

**SULIT**  
**SB015**  
*Biology 1*  
*Semester I*  
*Session 2023/2024*  
*2 hour*

**SB015**  
**Biologi 1**  
**Semester I**  
**Sesi 2023/2024**  
**2 jam**

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(Isikan maklumat dengan lengkap)



**KOLEJ MATRIKULASI SELANGOR**  
*SELANGOR MATRICULATION COLLEGE*

**PRA PEPERIKSAAN SEMESTER PROGRAM MATRIKULASI**  
*PRE MATRICULATION PROGRAMME EXAMINATION*

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**BIOLOGY SB015**

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU.**  
*DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.*

| Untuk Kegunaan Pemeriksa |           |          |
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| No. Soalan               | Markah    |          |
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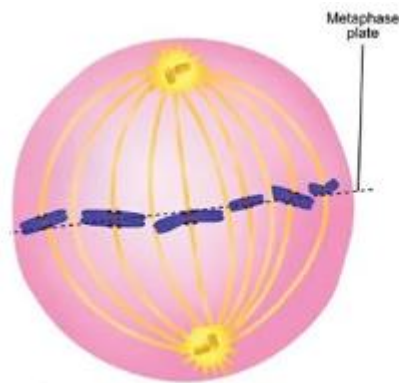
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Kertas soalan ini mengandungi **12** halaman bercetak.  
*This question paper consists of 12 printed pages.*

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**SULIT**

1. **FIGURE 1** shows mitosis process in animal cell.



**FIGURE 1**

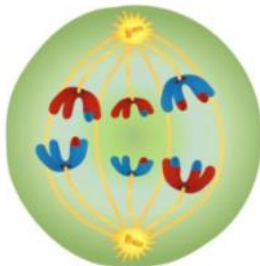
(a) Draw diagram that shows stage Prophase I with same number of chromosome

[3 marks]

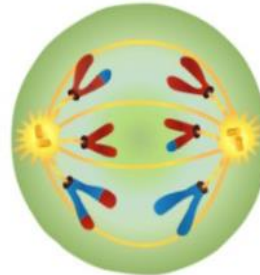
(b) Differentiate the chromosomal behaviour in a cell at **A** with those in a cell at **B**.

[1 mark]

**A**



**B**




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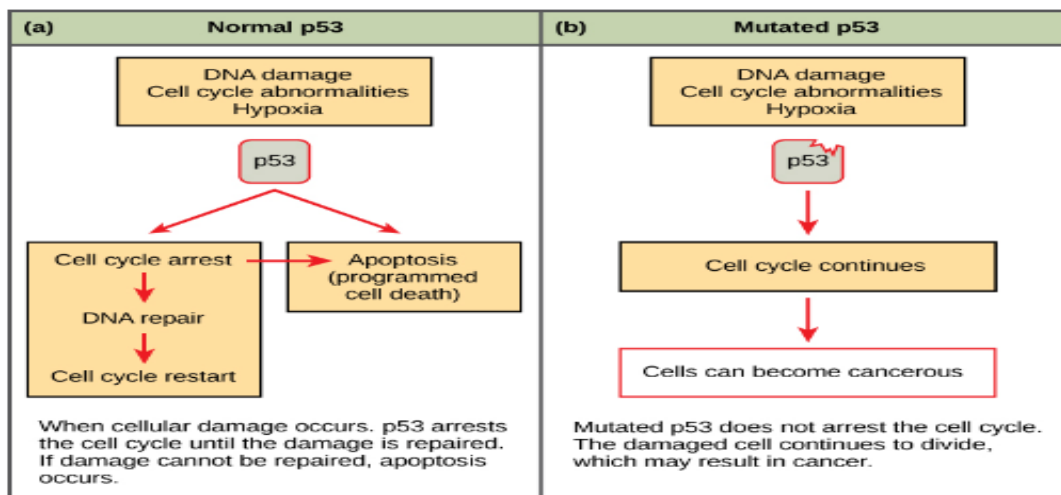
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(c) Assume a cell has a diploid chromosome number of 20, how many Tetrads would form during prophase I in the cell?

[1 mark]

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(d)



If the DNA of the cell is damaged, a protein called p53 at G1 checkpoint stops the cell cycle to allow the damaged DNA to be repaired.

According to the statement above, what will happen to the cell if P53 genes loss its function due to mutation

[2 marks]

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4. (a) In garden pea plant, purple flower (P) and inflated pod shape (F) is dominant over white flower (p) and constricted pod shape (f). A heterozygous parent for both characteristics is crossed with a homozygous recessive genotype.

(i) What are the genotypic ratio of the F1 generation?

[1 mark]

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(ii) What are the phenotypes of the F1 generation?

[1 mark]

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(iii) Which Mendel's Law explains the combination of alleles in the above cross?

[1 mark]

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(b) In *Drosophilla* sp. grey (G) body is dominant while black (g) body is recessive for body colour. Meanwhile for type of wing, normal (N) wing is dominant over vestigial (n) wing. F1 test cross was carried out on *Drosophilla* sp. with grey body and normal wing produces the following progenies:

| Phenotype                  | Number of progeny |
|----------------------------|-------------------|
| Grey body, normal wing     | 877               |
| Black body, vestigial wing | 869               |
| Grey body, vestigial wing  | 111               |
| Black body, normal wing    | 109               |

(i) Does the above cross follow Mendelian ratio? Give reason for your answer.

[2 marks]

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(ii) Explain how the situation in (a) (i) occurs

[2 marks]

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(iii) Construct genetic diagram to show the result obtained.

[4 marks]

(iv) Calculate the genetic distance between the body colour and wing shape.

[2 marks]

5. Suppose that, out of a sample population of 6500 rabbits, researchers find 400 rabbits that express a recessive allele **s** for short ears. Assuming there are only two alleles for ear length in the population and the rabbit's population is in Hardy-Weinberg equilibrium. (Calculation must be in 4 decimal points)

(a) (i) Calculate the recessive and dominant allele frequencies

[2 marks]

(iii) Calculate the number of heterozygous rabbits.

[1 mark]

(iii) Calculate the number of homozygous dominant rabbits

[1 mark].

(b) If the survivorship of the homozygous recessive reduces to zero.

(i) Calculate the new gene pool

[1 mark]

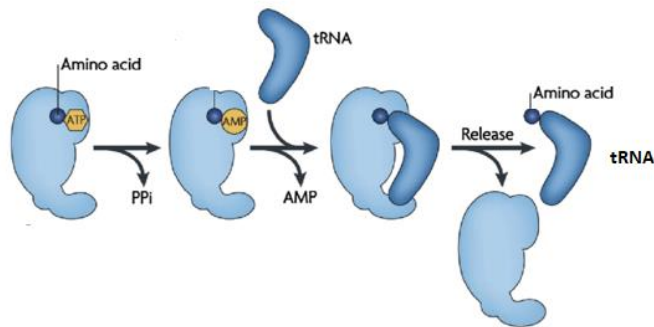
(ii) Calculate the new dominant allele frequency

[1 mark]

(iii) Calculate the new recessive allele frequency

[1 mark]

6. (a) **FIGURE 2A** shows the process of the covalent coupling of amino acids to specific 3'-end adapter molecules the tRNA.



**FIGURE 2A**

(i) Name the process in **FIGURE 2A**.

[1 mark]

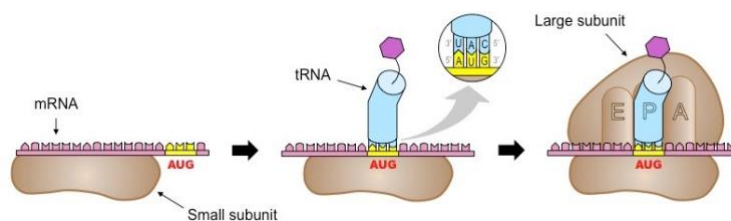
(ii) Name the enzyme involves in this process.

[1 mark]

(iii) Name the end product of this process.

[1 mark]

(b) **FIGURE 2B** shows the formation of translation initiation complex

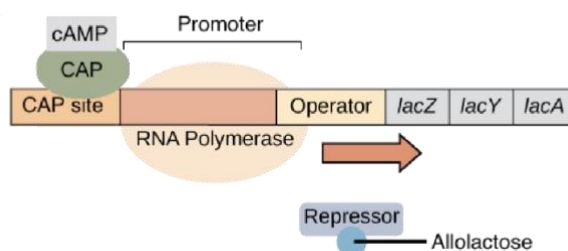


**FIGURE 2B**

Explain the process shown in **FIGURE 2B**.

[4 marks]

(c) **FIGURE 2C** shows a normal mechanism of *lac* operon in the presence of lactose and absence of glucose.



**FIGURE 2C**

(i) Explain the event or mechanism shown in **FIGURE 2C**.

[4 marks]

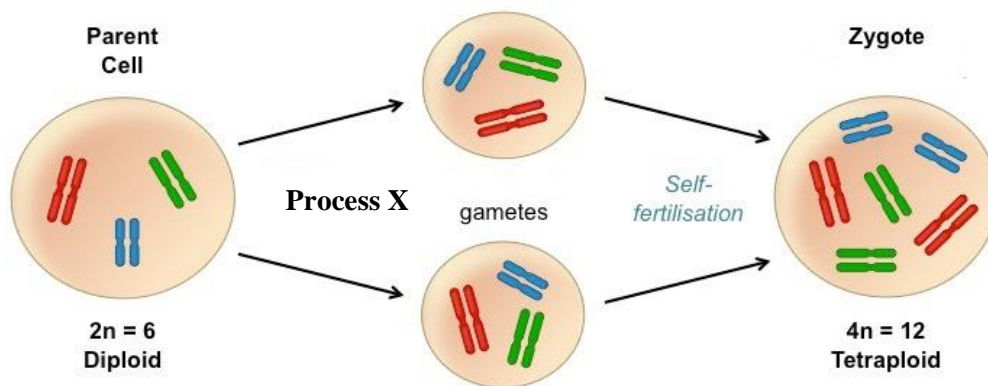
(ii) Isopropyl thiogalactoside (IPTG) is a molecule that is structurally similar to the inducer of *lac* operon. What do you think happen to the operon if IPTG is present instead of lactose?

[2 marks]

5. (a) Aneuploidy is an abnormal condition in which one or more chromosomes are present in extra copies or are deficient in number. State **ONE** example of this condition that results in extra copies of chromosome in autosome and explain how it happens.

[5 marks]

(b) **FIGURE 3** shows the process that form an autopolyploid zygote.



**FIGURE 3**

- Identify **process X** that produced unreduced gametes. [1 mark]  

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- Is the zygote ( $4n=12$ ) viable and form fertile organism? Explain your answer. [3 marks]  

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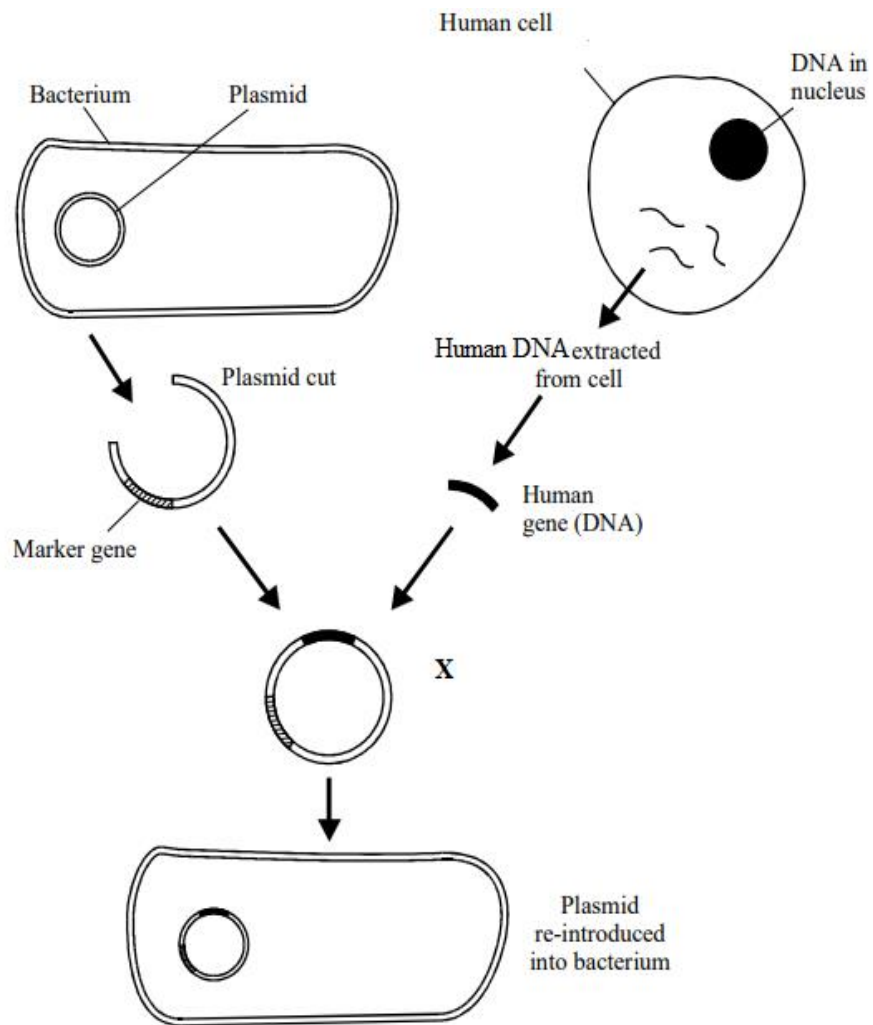
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- Give **TWO** advantages of the tetraploid plants. [2 marks]  

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6. (a) **FIGURE 4.1** shows the stages in gene cloning.



**FIGURE 4.1**

i. Name structure **X**

[1 mark]

ii. Explain how structure **X** are made by genetic engineering.

[3 marks]

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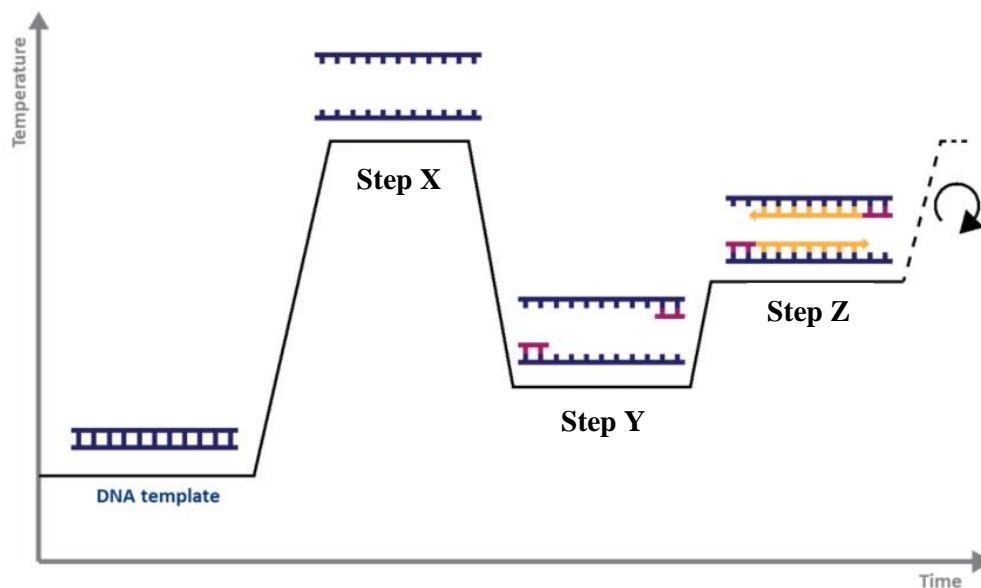
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- iii. Explain how the use of the marker gene in **FIGURE 8.1** enable bacteria containing structure **X** to be detected.

[3 marks]

- (b) **FIGURE 4.2** below shows schematic representation of a cycle of amplification of a DNA segment carried *in vitro*.



**FIGURE 4.2**

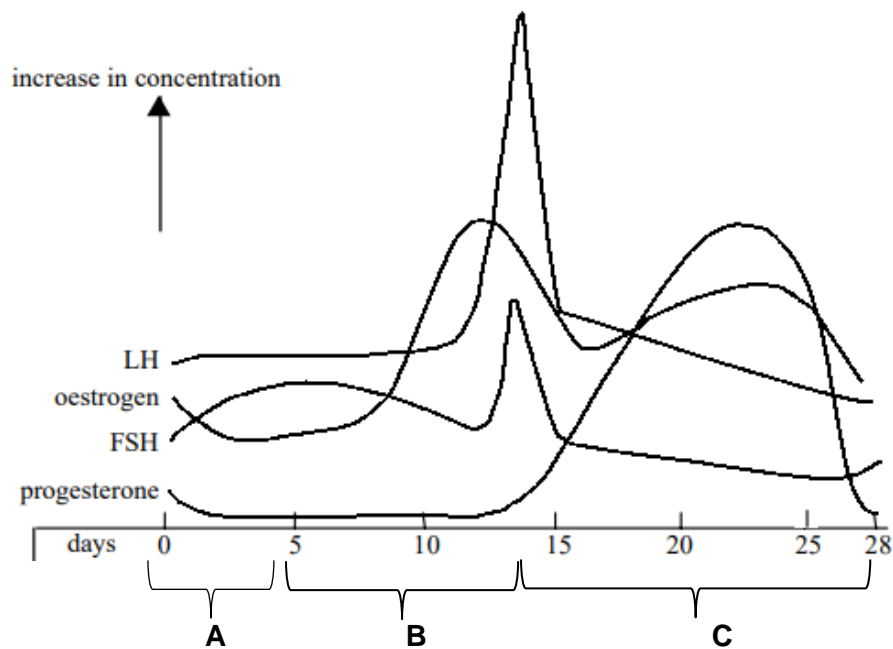
- i. Name **Step Y**. [1 mark]

- ii. Briefly explain **Step Z**. [2 marks]

- iii. If the template used for the amplification of the gene is extracted from mRNA, briefly explain the step required to prepare the DNA template.

[3 marks]

7.(a) The **FIGURE 5.1** shows changes in hormones concentrations during female reproductive cycle. A, B and C are the phases in uterine cycle.



**FIGURE 5.1**

- i. Name phase **B** and state the structure that secrete estrogen during that phase.

[2 marks]

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- ii. With reference to the hormone patterns shown in graph, describe the hormonal control of FSH and LH from day 1-14 during female productive cycle.

[4 marks]

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- iii. Briefly describe negative feedback mechanism during phase C

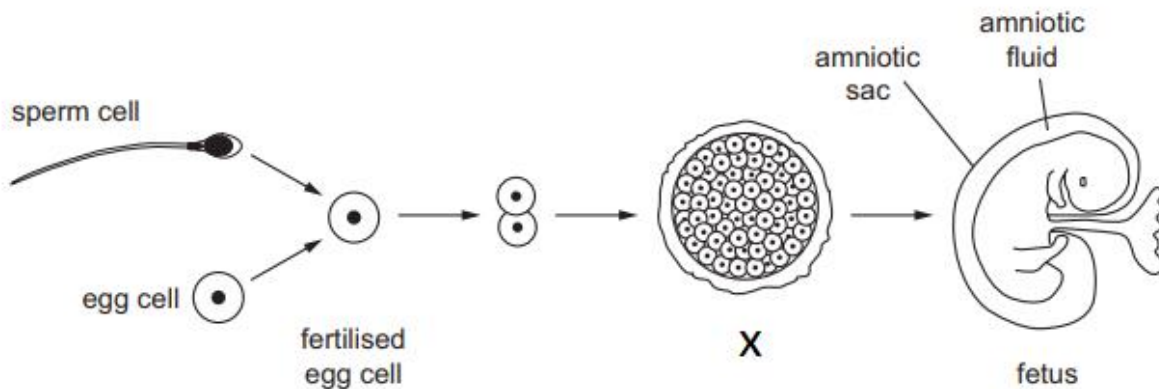
[2 marks]

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- (b) **FIGURE 5.2** shows stages in formation of a human fetus.



**FIGURE 5.2**

- i. Name X

[1 mark]

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- ii. Name the process that result in the formation of X

[1 mark]

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- iii. Where does the process takes place?

[1 mark]

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- iv. At the end of 3<sup>rd</sup> trimesters of pregnancy, mother will feel contraction during parturation. Explain the role of hormones during birth process.

[5 marks]

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