BIOLOGY UNIT
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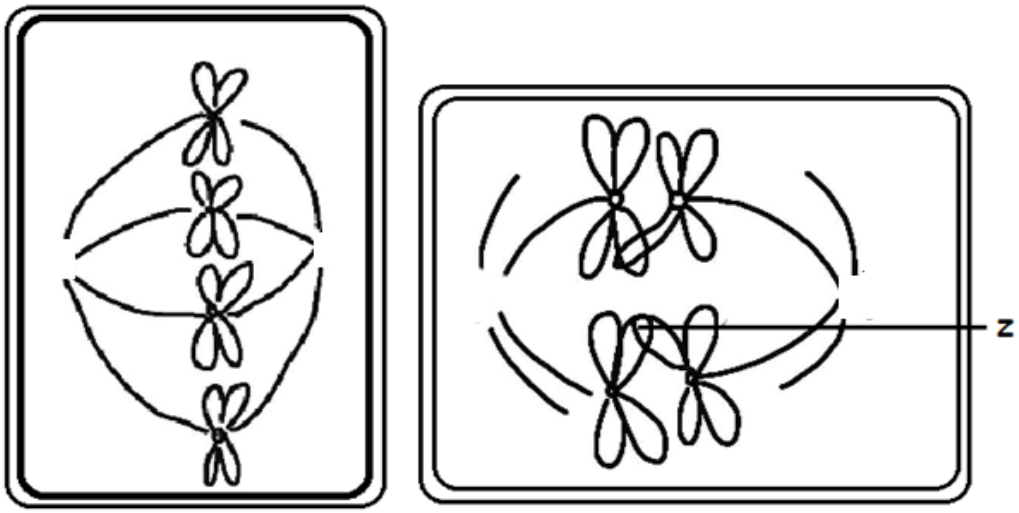
BIOBOOSTER
SEMESTER I SESSION 2023/2024

TOTAL MARKS: /80

NAME: _____ **CLASS:** _____

INSTRUCTION: ANSWER ALL QUESTIONS

1. Cell **A** and cell **B** are two different cells that are found in different part of the same plant.



Cell A Cell B

FIGURE 1

a) Name the example for Cell **B**. [1 *mark*]

_____

b) Differentiate the chromosome behavior for cell A and cell B in the stage before the stage in **FIGURE 1.** [2 *marks*]

_____

_____

_____

_____

c) After cell division is completed, how many chromosomes are present in Cell A and Cell **B**? [2 *marks*]

_____

d) Name the process that occurs at **Z** and state its importance. [2 *marks*]

_____

_____

_____

2. a) In rabbits, short hair is controlled by a dominant allele (*L)* while long hair is controlled by its recessive allele (*l)*. On the other chromosome, black hair is controlled by a dominant allele (*B)* while brown hair is controlled by its recessive allele (*b)*. By using Punnett square, draw the genetic diagram to determine the genotypic and phenotypic ratio for F_1 progeny if the heterozygous rabbit is test-crossed. [4 *marks*]

b) In the pea plant, the purple flower (*P*) is dominant over the red flower (*p*), and the long pollen shape (*L*) is dominant over the round pollen shape (*l*). A cross was done between a homozygous purple flower long pollen plant and a homozygous red flower round pollen plant. The F_1 generation was then crossed with a red and round pollen plant, producing the following progenies:

Phenotypes	No. of progeny
Purple flower, long pollen	48
Purple flower, round pollen	13
Red flower, long pollen	12
Red flower, round pollen	46

TABLE 1

i. Does the above cross follow the Mendelian ratio. [1 *mark*]

_____

ii. Explain how the situation in (b)(i) occurs. [2 *marks*]

_____

_____

_____

iii. Draw the genetic diagram for the test cross of the F_1 generation.

[4 *marks*]

iv. Calculate the distance between the genes. Show your calculation.

[2 *marks*]

3. In the ladybug population, the spot color of the yellow ladybug was controlled by two alleles. The black spot (B) is dominant over the red spot (b). In a population of 600 ladybugs, the following data is recorded.

Phenotypes	**Genotypes**	**Number of individuals**
Black spot ladybugs	BB	350
Black spot ladybugs	Bb	130
Red spot ladybugs	bb	120

TABLE 2

a) Find the gene pool size for the spot color of the ladybug population.[1 *mark*]

b) Calculate the frequency of dominant allele, B. [1 *mark*]

c) Calculate the frequency of recessive allele, b. [1 *mark*]

d) If the ladybugs were left to breed randomly and the population remained in equilibrium, how many individuals are expected to be heterozygous in the next generation of 1500 ladybugs? [3 *marks*]

4. a) **FIGURE 2** shows protein synthesis flow in a eukaryotic cell.

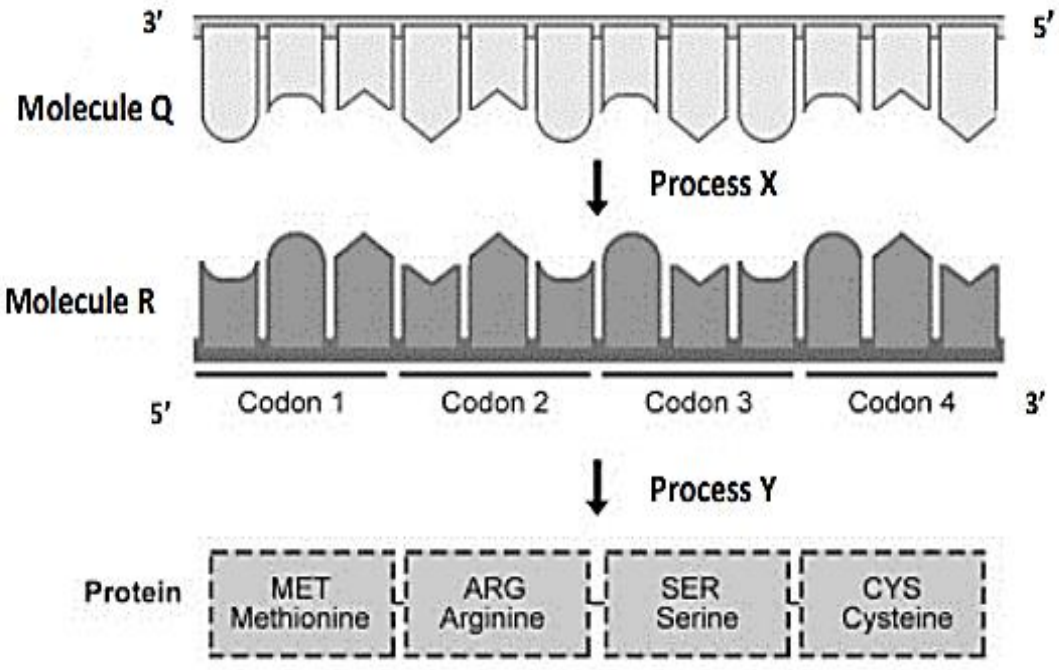


FIGURE 2

i. Name process **X** and **Y**. [2 *marks*]

_____

_____

ii. What is the base sequence of the Codon 1? [1 *mark*]

_____

iii. What is the anticodon sequence for 4(a)(ii)? [1 *mark*]

_____

iv. What happens if enzyme that invoved in process **X** is mutated and cannot perform its function? [1 *mark*]

_____

_____

_____

v. Explain the formation of the initiation complex in process **Y**. [3 *marks*]

_____

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_____

_____

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_____

b) **FIGURE 3** shows an operon model proposed by Jacob and Monod.

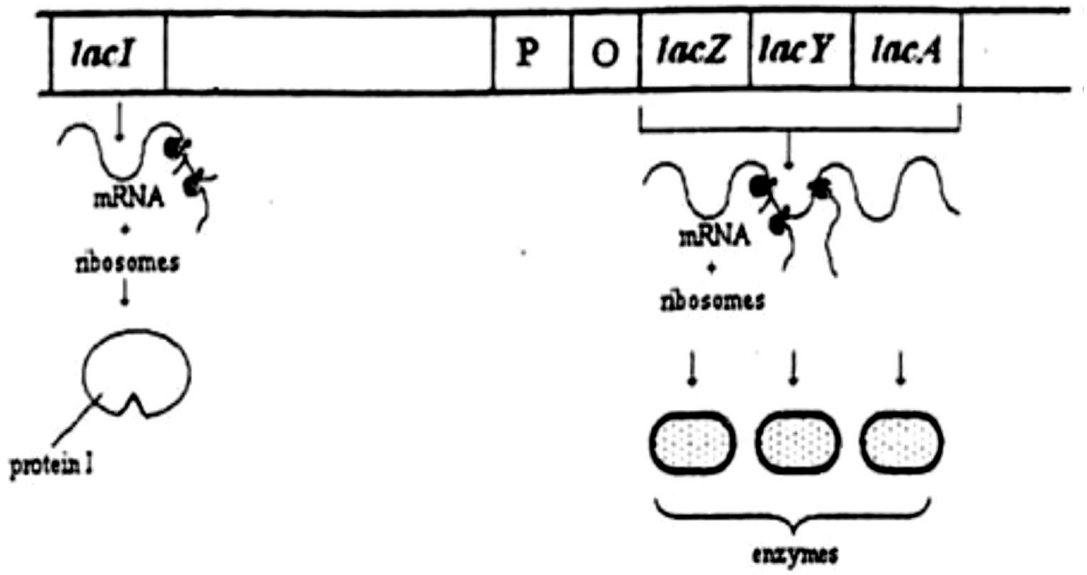

FIGURE 3

i. What is the function of **P** and ***lacZ***? [2 *marks*]

_____

_____

_____

ii. Mutation can disrupt the normal regulatory mechanism of an operon. What will happen when the regulatory gene, ***lacI*** is mutated by radiation? [3 *marks*]

_____

_____

_____

_____

iii. What is the effect of deficiency of enzyme encoded by ***lacY*** in lactose metabolism? [1 *mark*]

_____

_____

5. a) **FIGURE 4(a)** shows a segment of a normal DNA. Sequence **M** are the result of point mutation from normal DNA.

3'- G G C T A A C C G A T G G T A - 5'

Normal DNA

3'- G G C T A A C G G A T G G T A - 5

M

FIGURE 4(a)

i. By using genetic code table in **FIGURE 4(b),** what is the amino acid sequence for **M**. [1 *mark*]

UUU, UUC: Phe UUA, UUG: Leu	UCU, UCC, UCA, UCG: Ser	UAU, UAC: Tyr UAA, UAG: Stop	UGU, UGC: Cys UGA: Stop UGG: Trp
CUU, CUC, CUA, CUG: Leu	CCU, CCC, CCA, CCG: Pro	CAU, CAC: His CAA, CAG: Gln	CGU, CGC, CGA, CGG: Arg
AUU, AUC, AUA: Ile AUG: Met	ACU, ACC, ACA, ACG: Thr	AAU, AAC: Asn AAA, AAG: Lys	AGU, AGC: Ser AGA, AGG: Arg
GUU, GUC, GUA, GUG: Val	GCU, GCC, GCA, GCG: Ala	GAU, GAC: Asp GAA, GAG: Glu	GGU, GGC, GGA, GGG: Gly

FIGURE 4(b)

_____

ii. Describe the effect of mutation occur in **M**. [2 *marks*]

_____

_____

_____

b) **FIGURE 5** shows a karyotype of an individual suffering from a genetic disorder.

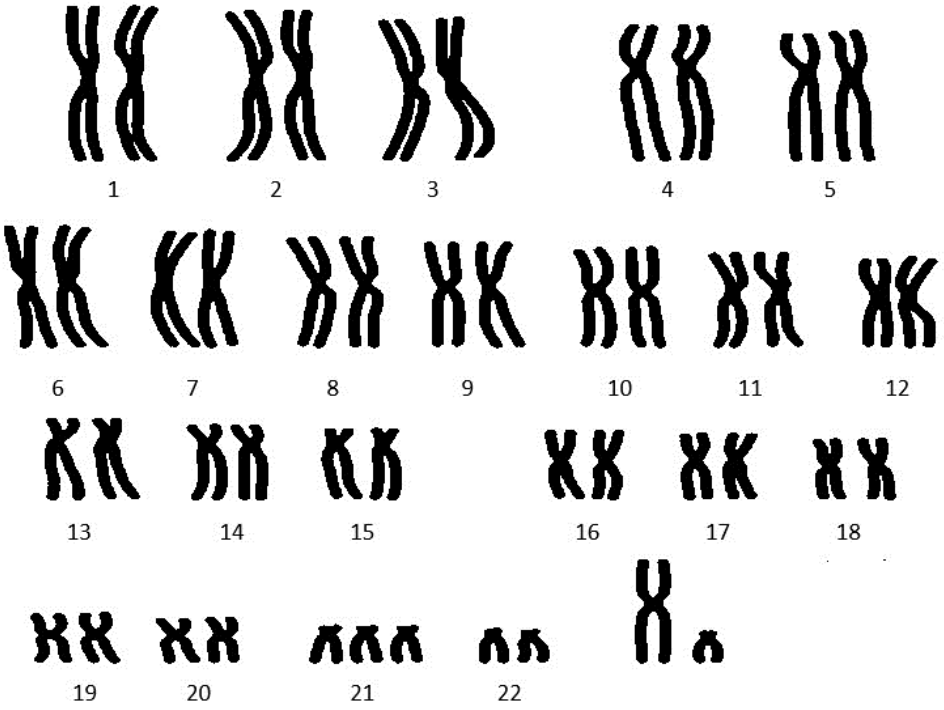

FIGURE 5

i. Based on **FIGURE 5**, name the disorder caused by the mutation? [1 *mark*]

_____

ii. How mutation in **FIGURE 5** arise? [3 *marks*]

_____

_____

_____

c) **FIGURE 6** shows a karyotype of an individual suffering from a genetic disorder due to chromosomal aberration.

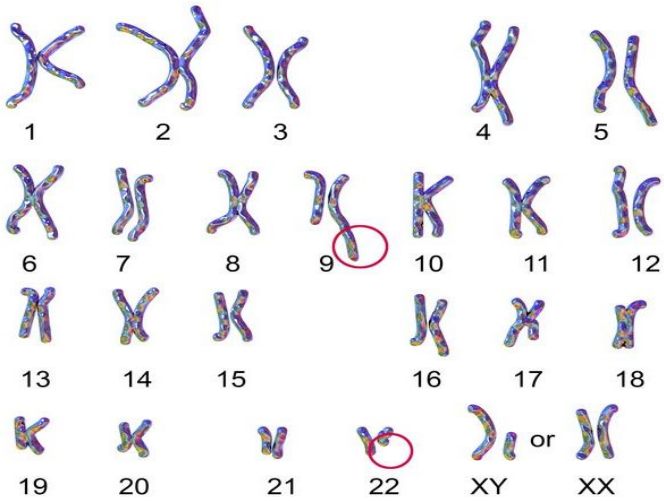

FIGURE 6

i. Name the genetic disorder shown in **FIGURE 6**. [1 *mark*]

_____

ii. Identify the chromosomal aberration that leads to this genetic disorder. [1 *mark*]

_____

iii. Explain the event in chromosomal aberration that leads to this disorder. [2 *marks*]

_____

_____

_____

6. a) **FIGURE 7** shows steps in Polymerase Chain Reaction.

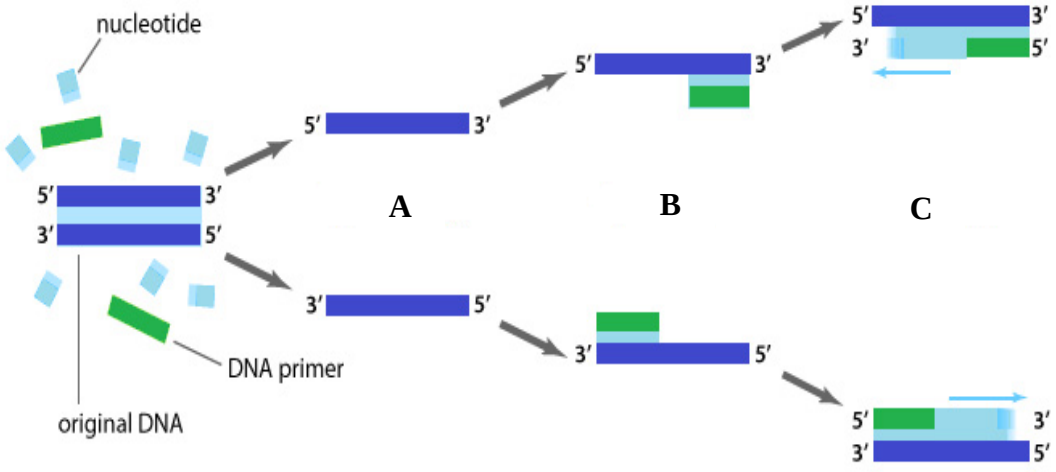

FIGURE 7

i. Identify step **A** and **B**. [2 *marks*]

A : _____

B : _____

ii. Describe the event that occur in stage **C**. [1 *mark*]

_____

_____

b) **FIGURE 8** shows part of general method in gene cloning.

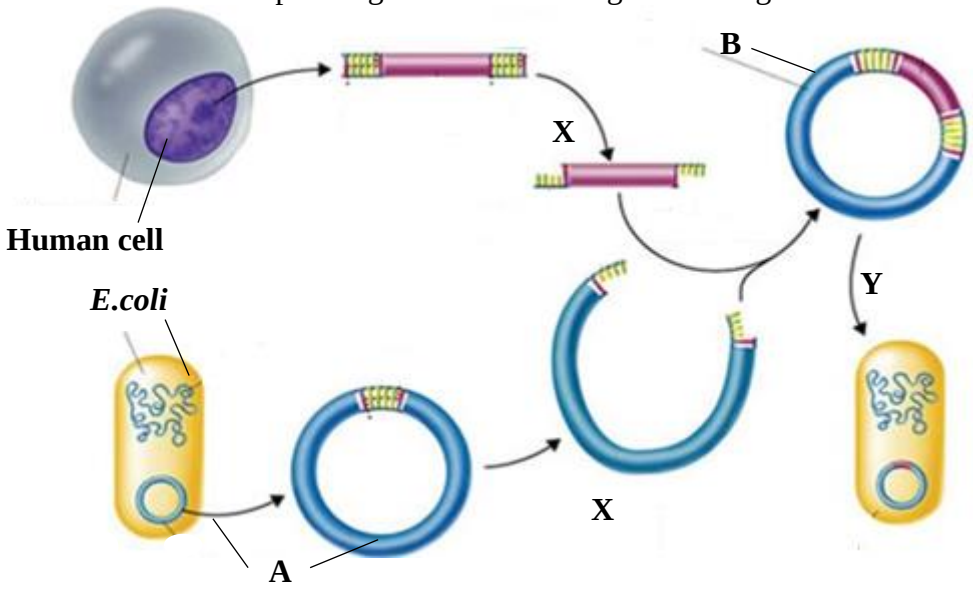

FIGURE 8

i. Give **TWO** characteristics of **A** as a cloning vector. [2 *marks*]

_____

_____

ii. Explain the characteristics of ***E. coli*** as host cell. [2 *marks*]

_____

_____

_____

iii. Name the structures label **B** and process **Y**. [2 *marks*]

Structure B : _____

Process Y : _____

iv. State the role of the enzyme **X**. [1 *mark*]

_____

v. Describe how structure **B** are formed. [3 *marks*]

_____

_____

_____

_____

7. a) **FIGURE 9** shows a process of spermatogenesis in human.

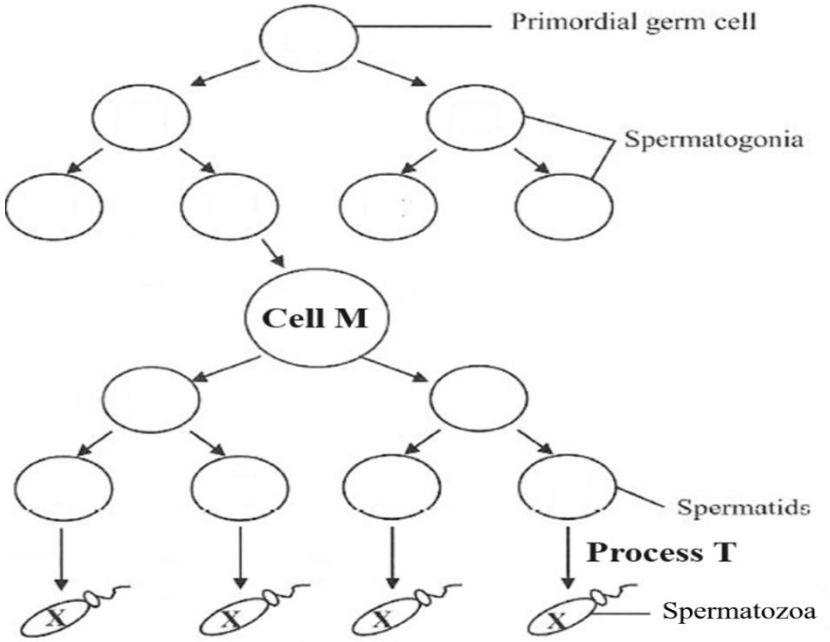

FIGURE 9

i. Name cell **M**. [1 *mark*]

_____

ii. Describe the effects of process **T** if Sertoli cell is absent in seminiferous tubule? [2 *marks*]

_____

_____

_____

b) **FIGURE 10** shows the changes of hormone level in the reproductive cycle of a woman.

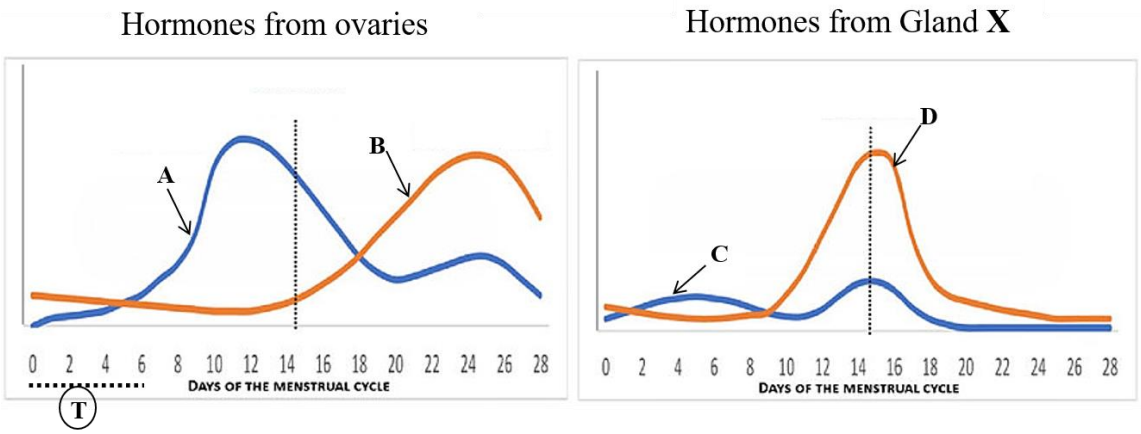

FIGURE 10

i. Name the hormones labelled **A** and **B**. [2 *marks*]

A: _____

B: _____

ii. What is the function of the hormones secreted by gland **X**? [2 *marks*]

_____

_____

iii. Identify phase **T** which occurs in menstrual cycle. [1 *mark*]

_____

iv. Explain the event that occur after phase **T** in menstrual cycle. [1 *mark*]

_____

v. Explain the effect of high peak of hormone **D** to the event occur in ovarian cycle. [3 *marks*]

_____

_____

_____

c) **FIGURE 11** below shows different concentration of different hormones during pregnancy.

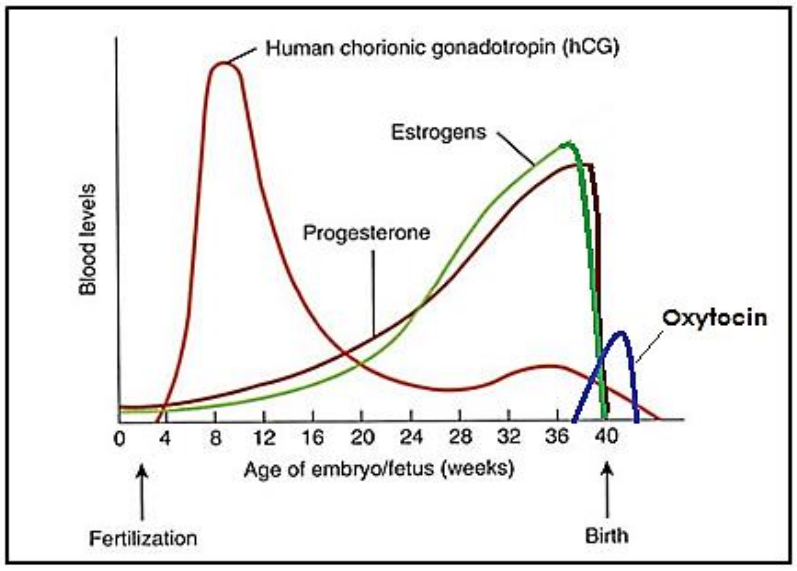

FIGURE 11

i. Explain the effects if hCG failed to be secreted during the first trimester. [2 *marks*]

_____

_____

_____

ii. Describe **TWO** roles of oxytocin during parturition. [2 *marks*]

_____

_____

_____