Chhatrapati Shahu Ji Maharaj University, Kanpur

Answer Script Details
Barcode 6434625

Roll No. 24080022030
Total Mark 54/75.00

Exam MASTER OF SCIENCE _ODD EXAM-DEC-24
Subject B050703T - CELL BIOLOGY AND GENETICS

Question wise Mark Summary

Q.No	Mark	Q.No	Mark	Q.No	Mark	Q.No	Mark
1A	4/5						
1B	3/5						
1C	4/5						
1D	3/5						
1E	3/5						
1F	3/5						
1G	3/5						
1H	4/5						
1I	4/5						
2	NA/15						
3	11/15						
4	NA/15						
5	NA/15						
6	NA/15						
7	NA/15						
8	NA/15						
9	12/15						

Chhatrapati Shahu Ji Maharaj University
Kanpur, Uttar Pradesh

PART-II

Date of Exam: 24/01/2025 Shift: 1st Room No.: 94
Paper Code: B050703T Subject: Zoology Year/Sem: 1st
Name of Candidate: ALSHIFA ALAM
Roll No. 2408002203 0

COE Facsimile
Signature of Invigilator
Signature of Candidate

MARKS OBTAINED										
Q.	1	2	3	4	5	6	7	8	9	10
(a)										
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(j)										
Total										
Total Marks in Figures									Max. Marks	
Total Marks in Words										

B050703T
Paper Code

Signature of Evaluator

Course: M.Sc Zoology (Previous)
Session: 2024-25 Year/Semester: 1st
Subject Name: Zoology
Medium: English ● Hindi ○

Paper Code: B050703T
Exam Date: 24/01/2025
Name of Candidate: ALSHIFA ALAM
Father's Name: MOHD ALAM

College Code: KN04
Exam Centre Code: KN04

Type of Exam
Regular ● Ex-Student ○
Private ○ Back Paper Exam ○

ANSWER BOOKLET NO.
6434625

B050703T
Paper Code

Enrollment Number: CSJMA240000013789

Candidate's Roll Number: 2408002203 0

Paper Code: B050703T

Signature of Candidate

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नोट- 1. परीक्षार्थी को निर्देशित किया जाता है कि आवरण पत्रे के पृष्ठ भाग पर अंकित सभी निर्देशों को सावधानी पूर्वक पढ़ें।
2. बॉक्स में भरी जाने वाली प्रविष्टियाँ बायीं तरफ से शुरू की जायें। 3. गोलों को काले या नीले बॉलपेन से भरा जायें।

INSTRUCTION TO THE CANDIDATE FOR FILLING PART-I

1. Read the instructions carefully given on the answer script and admit card.
2. Write Date of Exam, Shift, Paper Code & Name of Subject Correctly.
3. Write Name & Roll No. Correctly.
4. Write Semester & Branch Correctly.

INSTRUCTION TO THE CANDIDATE FOR FILLING PART-III

1. Use blue or black ball point pen for writing alphabets & numerals in ☐ boxes.
2. Carefully study the example before you start marking.
3. As shown in the example below, blacken thecircles completely.

4. Make no Stray marks o n this sheet.

5.DO NOT WRITE OR MARK ON THE BAR CODE.

IN ORDER TO AVOD UFM (UNFAIR MEANS) :

1. The Roll No. and Answer Book no. found elsewhere or any other symbol found in the answer book will be treated as unfair means.
2. Any tempering of Bar Code and Booklet no shall be treated as Unfair Means.
3. Do Not bring the materials like slip of paper/mobile/digital diaries/ study material/ revision notes in examination hall. Possession of the mobiles/ digital diaries/electronic/digital/ watch and any other electronic gadget except memory less scientific calculator sball be considered as UFM case.
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अनुचित साधन से बचने हेतु :

1. उत्तर पुस्तिका के निर्देशित स्थान को छोड़कर अनुक्रमांक एवं उत्तरपुस्तिका का क्रमांक कहीं और न लिखे तथा कोई भी चिन्ह न बनायें क्योंकि यह अनुचित साधन प्रयोग की परिधि में आता है।
2. उत्तर पुस्तिका के बारकोड अथवा उत्तर पुस्तिका संख्या पर छेद छाड़ करने पर अनुचित साधन प्रयोग माना जायेगा।
3. परीक्षा कक्ष में बिना अनुमति लाया न जायें, जैसे लिखे हुए कागज के टुकड़ें, मोबाईल, डिजिटल डायरी, डिजिटल घड़ी, घड़ी, पुस्तक यह सभी वस्तुएं जो अनुचित साधन के अन्तर्गत आती है। केवल संबंधित प्रश्नपत्र में ही मेमोरी लेस साईंटिफिक कैलकुलेटर ले जाने की अनुमन्यता होगी।
4. उत्तर पुस्तिकाओं में कागज न लगे न ही उत्तर पुस्तिका में चिपकायें। ऐसा करना अनुचित साधन प्रयोग की परिधि में आता है।

परीक्षार्थियों के लिए निर्देश

1. प्रवेश पत्र एवं उत्तर पुस्तिका पर दिये गये निर्देशों को ध्यान से पढ़ें।
2. कवर पृष्ठ के दूसरी तरफ कुछ न लिखें।
3. उत्तर पुस्तिका के पृष्ठों पर दोनों तरफ लिखें।
4. प्रश्न पत्र पर अपने अनुक्रमांक के अतिरिक्त कुछ न लिखें।
5. प्रश्न पत्र कोड एवं प्रश्न पत्र ID सावधानी पूर्वक लिखें।
6. अपनी स्थिति स्पष्ट लिखें।
7. उत्तर पुस्तिका के पृष्ठों की संख्या देखें। अगर उत्तर पुस्तिका में पृष्ठ (1-24) से कम है या फटे हुए है, तो परीक्षा शुरू होने के पूर्व दूसरी उत्तर पुस्तिका ले लें।
8. प्रश्नपत्र को देख, यदि प्रश्नपत्र के विषय कोड, विषय का नाम तथा प्रश्न में कोई त्रुटि है तो उसके परीक्षा प्रारंभ होने के 30 मिनट के अन्दर कक्ष निरीक्षक को तत्काल सूचित करें, उसके बाद विश्वविद्यालय द्वारा कोई कार्यवाही नहीं की जायेगी।
9. प्रश्नों के उत्तर लिखने के लिये पेंसिल का प्रयोग न करें।
10. कोई भी अतिरिक्त शीट नहीं दिया जायेगा।

INSTRUCTION TO THE CANDIDATE

1. Read the instructions carefully given on the Question Paper, Admit Card & Answer Script.
2. Do not write anything on back side of the cover page.
3. Write on both sides of pages of answer book.
4. Do not write anything on question paper except Roll Number.
5. Write Paper Code & Question Paper Id carefully.
6. CHECK the number of pages (1-24) or any other kind of damage in your answer script, if found than change the answer script immediately before the commencement of examination.
7. CHECK the Question Paper for any kind of discrepancy e.g. Subject Code, Subject Name, and Question of the Question Paper during first THIRTY MINUTES of the commencement of the exam, so that it can be corrected in TIME. After that no corrections shall be entertained by the university.
8. Do not use pencil for answering the question.
9. Write status correctly e.g. those appearing in carry over papers should fill in status as Carry Over. Those appearing as Ex- Students should fill in status as ex.
10. No supplementary answer book & graph paper will be provided.

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2. Use blue or black ball point pen for filling the circles.

Note- If your Roll No. is of 10 digits. Please leave first three columns .

Paper Code
B 0 5 0 7 0 3 T

1

(SECTION-A)

Short Answer Type Questions

Ans. 1(a)

Fluid Mosaic Model

- Fluid Mosaic Model for plasma membrane was given by Singer and Nicholson in 1972.
- They stated that plasma membrane has lipid bilayer with protein on either side.

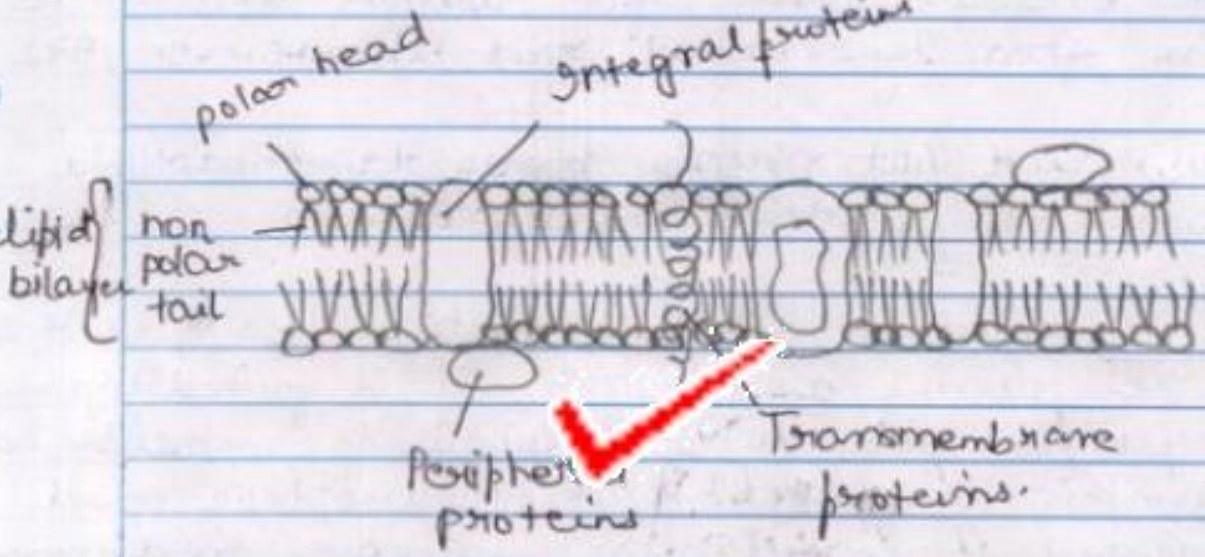
(i) Lipid :- Lipid forms the structure framework of the plasma membrane. It is formed of phospholipid molecules. Phospholipids molecules have hydrophic tail end and and hydrophilic head directed towards the aqueous medium. The hydrophobic tail ends of the two layers are adjoin together and hydrophilic heads are directed outwards in both the layers. It forms water resistant barrier but allow the lipid soluble substances to pass through easily across the plasma membrane.

(ii) Protein :- Occurs in two forms :-

(i) Extrinsic proteins :- loosely attached either to integral proteins or lipid polar heads by weak ionic interaction.

They include spectrin. Easily removable by applying physical methods.

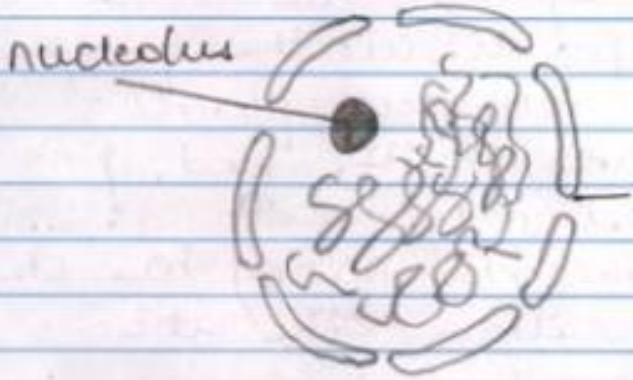
(ii) Intrinsic :- Partially or wholly embedded in the plasma membrane. and held their by strong hydrophobic or hydrophilic interactions.
They include glycophorins.



Ans. 1(b)

Nucleolus is found inside the nucleus. Nucleolus is the site of rRNA synthesis. They synthesize the ribosomal RNA which are utilized in the ribosome formation.
The genes coding for 18s, 5.8s and 28s rRNA are located inside the nucleolus. They contain the tandom repeats of the DNAs. It means

18s, 5.8s and 28s rRNA are formed from the single precursor molecule as 45 rRNA. This 45s rRNA then undergo methylation in the region to be conserved and then cleave into and combine with nucleolar proteins to form 80s RMP. This 80S RMP then breaks into 32s and 18s RNA. This 18s RNA is transported to the cytoplasm and along with proteins form small subunit of ribosome 40s. After that 32s RNA splits into 5.8s and 28s RNA and this come to cytoplasm and combines with the proteins to form larger subunit 60S.



Structure of Nucleus showing Nucleolus

Ans. 1(c)

Incomplete Dominance.

In incomplete Dominance, the genes of allelomorphic pair are not related as dominant or recessor but express themselves equally when present in the hybrid. As a result the F_1 progeny has intermediate characters to the two parental alleles.

Ex:- Flower colour in Four 'O' clock and snapdragon.

When true breading red flower plants are crossed with true breading white flower plants all the progeny in F_1 are pink flowered plants.
In F_2 the plants with red, pink and white appeared in the ratio 1:2:1.
Here the phenotypic ratio has changed from the Mendelian 3:1 ratio.

Red flower plants	White flower plants
RR	rr
↓	↓
R	r

$F_1 \Rightarrow Rr$
(Pink coloured)

	R	r
R	RR red	Rr pink
r	Rr pink	rr white

Phenotypic ratio ⇒ Red : Pink : White
1 : 2 : 1

Genotypic ratio ⇒ 1:2:1

Ans. 1(d)

Pleiotropism is a multiple effect of a gene. In this a single gene controls more than one character at the same time. Such genes are called Pleiotropic genes.

Ex:- In Pea the gene that controls the seed colour (Yellow

Ex:- Phenylketonuria:- It is autosomal recessive character control by the gene located on 12th chromosome The mutant gene fails to code for the enzyme phenylalanine hydroxylase that codes for the protein that converts the phenylalanine to tryosine. In the absence

of this protein; the phenylalanine begins to accumulate in the body fluids such as sweat, blood, cerebrospinal fluid. This causes mental retardation. These individuals are fair skinned, blonde hair with blue eyes because of the failure of melanin synthesis.

Ans. 1 (e)

Give Penetrance

Penetrance is the ability of the given gene to express itself to any degree. In the individual that carry that gene.

It can be of two types:-

① Complete penetrance:- Most genes in dominant and recessive state have complete penetrance in the homozygous state. Many completely dominant genes have complete penetrance in the heterozygous state also. Such genes are called to posses Complete penetrance.

Ex:- In drosophila, the recessive gene for vestigial wings has complete

penetrance in the homozygous state.

Ex:- The Allele R for red flower plants and Allele r for white flower plants have complete penetrance in the homozygous state: in the case of Flower of Four O' clock plant.

(ii) Incomplete penetrance:- Some genes in the dominant or recessive state can't give their complete penetrance are said to have incomplete penetrance.

Ex:- Polydactyl in man is caused by the dominant ~~recessive~~ gene P. The normal condition with five digits in each limb is given by pp (recessive). ~~By~~ But there are individuals with Pp genotype have not the condition of Polydactly for this character has 70% penetrance only.

Ans. 1 (f)

Significance of Meiosis

1) Gamete formation:- Meiosis is the division that occurs during the formation of gametes which have haploid chromosome number.

(ii) Maintaince of chromosome number :-

In Meiosis I, the two homologous chromosome move to two new cells that reduces the chromosome number from diploid condition to haploid condition. This haploid chromosomes then after the process of fertilization become diploid in individuals, thus it helps to maintain chromosome number.

(iii) Introduces variations :-

In pachytene stage, crossing over takes place which form new combinations of genes thus introduces variations in the population.

(iv) Evidence for common ancestory of living beings.

The steps of meiosis are usually same in all individuals thus shows the common ancestory b/w the organisms

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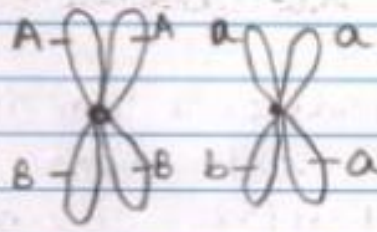
Ans. 1(g)

Homologous Chromosome.

Homologous chromosomes are chromosomes with same genes.
The alternative forms of a gene are called alleles which are present on the homologous chromosomes.
In humans 23 homologous chromosomes are present



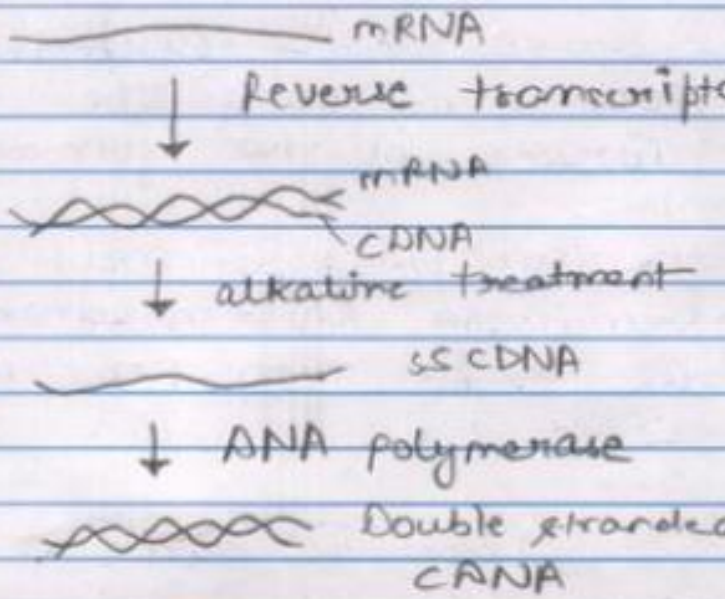
In meiosis I division the pairing of chromosomes which are homologous takes place.
The pairing of homologous chromosomes is known as synapsis.
It occurs during the zygote stage.
It occurs by the formation of synaptonemal complex.
In the anaphase I meiosis I the homologous chromosomes pairs separate and goes to two new nucleus.

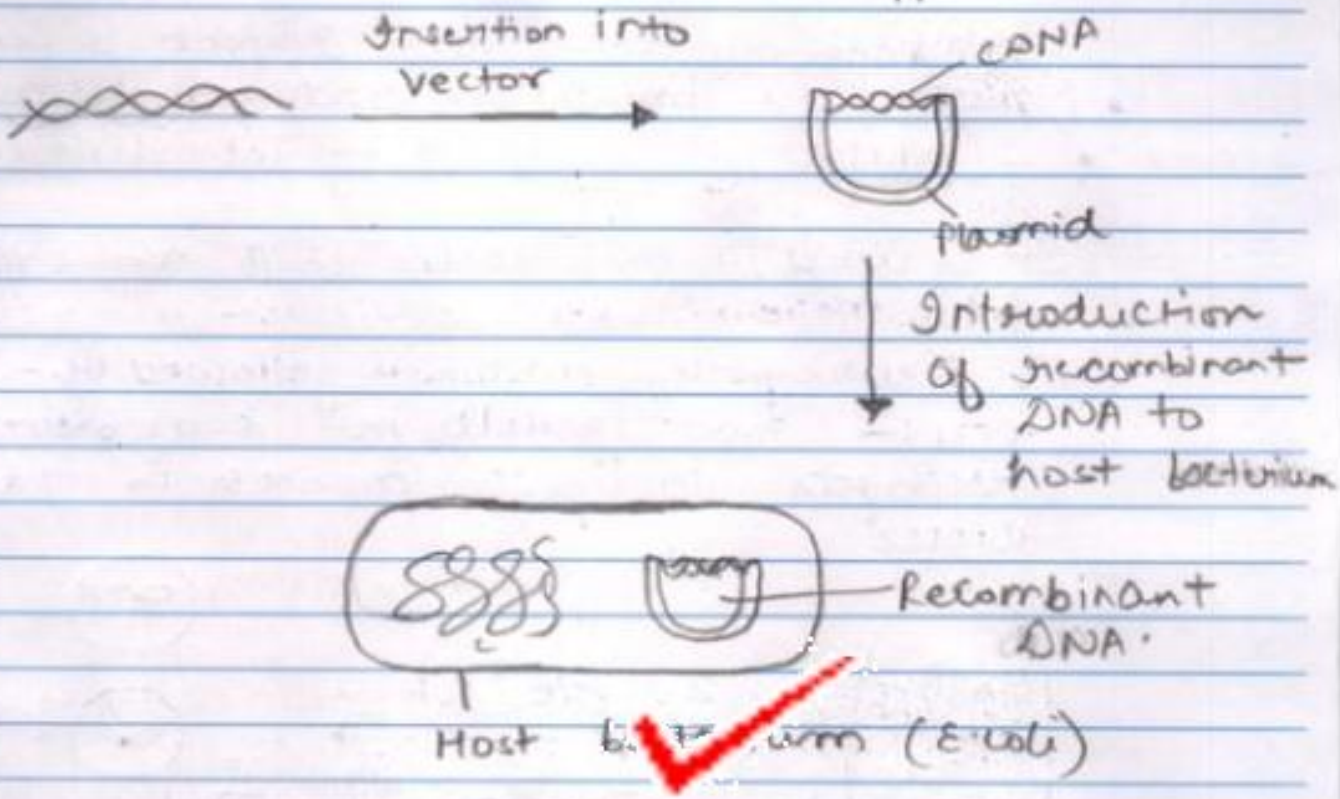
Ans. 1(h)

CDNA Library :-

cDNA are is synthesize from the mRNA template using reverse transcriptase. and then the cDNA - RNA complex separate to form ssCDNA by the enzyme alkaline phosphatase. cDNA duplicates by the enzyme DNA polymerase.

CDNA from a single tissue is linked to vectors and then these recombinant DNA are introduced into the host bacteria. The collection and storage of these bacterial colonies which contain CDNA clones is called cDNA library.





Ans. 1 (i)

Tetrad Analysis

- Paired homologous chromosome is called tetrad. since they are having four chromatide.
- It is the special method to map the genes with respect to centromere in those haploid organisms which are the product single crossovers.

Ordered Tetrad :-

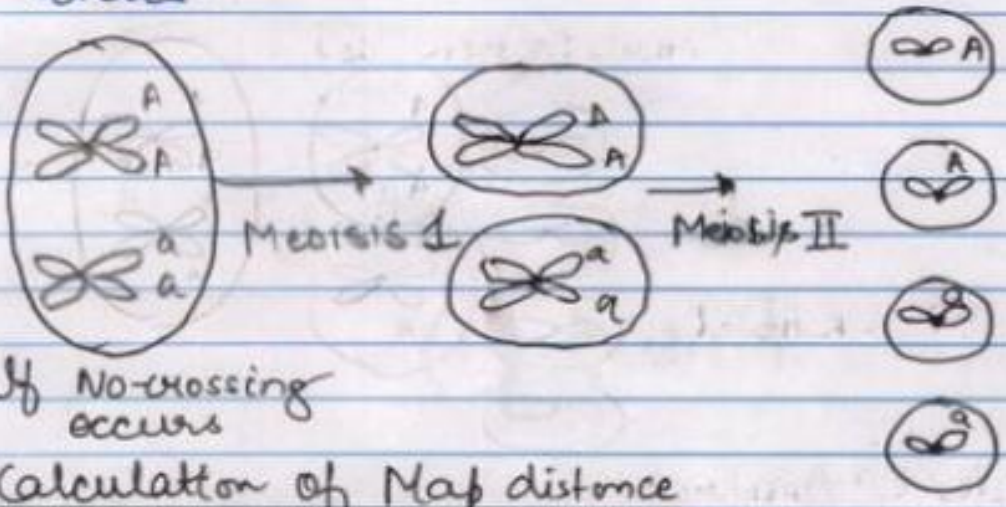
Ordered ~~Are~~ Tetrad is used to calculate the

distance of gene with respect to centromere

- Neurospora produces ordered tetrad.
- **Mapping of Gene by Tetrad Analysis.**

It is used to map locus with respect to centromere.

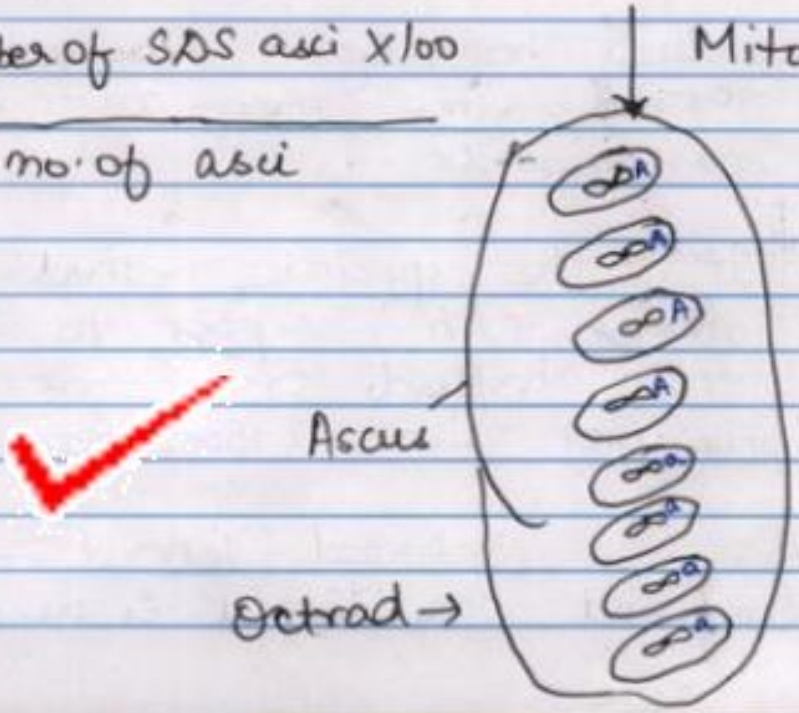
- In Neurospora, meiosis is followed by mitosis that results in 8 ascospores arranged in linear manner in the ascus.



If No-crossing occurs

Calculation of Map distance

$$\rightarrow \frac{\frac{1}{2} \times \text{Number of SDS asci} \times 100}{\text{Total no. of asci}}$$



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(SECTION-B)

(Ans. 1 3.)

Regulation of cell cycle is by:-

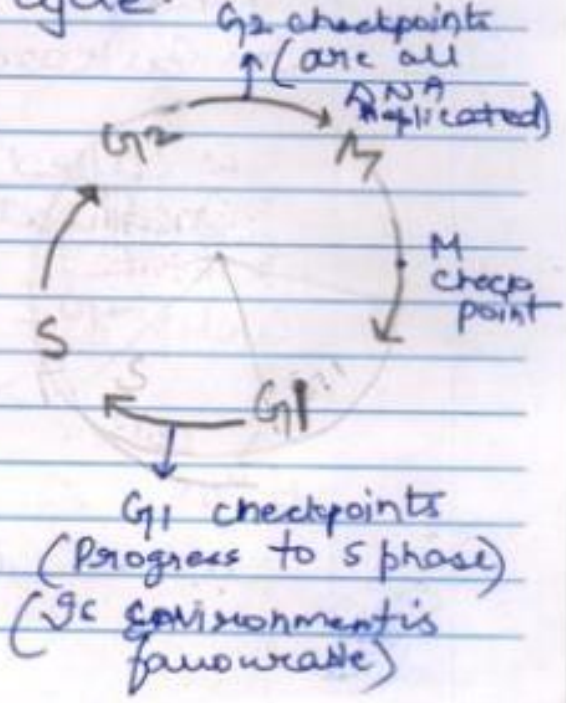
(i) Positive regulation
Cdk and cyclin dependent kinases

(ii) Negative regulation by
Inhibitors of cyclin-cdk complex.
such as P_{53} and P_{21} proteins.

(iii) Checkpoints.

(i) Checkpoints:- There are three checkpoints in the cell cycle.

1) G_1 checkpoint
2) G_2 checkpoint
3) M checkpoint



G_1 – checkpoint → Check all the conditions for cell division are favourable or not.

G_2 – checkpoint → Is DNA replicated?

M – checkpoint → It checks whether all the chromosomes are bind to spindle fibres and progress to cytokenisis.

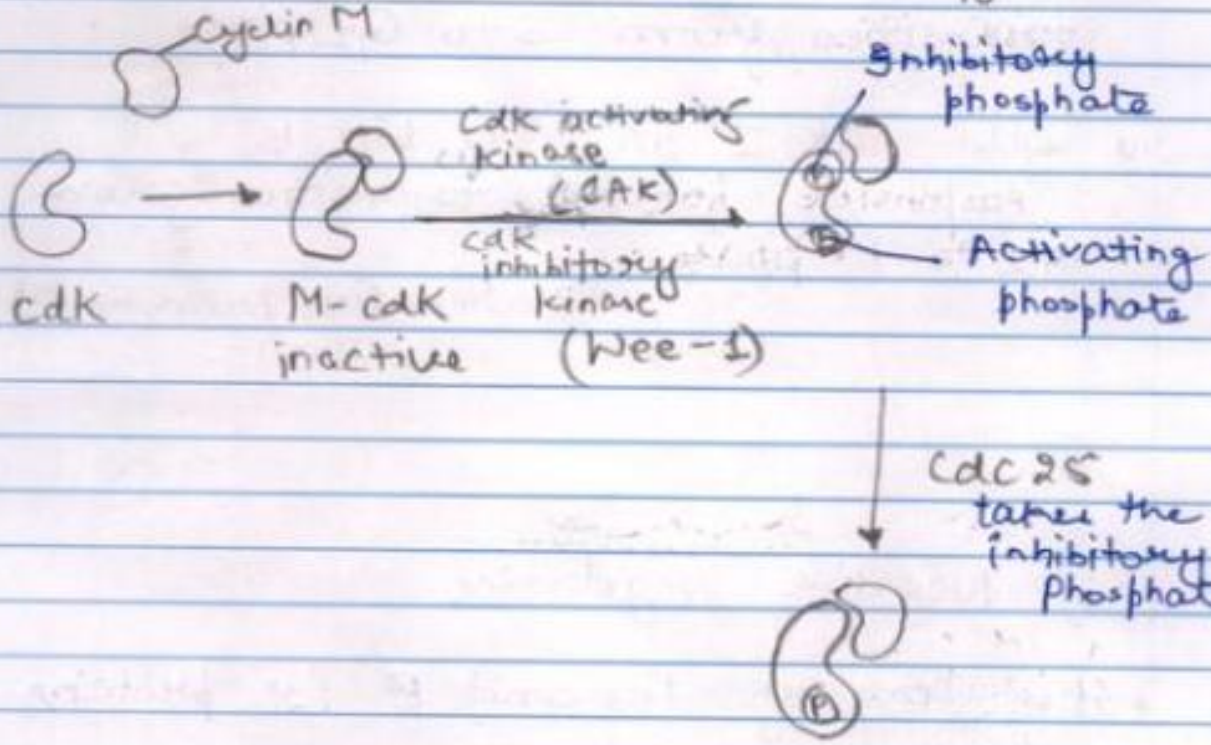
Positive Regulation

Cdk :– Cdk is the protein kinase enzyme The cell contains the family of cdk1 cdk 2, cdk 4, Cdk 6.

It is phosphyriated and transfers its phosphorus to specific proteins to activate them. These are called cyclin dependent kinases because they are activated by joining to cyclin protein.

In Eukaryotes, cdk 1 and cyclin B complex is formed which is called MPF which initiates and regulate cell division.

Cyclin B :– These are proteins which regulate the activity of cdk. There are cyclin A type, B type, D type, E type and also B_1, B_2, B_3 and D_1, D_2, D_3.



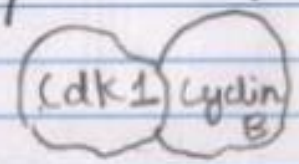
Different types of cdk and cyclin complex involve in the different stages of cell cycle are:-

- cdk 4, cdk 6 and cyclin A ⇒ Responsible for the progression throughout G_1 phase.
- Cdk 2 & cyclin E ⇒ Responsible for transition from G_1 to S phase.
- Cdk 2 & cyclin A ⇒ Responsible for the progression throughout S phase.
- cdk 1 & cyclin A ⇒ Responsible for the

transition from S to G2 phase.

- ~~Cyclo~~ cdk 1 and cyclin B ⇒ responsible for the transition from G2 to M phase.

MPK (Maturation Promoting factor)



(ii) Negative regulation

- It is done by P53 and P21 proteins.
- It will repair or do the apoptosis of cell.
- DNA damage activates the P53 protein which stimulates the transcription of many genes
- One of these genes codes for CKI protein called P21
- P21 binds to cdk and cyclin complex of S phase and inhibits their activity so that cell division do not progress to S-phase.

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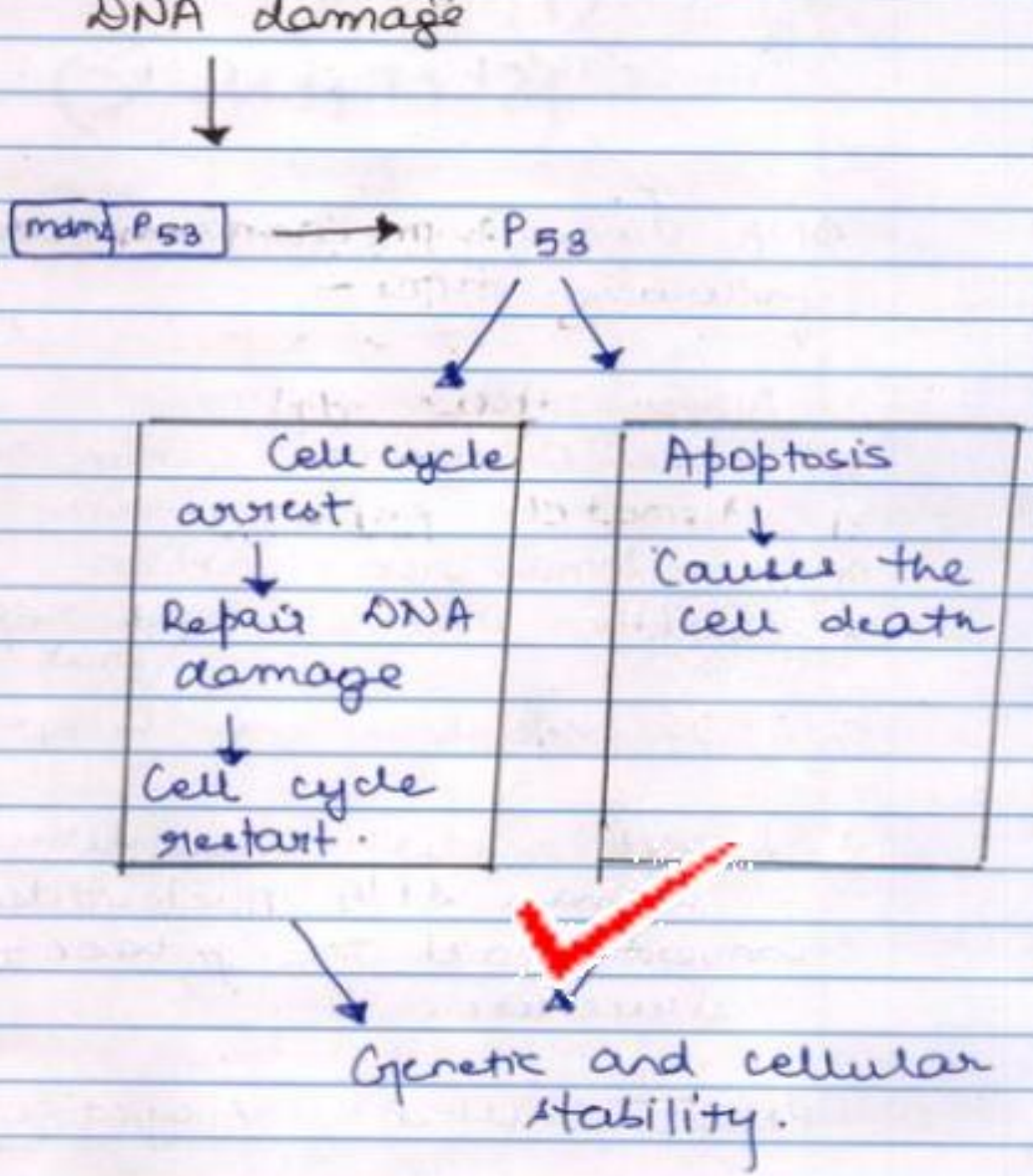


(Ans. 9)

(SECTION- C)

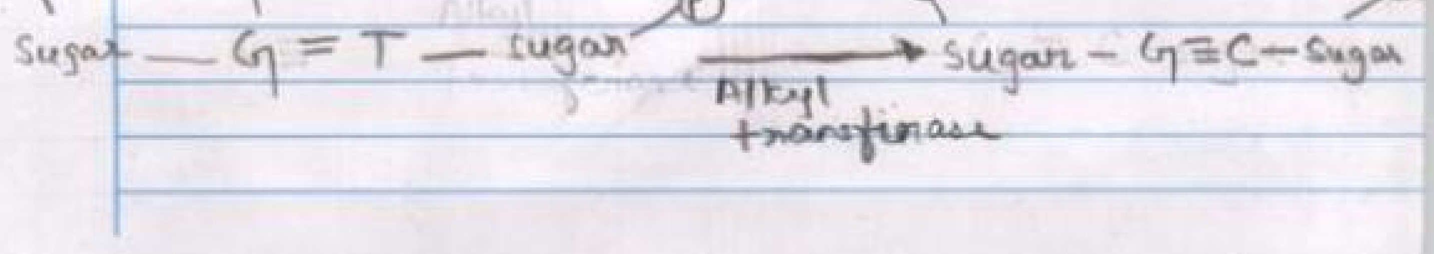
DNA damage mechanisms are of following types -

1) Direct repair system
2) Base / Nucleotide excision repair.
3) Mismatch repair system.
4) Homologous recombination
5) Double stranded DNA ~~repair~~ break.
6) SOS response in ~~[illegible]~~ E. coli.

1) Direct repair → Act directly to damage DNA nucleotides and convert [illegible] back to original structure.

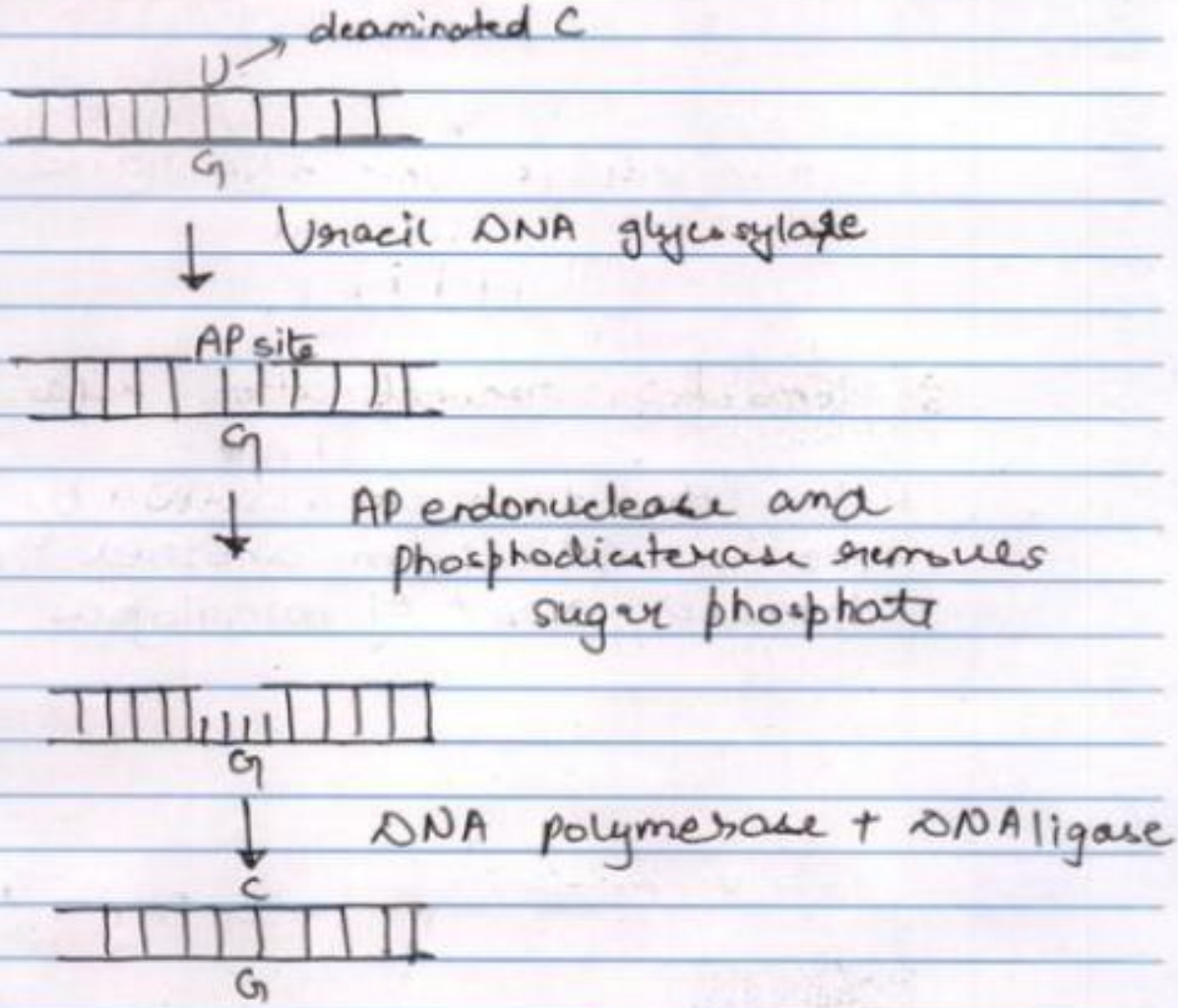
Repair caused by Alkylating agents :-

DNA repair occurs by enzyme (MGMT) ~~Methyl transferase Methyl~~ Methyl guanine Methyl transferase.

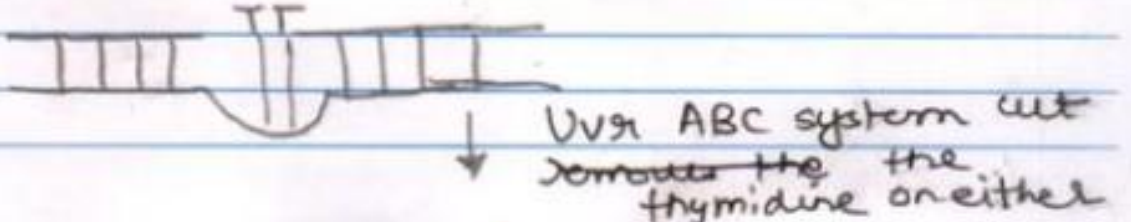


(ii) Excision Repair

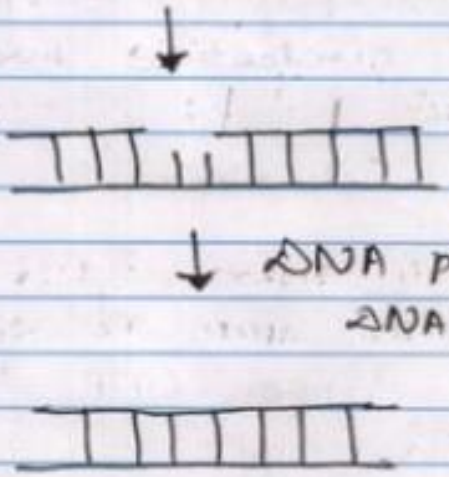
(a) Base Excision Repair → Repair the damage nucleotide base or 2-10 nucleotides.



(b) Nucleotide Excision Repair.
Repair pyrimidine dimerisation

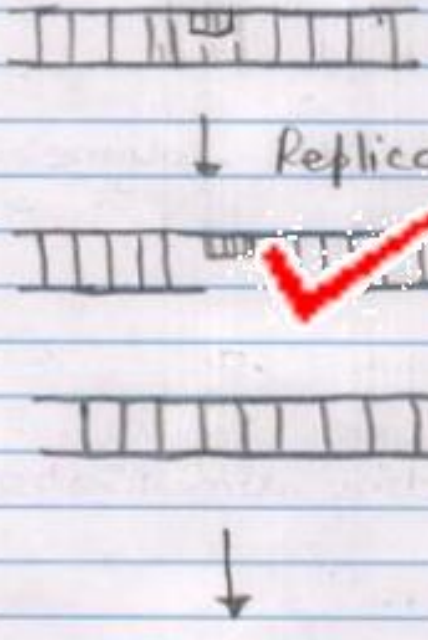


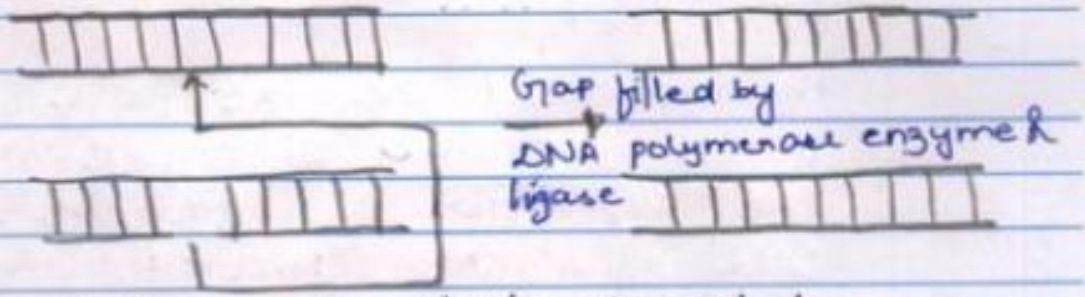
site and removed by Helicase II.



3) Homologous recombination Repair.

Repair the damage ss DNA by retrieving the ss DNA from another double stranded DNA of homologous chromosome





Exchange of single stranded DNA segment from normal duplex to damaged duplex

4) Double stranded DNA break repair.

(i) Non-homologous repair :- The damaged DNA & nucleotides are juxtapose and repair by joining with the help of DNA ligase.
It involves machinery :-

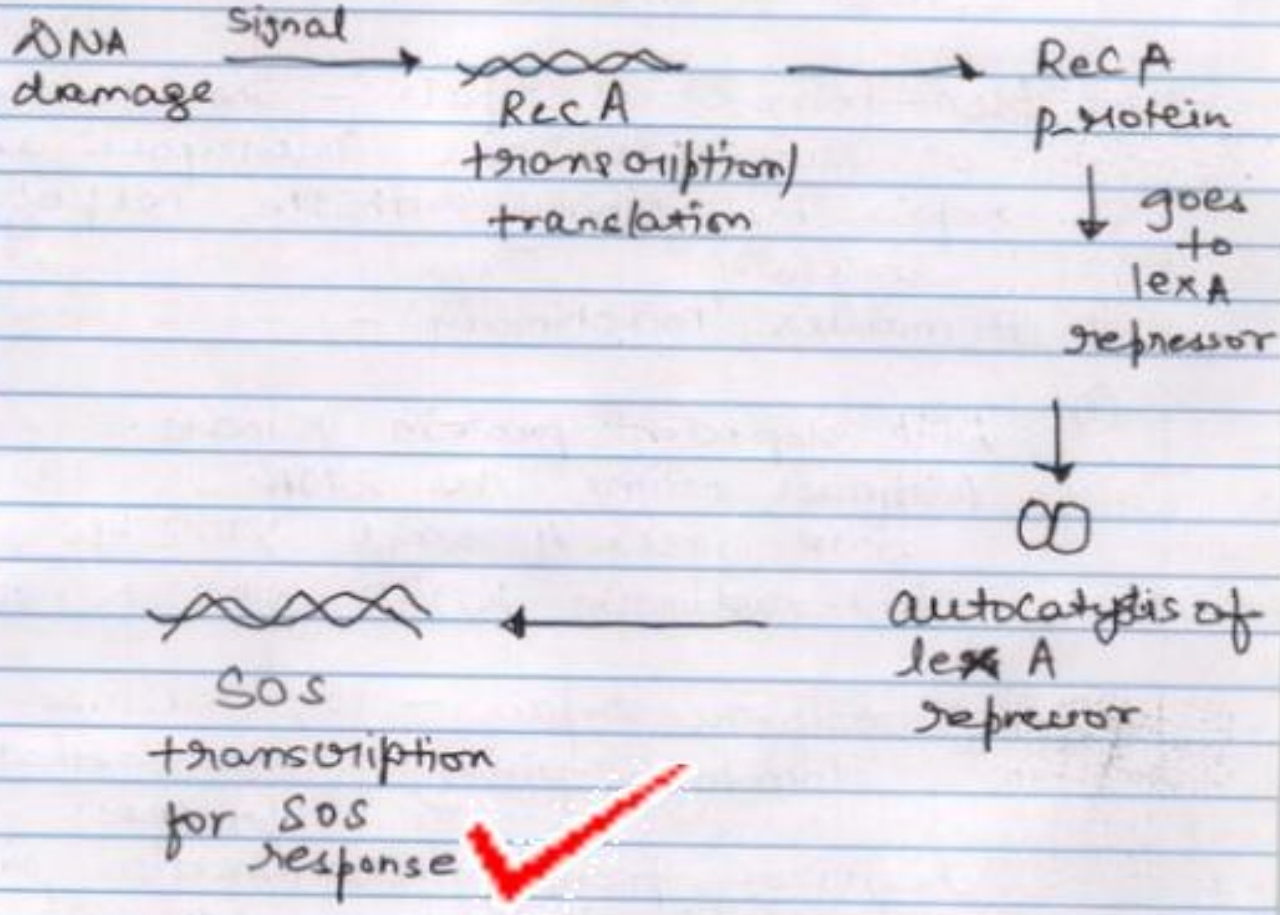
(i) DNA dependent protein Kinase.
(ii) Artimess trims the DNA.
(iii) DNA ligase 4 and XRCC4.
(iv) Heterodimer KU70 and KU80 proteins

(ii) Homologous repair :- ⇒ Involves general recombination process.
Homologous pairing
Requires special recombination proteins that identify the damaged DNA sequence and complementary DNA sequences to bring them closer.

SOS response

Co-ordinated response in E.coli that aids in the survival of organism by controlling the expression of proteins involved in cell division, recombination, repair etc

Includes LexA repressor and RecA protein. LexA repressor stops SOS gene transcription by binding to SOS box.



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