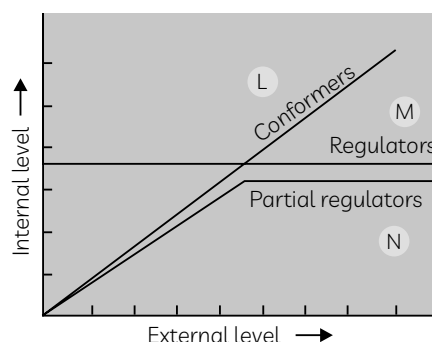
29. (1) Strategy based on the process of RNA interference (RNAi) - as a method of cellular defence can be used.
- (2) This method involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA (silencing).
- (3) The source of this complementary RNA can be from an infection by viruses having RNA genomes or mobile genetic elements (transposons) that replicate via an RNA intermediate.
- (4) Using *Agrobacterium* vectors, nematode-specific genes are introduced into the host plant. The introduction of DNA produces both sense and anti-sense RNA in the host cells.
- (5) Two RNA's being complementary to each other form a double stranded (dsRNA) that initiate RNAi and thus, silence the specific mRNA of the nematode.
- (6) As a consequence, the parasite cannot survive in a transgenic host expressing specific interfering RNA. The transgenic plant therefore gets protected from the parasite.



Related Theory

Nematodes parasites a wide variety of plants and animals including human beings. A nematode *Meloidogyne incognita* infects the roots of tobacco plants and causes a great reduction in yield. A novel strategy was adopted to prevent this infestation which was based on the process of RNA interference (RNAi). RNAi takes place in all eukaryotic organisms as a method of cellular defence. This method involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA (silencing). The source of this complementary RNA could be from an infection by viruses having RNA genomes or mobile genetic elements (transposons) that replicate via an RNA intermediate.

30. L: Conformers,
M: Regulators
- (A) To regulate the body temperature - M/Regulators
- (B) To keep their body temperature constant by behavioural response for coping with variations in environment - L/Conformers





Related Theory

Conformer: An overwhelming majority (99 per cent) of animals and nearly all plants cannot maintain a constant internal environment. Their body temperature changes with the ambient temperature. These animals and plants are simply conformers.

Regulator: Some organisms are able to maintain homeostasis by physiological (sometimes behavioural also) means which ensures constant body temperature, constant osmotic concentration, etc. All birds and mammals, and a very few lower vertebrate and invertebrate species are indeed capable of such regulation (thermoregulation and osmoregulation).

In summer, temperature of the outside is more than our body temperature, we sweat profusely. The resulting evaporative cooling, similar to what happens with a desert cooler in operation, brings down the body temperature. In winter when the temperature is much lower than 37°C, we start to shiver, a kind of exercise which produces heat and raises the body temperature.

OR

- (A) Since small animals have a larger surface area relative to their volume, they tend to lose body heat very fast when it is cold outside; then they have to expend much energy to generate body heat through metabolism. This is the main reason why very small animals are rarely found in polar regions.
- (B) Mammals from colder climates generally have shorter ears and limbs to minimise heat loss. (This is called the *Allen's Rule*.)
- (C) This is because in the low atmospheric pressure of high altitudes, the body does not get enough oxygen. But gradually we get acclimatised and stop experiencing altitude sickness.



Related Theory

Altitude sickness, because in the low atmospheric pressure of high-altitude, the body does not get enough oxygen. But gradually a person can get acclimatised and then he or she will stop facing this problem. The body compensates low oxygen availability by increasing red blood cell production, decreasing the binding affinity of haemoglobin and by increasing the breathing rate.

SECTION – D

31. (A) X- Estrogen secreted by growing follicles;
Y – Progesterone secreted by corpus luteum.
- (B) Uterine events that take place according to the ovarian hormone levels X and Y on -
- (i) 6 – 15 days: Endometrium of the uterus regenerates by proliferation under the influence of estrogen.
 - (ii) 16 – 25 days: Under the influence of Progesterone the endometrium of the uterus is maintained for implantation of fertilised ovum and other events of pregnancy.
 - (iii) 26 – 28 days (when ovum is not fertilized): in the absence of fertilisation, corpus luteum degenerates which causes disintegration of endometrium leading to menstruation, marking a new cycle.



Related Theory

The cycle starts with the menstrual phase, when menstrual flow occurs and it lasts for 3-5 days. The menstrual flow results due to breakdown of endometrial lining of the uterus and its blood vessels which forms liquid that comes out through vagina. Menstruation only occurs if the released ovum is not fertilised. Lack of menstruation may be indicative of pregnancy.

The menstrual phase is followed by the follicular phase during which, the primary follicles in the ovary grow to become a fully mature Graafian follicle and simultaneously the endometrium of uterus regenerates through proliferation. These changes in the ovary and the uterus are induced by changes in the levels of pituitary and ovarian hormones. Both LH and FSH attain a peak level in the middle of cycle which happens around the 14th day. Rapid secretion of LH leading to its maximum level during the mid-cycle called LH surge induces rupture of Graafian follicle. It leads to the release of ovum (ovulation). The increase in LH levels around 14th day is also known as the LH surge. After ovulation, the anterior pituitary gland stops producing FSH but continues to release LH, which leads to the conversion of the ruptured follicle into a corpus luteum. The release of Progesterone is essential for endometrial maintenance. The estrogens and progesterone released from the corpus luteum prepare the reproductive organs for pregnancy and stimulate the endometrium to become soft and thick.



OR

- (A) Part labeled A -Placenta. It acts as an endocrine tissue as it produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogens, progestogens, etc. It is also called the *functional junction* because it facilitates the supply of oxygen and nutrients to the embryo and removes carbon dioxide and excretory/waste materials produced by the embryo.
- (B) The placenta is connected to the embryo through an umbilical cord which helps in the transport of substances to and from the embryo.
- (C) Amniotic fluid; a foetal sex determination test is based on the chromosomal pattern of the cells in the amniotic fluid surrounding the developing embryo.

32. Evaluation of DNA and RNA on the basis of the properties of the genetic material:

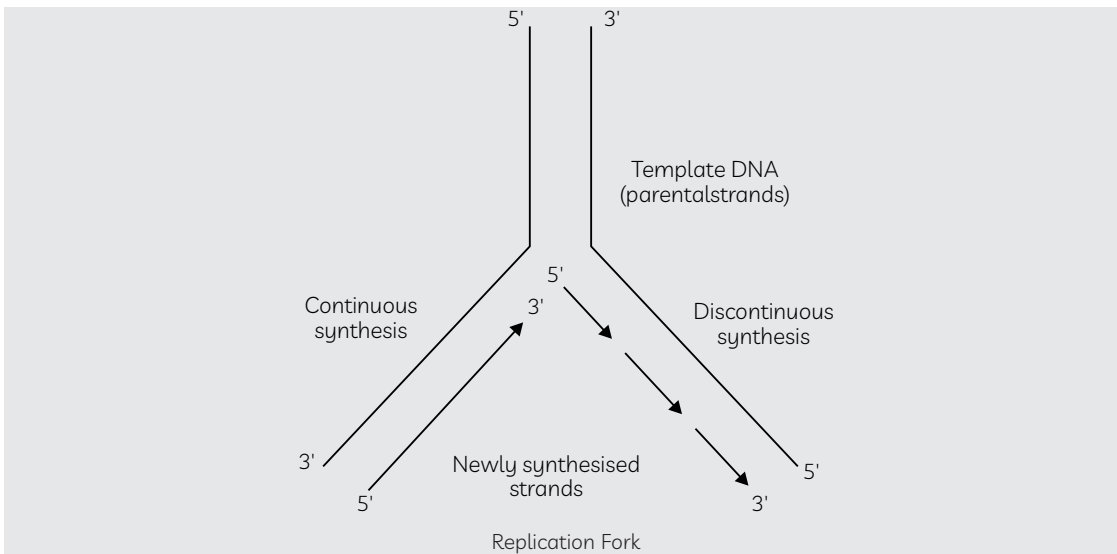
- (1) It should be able to generate its replica (Replication): As per the rule of base pairing and complementarity, both the nucleic acids (DNA and RNA) have the ability to direct their duplications.
- (2) The genetic material should be chemically and structurally stable enough not to change with different stages of life cycle, age or with change in physiology of the organism.
Presence of 2'-OH group and uracil make RNA more reactive and structurally less stable than DNA. Therefore, DNA is a better genetic material than RNA.
- (3) It should provide the scope for slow changes (mutation) that are required for evolution: Both DNA and RNA are able to mutate. In fact, RNA being unstable, mutates at a faster rate. Consequently, viruses having RNA genome and having shorter life span mutate and evolve faster.
- (4) It should be able to express itself in the form of 'Mendelian Characters': RNA can directly code for the synthesis of proteins, hence can easily express the characters. DNA, however, is dependent on RNA for synthesis of proteins. The protein synthesising machinery has evolved around RNA.
- (5) The above discussion indicates that both RNA and DNA can function as genetic material, but DNA being more stable is preferred for storage of genetic information

OR

Mechanism of Replication of DNA suggested by Watson and Crick

- (1) The two strands of DNA would separate and act as a template for the synthesis of new complementary strands. After the completion of replication, each DNA molecule would have one parental and one newly synthesised strand. This scheme was termed as semiconservative replication of DNA.
- (2) In living cells, such as *E. coli*, the process of replication requires a set of catalysts (enzymes). The main enzyme is referred to as DNA-dependent DNA polymerase, since it uses a DNA template to catalyse the polymerisation of deoxynucleotides.
- (3) Furthermore, energetically replication is a very expensive process. Deoxyribonucleoside triphosphates serve dual purposes. In addition to acting as substrates, they provide energy for polymerisation reaction.
- (4) For long DNA molecules, since the two strands of DNA cannot be separated in its entire length (due to very high energy requirement), the replication occurs within a small opening of the DNA helix, referred to as replication fork.
- (5) The DNA-dependent DNA polymerases catalyse polymerisation only in one direction, that is $5' \longrightarrow 3'$.
- (6) Consequently, on one strand (the template with polarity $3' \rightarrow 5'$), the replication is continuous, while on the other (the template with polarity $5' \rightarrow 3'$), it is discontinuous. The discontinuously synthesised fragments are later joined by the enzyme DNA ligase.



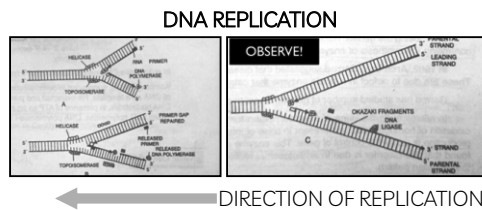


- (7) The DNA polymerases on their own cannot initiate the process of replication.
- (8) There is a definite region in *E. coli* DNA where the replication originates, such regions are termed as origin of replication.
- (9) In eukaryotes, the replication of DNA takes place at S-phase of the cell- cycle.
- (10) The replication of DNA and cell - division cycle should be highly coordinated. A failure in cell division after DNA replication results into polyploidy.



Related Theory

DNA replication requires the parental double helix in an unwound stage to make its internal bases available for replication. This is done by the enzyme HELICASE. Unwinding of DNA results in formation of a Y-SHAPED replication fork.



- ➔ PRIMASE carries out the formation of the PRIMER strand. Once the primer is formed, DNA replication happens in 5'→3' direction. During synthesis of a new strand, deoxyribonucleotides are added only to the 3'OH end. The exposed single strands are stabilised by SSB or the SINGLE STRAND BINDING PROTEIN. The SSB's hold open the strands to form replication fork.
- ➔ Single strand binding proteins (SSB's stabilise the DNA strands to form the replication fork. During DNA replication, synthesis of one of the daughter strand along the lower parental strand takes place in the form of short pieces. This strand is called the lagging strand and the short pieces of DNA fragments synthesised here are called the Okazaki fragments. DNA LIGASE joins the Okazaki fragments in the lagging strand.

33. Disease: Cancer

Probable Causes:

Physical/ Environmental- Exposure to X-rays/gamma rays/UV rays;

Chemicals/Nicotine in tobacco/other carcinogens

Biological- Viral oncogenes/Mutations

Detection and diagnosis:

- (1) Cancer detection is based on biopsy and histopathological studies of the tissue; blood and bone marrow tests for increased cell counts in the case of leukemias. In biopsy, a piece of the suspected tissue cut into thin sections is stained and examined under microscope (histopathological studies) by a pathologist.



- (2) Techniques like radiography (use of X-rays), CT (computed tomography) and MRI (magnetic resonance imaging) are very useful to detect cancers of the internal organs. Computed tomography uses X-rays to generate a three-dimensional image of the internal of an object. MRI uses strong magnetic fields and non-ionising radiations to accurately detect pathological and physiological changes in the living tissue.
 - (3) Antibodies against cancer-specific antigens are also used for detection of certain cancers.
 - (4) Techniques of molecular biology can be applied to detect genes in individuals with inherited susceptibility to certain cancers.
- (any three methods)



Related Theory

Contact inhibition: Normal cells have a property called contact inhibition. In this property the uncontrolled growth of cancerous cells is restricted as a result of contact with other normal cells.

Due to the loss of contact inhibition, cancerous cells continue to divide giving rise to tumors. Tumors are of two types: benign and malignant.

Benign tumors normally remain confined to their original location and do not spread to other parts of the body and cause little damage.

Malignant tumors are a mass of proliferating cells.

These cells grow very rapidly, invading and damaging the surrounding normal tissues. They also starve the normal cells by competing for vital nutrients. Cells sloughed from such tumors reach distant sites through blood, and wherever they get lodged in the body, they start a new tumor there. This property called metastasis is the most feared property of malignant tumors.

Causes of cancer: Transformation of normal cells maybe induced by carcinogens. Ionising radiations like X-rays, gamma rays and non-ionising radiations like leading to neoplastic transformation of cells. The chemicals present in tobacco smoke can also cause cancer. Cancer causing viruses are called oncogenic viruses can also cause cancer. Also there are certain cellular oncogenes in the normal cells which can get activated under certain conditions leading to oncogenic transformation of normal cells.

Treatment: Radiation therapy, surgery, immunotherapy can help in treating cancer. Several chemotherapeutic drugs can kill cancerous cells. Tumour cells generally go undetected by the immune system. But if we use biological response modifiers like alpha interferon who can activate the immune system against tumour causing cells, we can fight cancer.

OR

Disease: AIDS (Acquired ImmunoDeficiency Syndrome)

Pathogen: Human Immuno deficiency virus (HIV).

Reason:

Due to decrease in the number of helper T lymphocytes, the person starts suffering from infections that could have been otherwise overcome such as those due to bacteria especially *Mycobacterium*, viruses, fungi and even parasites like *Toxoplasma*.

The *path* of this pathogen and its *spread and effect* on the human body:

- (1) After getting into the body of the person, the virus enters into macrophages where RNA genome of the virus replicates to form viral DNA with the help of the enzyme reverse transcriptase.
- (2) This viral DNA gets incorporated into host cell's DNA and directs the infected cells to produce virus particles.
- (3) The macrophages continue to produce virus and in this way acts like a HIV factory.
- (4) Simultaneously, HIV enters into helper T-lymphocytes (TH), replicates and produce progeny viruses.
- (5) The progeny viruses released in the blood attack other helper T-lymphocytes. This is repeated leading to a progressive decrease in the number of helper T lymphocytes in the body of the infected person.
- (6) During this period, the person suffers from bouts of fever, diarrhoea and weight loss.



Related Theory

AIDS means Acquired Immuno deficiency syndrome. It is caused by the human immuno deficiency virus or HIV. HIV virus is a member of a group of viruses called retrovirus. The transmission of HIV infection can happen if there is a sexual contact with infected person, by transfusion of contaminated blood and blood products, by sharing infected needles, from the infected mother to her child through the Placenta. HIV/AIDS spreads only through body fluids.



There is always a time-lag between the infection and appearance of AIDS symptoms. This period may vary from a few months to many years (usually 5-10 years).

The primary and secondary responses are carried out with the help of special type of lymphocytes present in our blood. B-lymphocytes produce an army of proteins in response to pathogens in our blood to fight with them. These proteins are called antibodies. T cells help in producing antibodies. Hence, both sides of B AND T cells are responsible for the primary and secondary immune responses of the body.

T-CELLS are the lymphocytes that bind to the surface of other cells that display the antigen and trigger a response. Each T-CELL is specific only to a particular antigen and is not effective against others.

