Second Semester

Biology

(الأحياء)

(Questions)

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٤٤ هـ - ٢٠٢٢ / ٢٠٢٣ م

الدور الأول - الفصل الدراسي الثاني

تنبيه:
- المادة: الأحياء.
- الأسئلة في (١٦) صفحة.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (○) وفق النموذج الآتي:

س - عاصمة سلطنة عمان هي:

○ القاهرة ○ الدوحة

● مسقط ○ أبوظبي

ملاحظة: يتم تظليل الشكل (●) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ● **غير صحيح** ▭ ◉ ◔ ✗ ✓

مُسَوَّدَة، لا يتم تصحيحها

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NOTE: You can use the mRNA triplet codons and amino acids table in page 16.

Question 1: Multiple Choice Items (14 marks)

There are 14 multiple-choice items worth one mark each.
Shade in the bubble (⬭) next to the **correct** answer for each of the following items.

1) What is the correct statement about the semi-conservative replication?

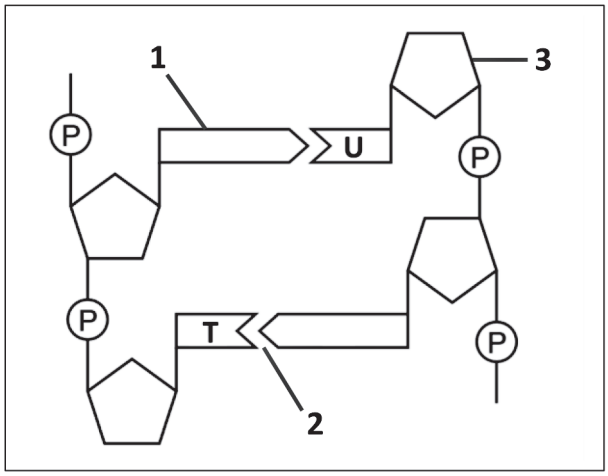
⬭ All DNA molecules formed would have two new strands.

⬭ All DNA molecules formed would have two original strands.

⬭ The original DNA molecule would remain at the end of the process.

⬭ Each DNA molecule formed would have one new strand and one original strand.

2) The diagram below shows a strand of DNA and mRNA during transcription.



Which of the following correctly identifies the structures labeled 1, 2 and 3?

	1	2	3
⬭	purine	two hydrogen bonds	deoxyribose
⬭	pyrimidine	three hydrogen bonds	ribose
⬭	purine	two hydrogen bonds	ribose
⬭	pyrimidine	three hydrogen bonds	deoxyribose

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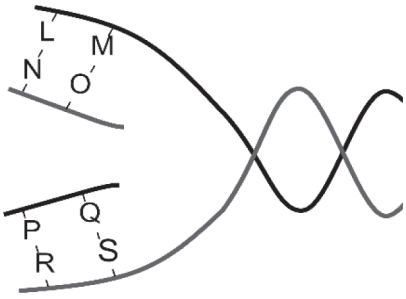
Question 1 continued



3) The diagram opposite represents DNA during replication.

If the base (**L**) represents **thymine**, and the base (**M**) represents **guanine**,

Which letters represent the base **adenine**?

- ☐ N and P
- ☐ N and R
- ☐ O and S
- ☐ O and Q

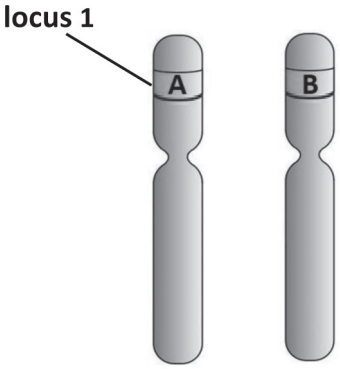
4) A polypeptide has the following amino acid sequence:

Ala - Cys - Lys - Ile - Asp

The sequence of DNA coding for this section of the polypeptide could be:

- ☐ CGT TCG TTT TAT TTG
- ☐ CGT ACG TTT TAT TTG
- ☐ CGA ACA TTC TAT TTT
- ☐ CGT ACT TTT TAC TTG

5) In the diagram below, the term that accurately defines the forms labeled (A) and (B) that are found at **locus (1)** is called:



- ☐ alleles
- ☐ genes
- ☐ chromosomes
- ☐ bivalents

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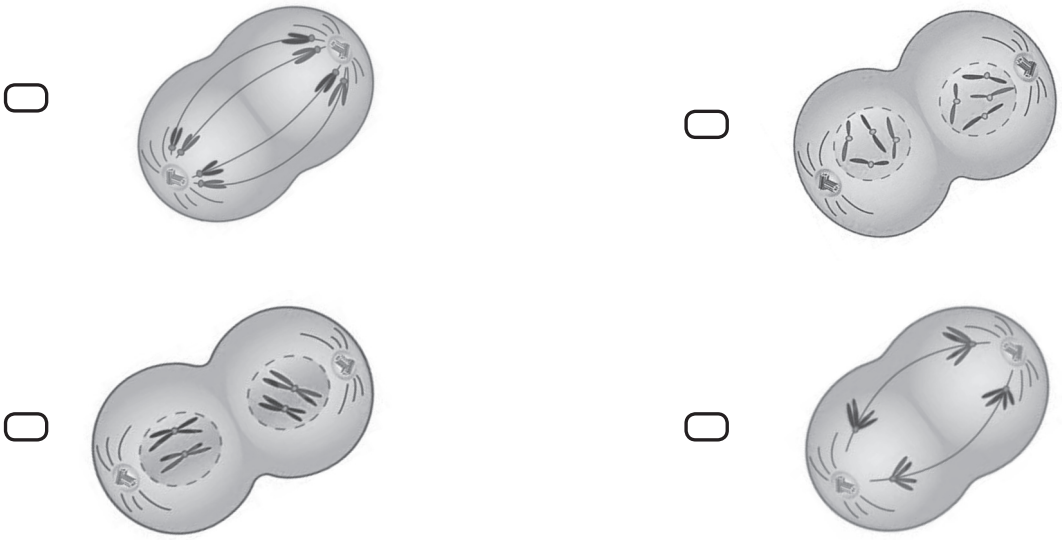
Question 1 continued

6) Which of the cells below represents the stage of telophase II?

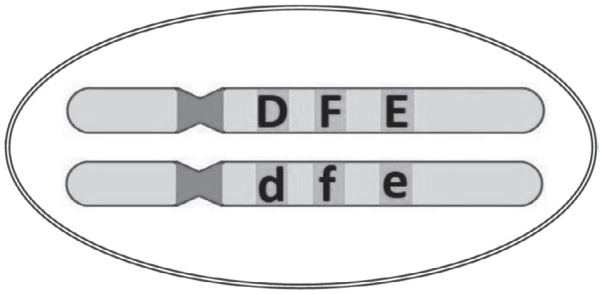


7) A healthy person has less than 36 repeats of CAG triplet in the HTT gene. A person with over 36 repeats of CAG might develop Huntington's disease.

This change in repeats number is an example of:

- repetition
- deletion
- substitution
- insertion

8) The diagram below shows 3 loci without a crossing over event.



An expected genotype in the gametes produced from this individual is:

- DFe
- dfE
- Dfe
- DFE

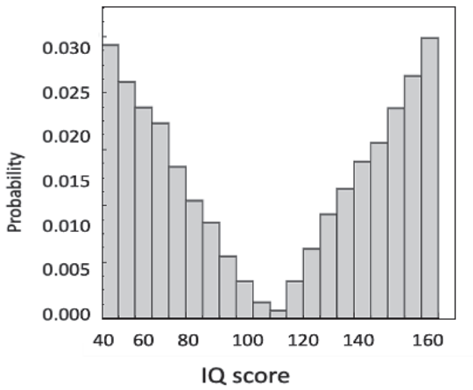
Question 1 continued

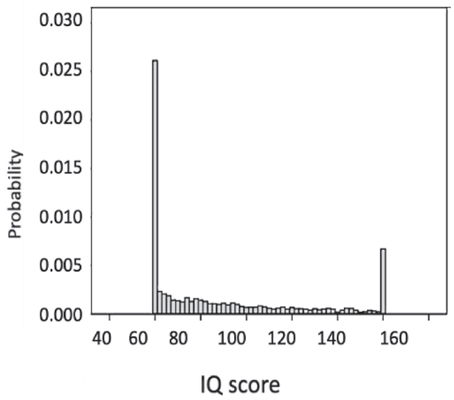
9) The type of variation that arises when the characteristic concern is one of two or more discrete types without intermediate forms is called:

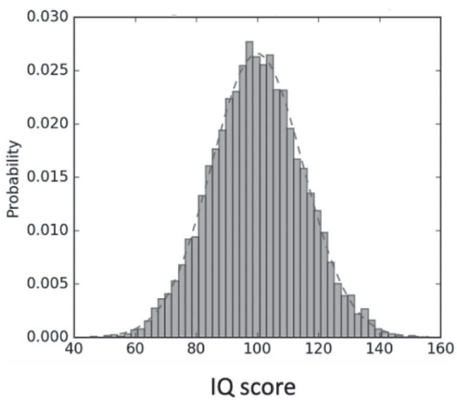
- ○ continuous variation
- ○ discontinuous variation
- ○ phenotypic variation
- ○ genetic variation

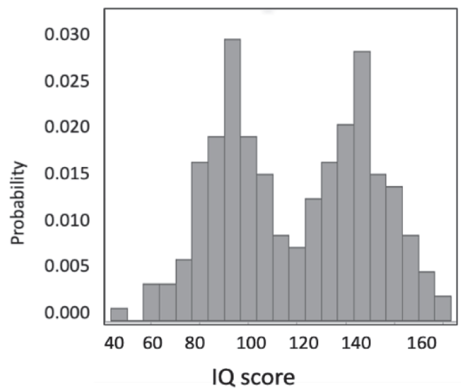
10) Intelligence in humans is measured by IQ tests and controlled by many genes.

The plot that represents the variation of this trait in a population is:

○ 

○ 

○ 

○ 

11) A tool that is used to identify the genes present in an organism's genome and to find out which genes are expressed within cells is called:

- ○ microarrays.
- ○ genetic screening.
- ○ electrophoresis.
- ○ gene therapy.

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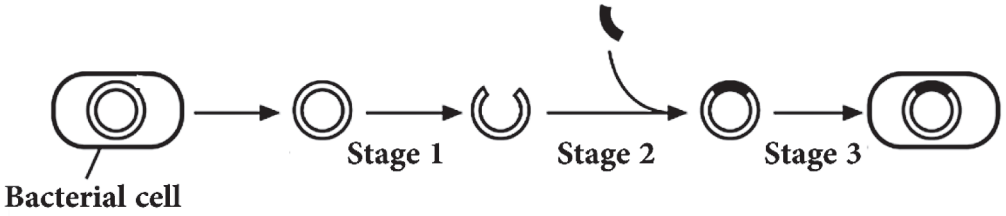
Question 1 continued

12) The diagram below shows the stages used in genetic engineering.



What enzymes are used in stages 1 and 2?

	Stage 1	Stage 2
☐	Ligase	Restriction endonucleases
☐	Restriction endonucleases	Ligase
☐	DNA polymerase	Ligase
☐	Restriction endonucleases	DNA polymerase

13) What are the benefits of genetic engineering for crops?

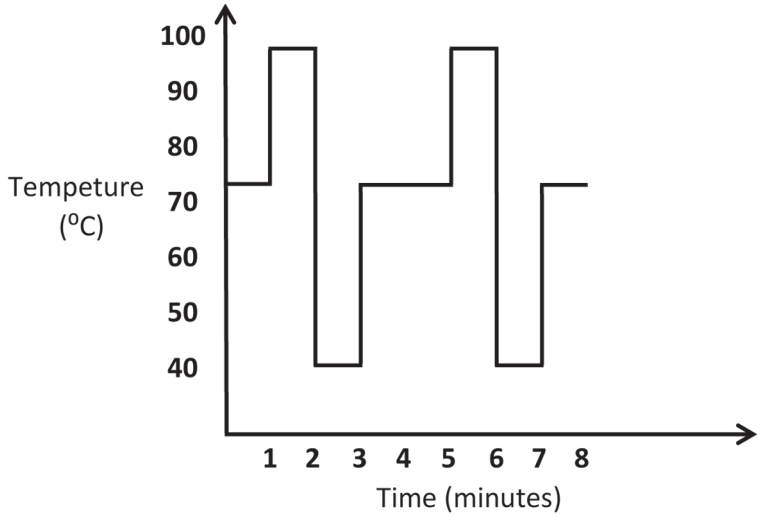
(Choose from the four statements below).

1. produce herbicide-resistant crops.
2. reduce some costs for farmers.
3. evolving of herbicide-resistant weeds.
4. increase crop yields.

☐ 1, 2, 3 and 4
☐ 1, 2 and 4 only
☐ 1, 2 and 3 only
☐ 3 and 4 only

Question 1 continued

14) The graph below shows how temperature changes during repeated cycles of a polymerase chain reaction (PCR).



At which periods do DNA strands separate?

- ☐ (1 – 2) and (5 – 6)
- ☐ (1 – 2) and (6 – 7)
- ☐ (2 – 3) and (5 – 6)
- ☐ (2 – 3) and (6 – 7)

Question 2: Extended Responses (56 marks)

Write your answer for each of the following questions in the space provided.
Be sure to show all your work, including the correct units where applicable.

15) (4 marks)

a. How are two polynucleotide chains of DNA normally held together?

b. The table below shows the percentage composition of bases in the DNA of two different organisms.

	% Adenine	% Guanine	% Thymine	% Cytosine
Organism 1	20	X	Y	Z
Organism 2	25	24	33	18

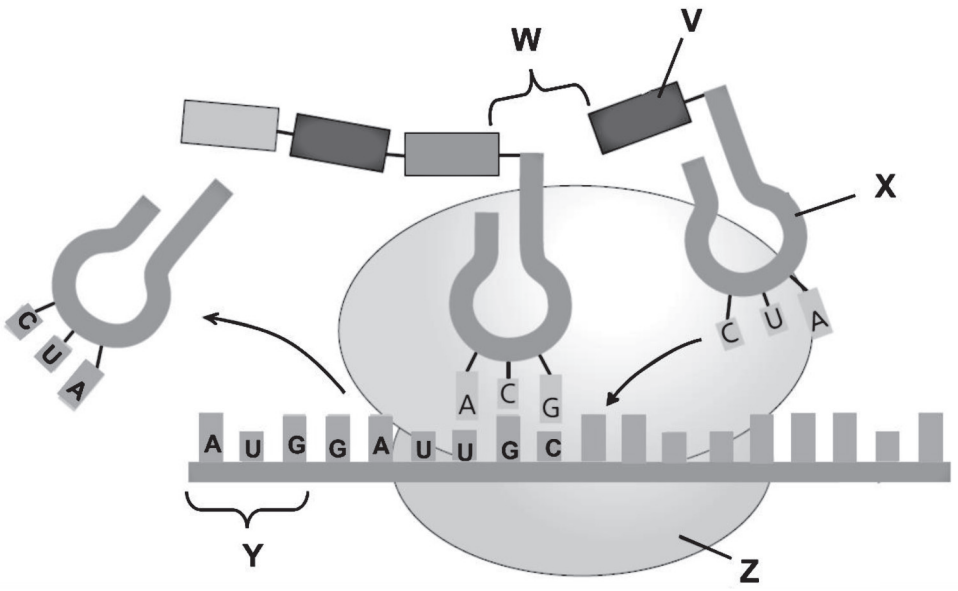
(i) Based on the DNA structure, calculate the value (X).

(ii) **Organism 2** has a single-stranded DNA as its genetic material.

State an evidence from the table above that suggests that the DNA is single-stranded.

Question 2 continued

16) The diagram below shows a biological process in a living cell. (6 marks)



a. What is this biological process?

_____

b. Name the parts labeled (**X**), (**Y**) and (**Z**).

X: _____

Y: _____

Z: _____

c. Describe the process at the stage labeled (**W**).

_____

_____

d. Identify the **DNA sequence** codes for the amino acid labeled (**V**).

_____

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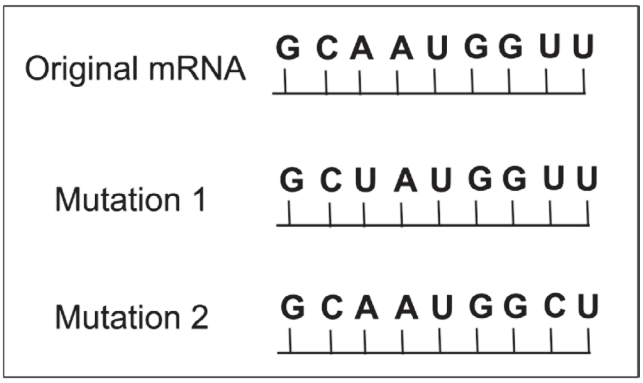
Question 2 continued

17) (5 marks)

a. If a mutation took place in a gamete-producing cell, will it be less or more harmful?

Explain your answer.

b. The diagram below shows the effects of two different mutations of the DNA on the base sequence of the mRNA.



(i) Name the type of mutation represented by mutation 1.

(ii) Explain how each mutation may affect the polypeptide for this section of the DNA which is part of the code.

- Mutation 1:

- Mutation 2:

Question 2 continued

18) a. In sheep, the texture of the fleece coat (hairy or wooly) is controlled by a single gene with two alleles. The dominant allele produces a hairy coat while the recessive allele produces a wooly coat. (8 marks)

A sheep keeper crossed two heterozygous sheep and 3 lambs were produced.

(Use the letter **H** to write the genotypes).

(i) Define "dominant allele".

_____

_____

(ii) State the following:

- The parental genotype. _____

- The possible gametes genotypes of the parents. _____

- The possible phenotypes of the produced lambs.

_____

b. In an ornamental plant, one locus on chromosome 7 has two alleles: (**A**) and (**a**), and a second locus on chromosome **11** has two alleles: (**D**) and (**d**). The allele (**A**) will produce red flowers while the allele (**a**) will produce orange flowers. However, both colors can only be produced when allele (**D**) is expressed.

(i) Define the term "locus".

_____

(ii) What type of effect has allele (D) in relation to allele (d)?

_____

(iii) Explain why it is possible for a heterozygous plant of this species to produce four types of gametes from these two loci.

_____

(iv) Write one possible genotype of an orange flower.

_____

Question 2 continued

19) PRPS1 is a gene located on the sex determining chromosome **X**. There are two alleles that determine the phenotype of the ability to hear. The allele (**H**) is a normal allele and enables hearing, while the allele (**h**) results in deafness (loss of hearing).

A child who is deaf was born to parents both of whom had normal hearing. (5 marks)

a. Name the type of inheritance of this gene.

_____

b. Write the genotypes of the parents.

- Father's genotype:

_____

- Mother's genotype:

_____

c. Predict the probabilities in this family for:

- a daughter with normal hearing.

_____

- the grandmother from the father's side is affected by deafness.

_____

Question 2 continued

20) The body color in a fish species is controlled by multiple genes. One of these genes has two alleles: (**F**) and (**f**), which determine whether the color is purple or blue. Allele (F) produces the color purple, and allele (f) produces the color blue.

A second **non-linked** gene controls the intensity of the color. It has two alleles: ($\mathbf{N^D}$) and ($\mathbf{N^L}$), both of which have an equivalent effect on each other. Allele ($\mathbf{N^D}$) produces a dark color and ($\mathbf{N^L}$) produces a light color. The colors that might result from all possible combinations of the alleles of these two genes is shown in the table below.

(5 marks)

Color	Intensity of color		
	light	**medium**	**dark**
purple	light pink	deep pink	purple
blue	sky blue	royal blue	navy blue

a. **(i)** Write the term that describes the effect of both alleles ($\mathbf{N^D}$) and ($\mathbf{N^L}$).

_____

(ii) Describe the term "non-linked genes".

_____

_____

b. State the following genotypes of:

- Heterozygous purple fish. _____

- Royal blue. _____

c. If the alleles determining the color were both have an equal effect on color when they are present (produce stripes of colors), they are termed ($\mathbf{F^A}$) and ($\mathbf{F^B}$).

State the phenotype of the fish having the genotype: $\mathbf{F^AF^BN^DN^L}$.

_____

Question 2 continued

21) The leaf length in a species of grass is a polygenic trait and is influenced by two genes (**A**) and (**B**) located on different chromosomes. This phenotype is also affected by environmental factors such as the quantity of light. Both (**A**) and (**B**) alleles will add **5 cm** to the leaf length each, while (**a**) and (**b**) alleles will add **3 cm** each. (7 marks)

a. State the meaning of "environmental factors".

_____

_____

b. What is the type of genetic variation for the leaf length?

_____

Prove your answer.

_____

c. Write the phenotypes (length of the leaf in cm) for the offspring in the table below.

Parent 1 / Parent 2	AB	Ab	aB	ab
AB	_____	18 cm	_____	_____

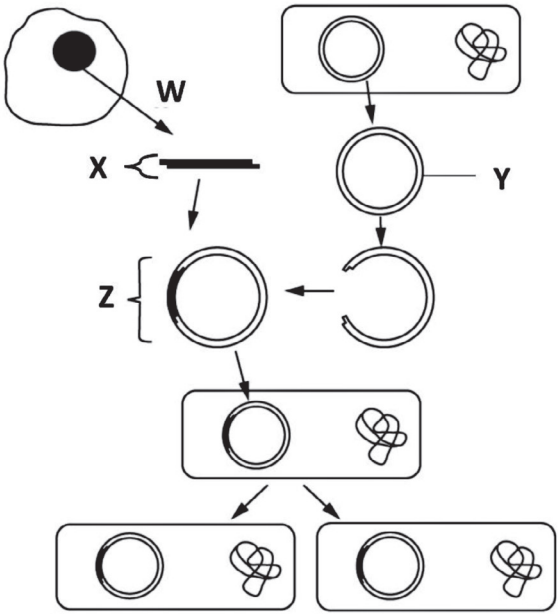
d. In another species of plants, this trait (leaf length) is also influenced by a third gene. This gene has 2 alleles: (C) will add 2 cm to the length and (c) will add 1 cm.

Predict the **phenotype** of a plant with the genotype **AAbbCc**.

_____

Question 2 continued

22) (TPAs) are human proteins that are used as drugs to break down blood clots.
TPAs can be produced by genetically-engineered bacteria.
The diagram below shows some of the stages involved in genetically engineering a bacterium to make a TPA. (7 marks)



a. Name the structures labeled (**X**) and (**Y**).

X: _____

Y: _____

b. (**W**) represents the action of an enzyme on a molecule of DNA.

State the name of this enzyme.

_____

c. Explain how the structure (**X**) is inserted into the structure (**Y**) to form the structure (**Z**).

_____

_____

d. Before (TPA) is made by genetically-engineered bacteria it was only available from blood donated by people.

Suggest two advantages of producing (TPA) by genetically-engineered bacteria.

1. _____

2. _____

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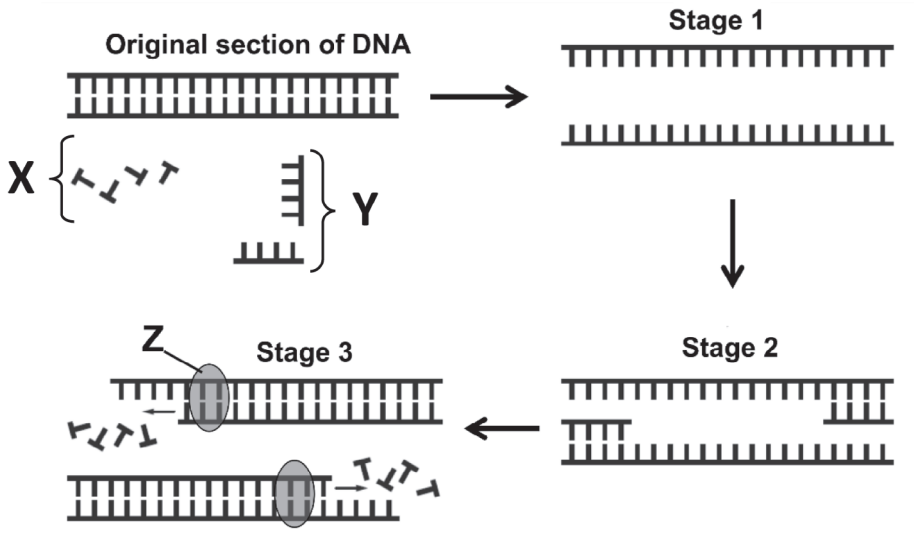
Question 2 continued

23) The diagram below shows the stages in one polymerase chain reaction (PCR) cycle (6 marks)



a. Identify the structures labeled (Y) and (Z).

Y: _____

Z: _____

b. (PCR) was first used to help solve a crime in 1986.
Suggest why (PCR) can now be used to help solve a crime committed in 1980, where only a small blood spot was found as evidence.

_____

c. Each stage of (PCR) is temperature dependent.
Complete the table for stages 1 and 3.

Stage	Temperature (°C)	Reason
1	95	_____
3	_____	To allow replication of DNA.

d. Describe the role of the structure labeled (**X**) in stage **2**.

_____

_____

Question 2 continued

24) (3 marks)

a. Give an example of the uses of genetic technology in:

- Medicine:

_____

- Insect resistant crops:

_____

b. A person is free of the symptoms of Cystic fibrosis.

Which test is used to check if he is free of the alleles of the disease?

_____

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

mRNA triplet codons and amino acids table

[End of Examination]

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مُسَوَّدَة

مُسَوَّدَة

سلطنة عمان
وزارة التربية والتعليم

مركز القياس والتقويم التربوي
The Center for Educational Assessment and Measurement (CEAM)

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٤٤ هـ - ٢٠٢٢ / ٢٠٢٣ م

الدور الثاني - الفصل الدراسي الثاني

تنبيه:
- المادة: الأحياء.
- الأسئلة في (١٤) صفحة.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

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- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (▭) وفق النموذج الآتي:

س - عاصمة سلطنة عمان هي:

▭ القاهرة ▭ الدوحة

▬ مسقط ▭ أبوظبي

ملاحظة: يتم تظليل الشكل (▬) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ▬ **غير صحيح** ▭ ◉ ◒ ☒ ☑

مُسَوَّدَة، لا يتم تصحيحها

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Question 1: Multiple Choice Items (14 marks)

There are 14 multiple-choice items worth one mark each.
Shade in the bubble (○) next to the **correct** answer for each of the following items.

1) Which nitrogenous bases are pyrimidines?

- ○ adenine and thymine.
- ○ cytosine and guanine.
- ○ thymine and uracil.
- ○ uracil and guanine.

2) A fragment of DNA contained 140 nucleotide base pairs.

What is the total number of deoxyribose sugars in this fragment?

- ○ 40
- ○ 70
- ○ 140
- ○ 280

3) The diagram below shows the base sequence for a section of a gene and a mutated version of this section.

section of gene	C G T A T A T C C T A T G C C C C T G A C
mutated version	C G T A T A T C C T A T C T C C C T G A C

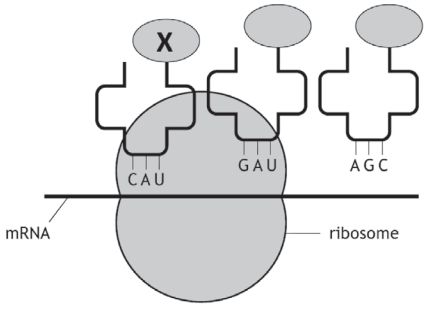
This is an example of:

- ○ a deletion mutation.
- ○ an insertion mutation.
- ○ a substitution mutation.
- ○ a translocation mutation.

4) The diagram below shows three tRNA molecules and their attached amino acids during translation.

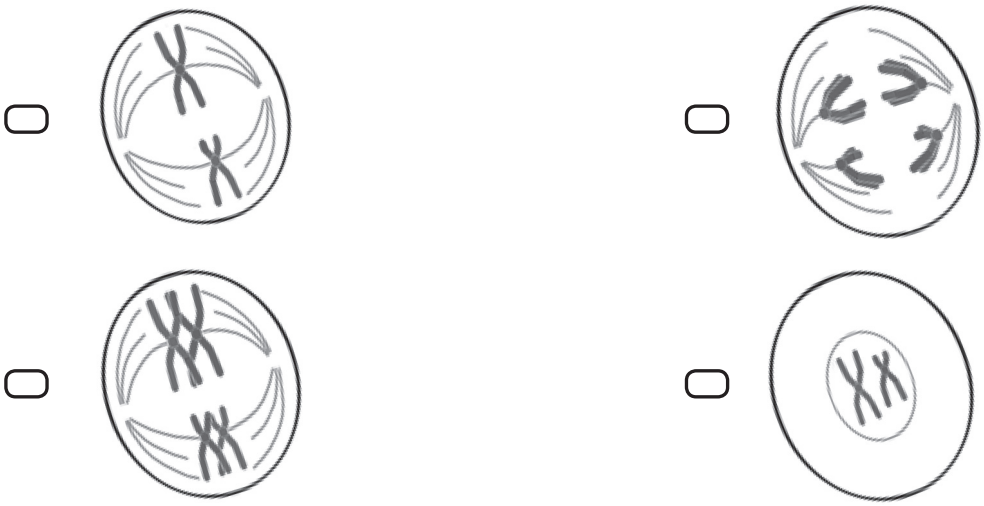
Identify the **DNA** sequence that codes for the amino acid labeled **(X)**.

- ○ CAT
- ○ GUA
- ○ GTA
- ○ CAU

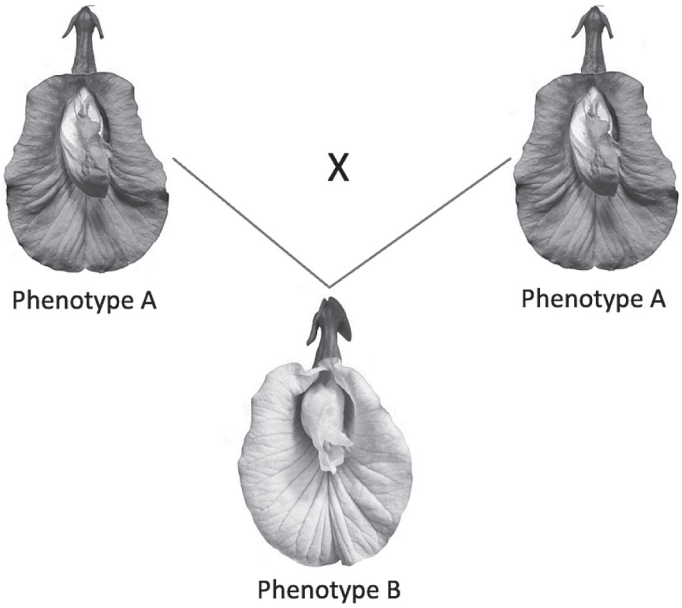


Question 1 continued

5) The diagram that represents the stage of metaphase I of meiosis is:



6) The diagram below represents a cross between two heterozygous for the color of the flower's petals.



The correct term that describes the alleles of phenotype **B** is:

- dominant
- recessive
- codominant
- hybrid

Question 1 continued

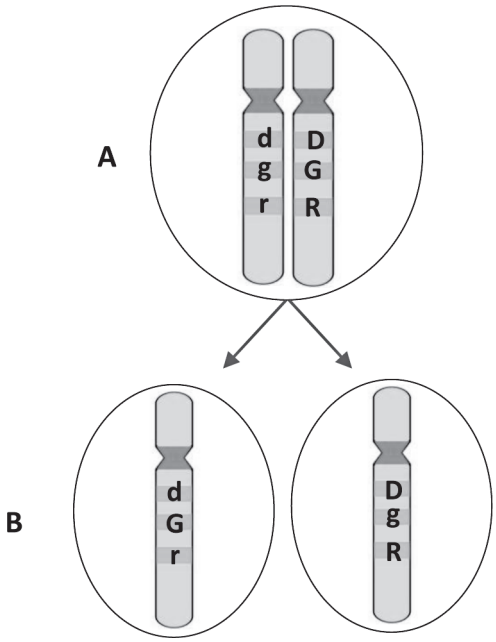
7) Below are two segments of alleles.

ACTGGCTACGGATAGCC ⇨ ACTGGCTACGGATAGC

The type of mutation that is responsible for the two variants is:

- ☐ substitution.
- ☐ deletion.
- ☐ insertion.
- ☐ repetition.

8) The diagram below shows a process in the sexual reproduction.

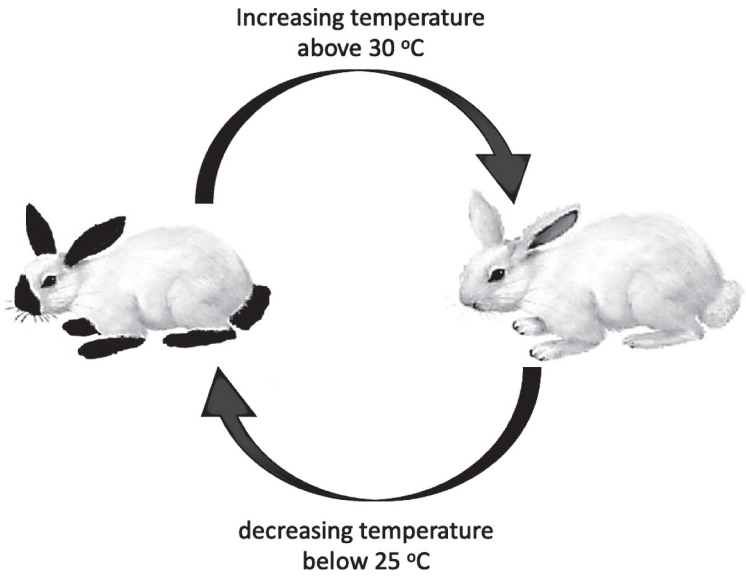


The correct statement that describes product **(B)** in relation to **(A)** is:

☐	Independent assortment	new combination	diploid
☐	dependent assortment	new combination	diploid
☐	Independent assortment	new combination	haploid
☐	dependent assortment	new combination	haploid

Question 1 continued

9) The diagram below demonstrates how the fur color in some rabbits responds to the change in the surrounding temperature.



The type of the factor that plays a role in changing the phenotype of the rabbit's fur is:

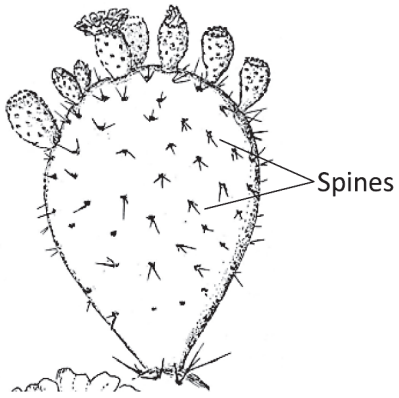
- ☐ environmental only.
- ☐ genetic only.
- ☐ environmental and genetic.
- ☐ mutation.

10) The diagram opposite shows the cactus plant.

The density of the spines is broadly variable among the population of cactus.

The bases of inheritance of this trait in cactus is:

- ☐ multiple alleles.
- ☐ multiple genes.
- ☐ two alleles.
- ☐ linked genes.

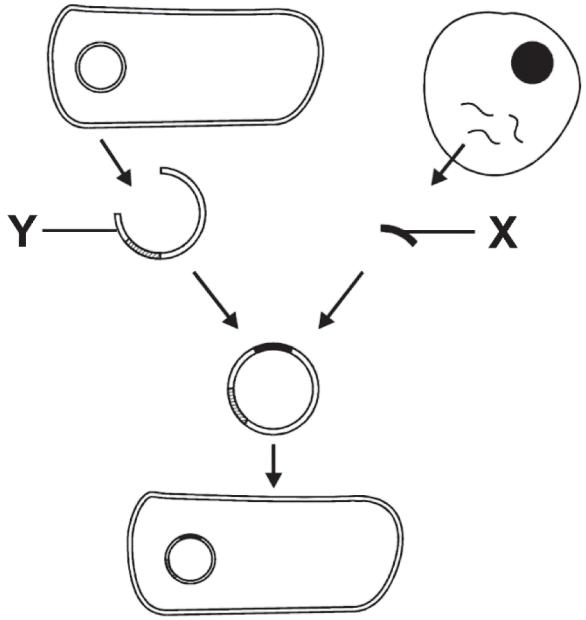


Question 1 continued

11) "DNA made by artificially joining together pieces of DNA from two or more different species" is known as:

- ▢ genetic engineering.
- ▢ recombinant DNA.
- ▢ genetic screening.
- ▢ genetically modified organism.

12) The diagram below shows how insulin can be made using Genetic engineering.



What are the structures labeled **(X)** and **(Y)**?

	X	Y
▢	vector	insulin gene
▢	insulin gene	vector
▢	plasmid	insulin gene
▢	plasmid	vector

Question 1 continued

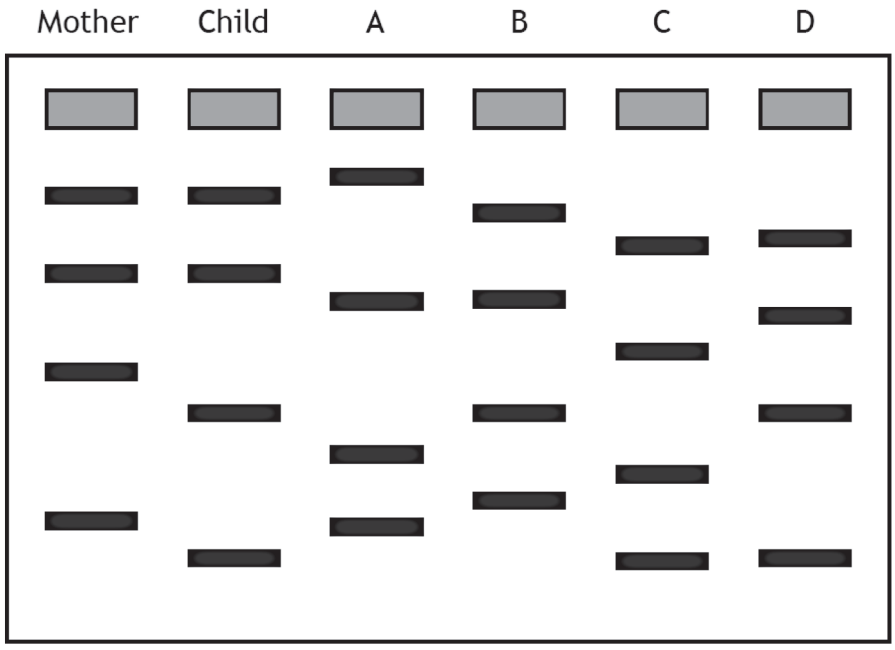
13) What could be the benefits of genetic engineering in salmon?

(Choose from the following statements)

1. modified salmon are able to grow all year.
2. less time to reach market size.
3. modified salmon reduce their ability to compete with wild salmon in a natural environment.

- ☐ 1, 2, and 3
- ☐ 1 and 2 only
- ☐ 2 and 3 only
- ☐ 1 and 3 only

14) DNA from a mother, a child and four men (A, B, C and D) in a paternity suit was analyzed as shown in the diagram below.



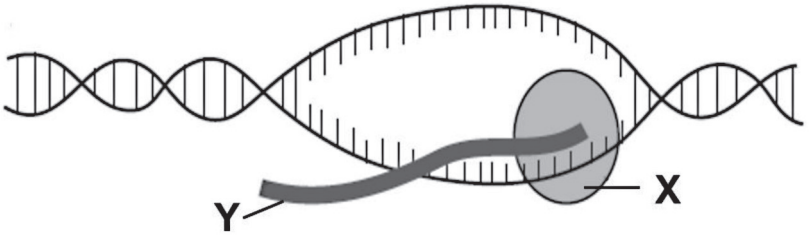
From the results shown in the diagram above, who is the father of the child?

- ☐ A
- ☐ B
- ☐ C
- ☐ D

Question 2: Extended Responses (56 marks)

Write your answer for each of the following questions in the space provided.
Be sure to show all your work, including the correct units where applicable.

15) The diagram below shows a biological process in a living cell. (4 marks)



a. **(i)** Name this process. _____

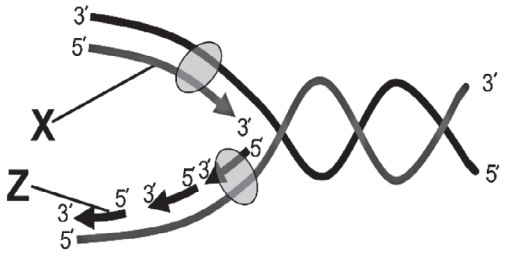
(ii) Where does this process take place? _____

b. Name the structures labeled **(X)** and **(Y)**.

(X): _____

(Y): _____

16) The diagram below shows replication of DNA. (5 marks)



a. **(i)** Name the structure labeled **(X)**.

_____

(ii) Explain why only the structure labeled **(X)** can be replicated continuously.

_____

_____

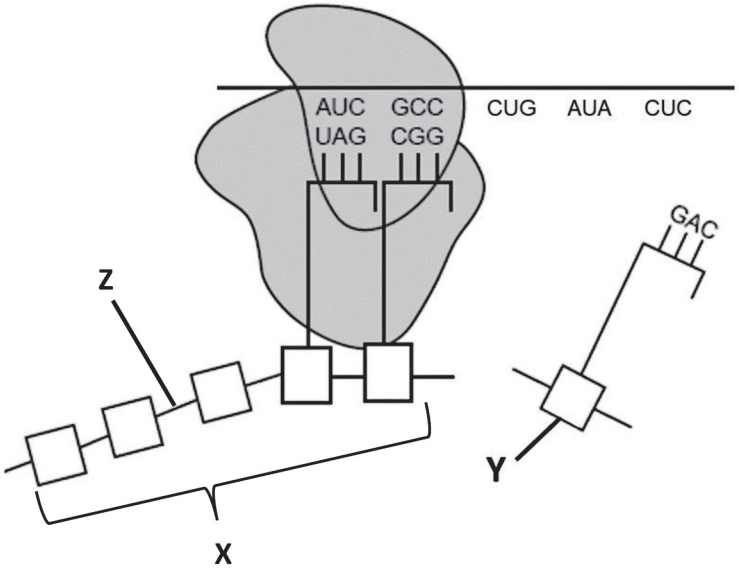
b. **(i)** Name the fragments labeled **(Z)**. _____

(ii) What is the enzyme that joins the fragments labeled **(Z)** together?

_____

Question 2 continued

17) The diagram below shows part of the translation process. (6 marks)



a. Name the structures labeled **(X)** and **(Z)**.

(X): _____

(Z): _____

b. What is the amino acid labeled **(Y)**? _____

c. State the DNA code for the amino acid labeled **(Y)**. _____

d. Briefly describe the translation process.

_____

_____

_____

_____

_____

Question 2 continued

18) a. In a species of animals, the allele for a brown coat color is dominant to grey, and the allele for red eyes is dominant to blue.

(Use the symbols **(B)** and **(b)** for the alleles for the coat color and **(R)** and **(r)** for the alleles for the eye color). (8 marks)

(i) State the term that describes the inheritance of the two genes.

(ii) Write the following:

- the genotype of a heterozygous brown coat animal with blue eyes:

- the phenotype for **(bbRr)** genotype:

(iii) In a cross of this species two individuals were born with blue eyes and a grey coat. Determine the parental genotype if both parents had a brown coat and red eyes.

b. In a family both parents' blood group were **AB**, and they have two kids, one with **A** blood group and the other with **B** blood group.

(i) State the type of the interaction between alleles **A** and **B**.

(ii) Construct a genetic diagram to demonstrate how the two kids have inherited their blood groups.

Question 2 continued

19) Rhododendron indicum is an evergreen flowering plant. One gene termed (I), controls the color of the flower and has four alleles. The interaction between these alleles is illustrated in the table below. (5 marks)

genotype	phenotype
$I^P I^P$	purple
$I^C I^C$	carmine
$I^R I^R$	red
$I^C I^R$	carmine
$I^R I^P$	purple
$I^C I^P$	dots of purple and carmine

The expression of the colors carmine, red and purple is affected by another gene called **(E)**. The dominant allele of this gene allele produces a substance that blocks the production of the color resulting in a **white** flower. While the recessive allele **(e)** allows the production of the color.

a. State the term that describes the existence of three or more alleles of a gene.

_____

b. What are the phenotypes for the following flowers?

- $I^P I^P$ Ee: _____

- $I^C I^P$ ee: _____

c. State the genotypes for the following phenotypes:

- a red flower that was produced from purple and carmine parents:

_____

- a pure carmine flower that was produced from white parents.

_____

Question 2 continued

20) **Fragile X syndrome (FXS)** is a genetic disorder characterized by intellectual disabilities. The gene **(FMR)** located on chromosome **X** codes for a protein which is necessary for the healthy development of the brain. The syndrome is caused by the recessive allele of this gene that fails to produce the protein. (5 marks)

a. State the terms that can be used to describe the following:

- inheritance pattern of **(FXS)**.

_____

- an individual that has one disease causing allele but his phenotype is normal.

_____

b. The table below demonstrates parental gametes in a family.

Write the possible **phenotypes** of sons and daughters that were born to this family.

Male \ Female	X^F	X^f
X^F	_____	_____
Y	_____	_____

c. In another family, a girl was born affected with (FXS) disease. Predict her father's genotype.

_____

Question 2 continued

21) The weight of the fruit in a variety of watermelon can reach up to 6 kg and controlled by two genes **(M)** and **(L)**. The dominant allele for each gene will promote the production of the heavy weight of the fruit. Two homozygous plants for the heavy fruits were crossed and the seeds were planted in different mediums as follow: (7 marks)

Medium	Medium features	Weight of the fruit
Medium A	High nutrients soil + low spacing + 20 °C	3 kg
Medium B	Poor nutrients soil + low spacing + 20 °C	1 kg
Medium C	High nutrients soil + large spacing + 20 °C	4 Kg
Medium D	Poor nutrients soil + large spacing + 20 °C	1.5 kg

a. State the type of variation in the size of the watermelon's fruit.

Prove your answer.

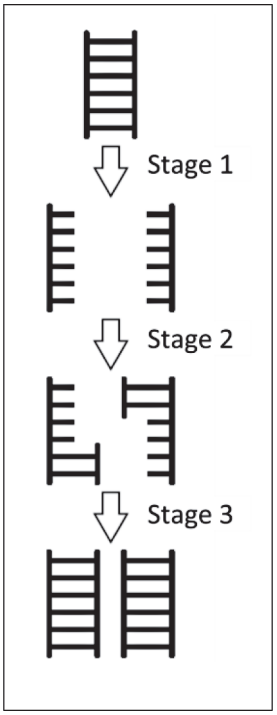
b. **(i)** From the table above, suggest two factors that affect the size of the water melon.

(ii) When the seeds from the plants grown in **medium B** were planted in **medium C** they reached 4 kg. Explain this observation.

c. The optimum temperature for the watermelon to reach its full potential of weight is 25 °C. Predict **the weight** of the fruits produced from the cross mentioned above and grown in a medium of high nutrients soil and large spacing at 25 °C.

Question 2 continued

22) The diagram represents three stages during one cycle of the polymerase chain reaction (PCR). (7 marks)



a. Describe the **stage 1.**

_____

_____

b. **(i)** Name the enzyme used in **stage 3**.

_____

(ii) Suggest an advantage of using a heat-stableform of this enzyme during PCR.

_____

_____

c. State what is happening to the DNA in (PCR) and gel electrophoresis.

- in PCR:

_____

- in gel electrophoresis:

_____

_____

Question 2 continued

23) "Sticky ends" is a term used in genetic engineering. (4 marks)

a. Explain what is meant by the term "sticky ends".

b. Outline the significance of "sticky ends" in genetic engineering.

24) **Cystic fibrosis (CF)** is a genetic disorder. (5 marks)

a. One way of treating **CF** is by using gene therapy.
What is meant by gene therapy?

b. Describe one way in which **CF** affects the lungs.

c. State two advantages of using genetic screening to treat **CF**.

d. Describe how two parents who do not have **CF** may have a child with **CF**.

[End of Examination]

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

mRNA triplet codons and amino acids table

مُسَوَّدَة

سلطنة عمان
وزارة التربية والتعليم

مركز القياس والتقويم التربوي
The Center for Educational Assessment and Measurement (CEAM)

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٤٣ هـ - ٢٠٢١ / ٢٠٢٢ م

الدور الأول - الفصل الدراسي الثاني

تنبيه:
- المادة: الأحياء.
- الأسئلة في (١٦) صفحة.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (▭) وفق النموذج الآتي:

س - عاصمة سلطنة عمان هي:

▭ القاهرة ▭ الدوحة

▬ مسقط ▭ أبوظبي

ملاحظة: يتم تظليل الشكل (▬) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ▬ **غير صحيح** ▭ ◉ ◒ ✗ ✓

مُسَوَّدَة، لا يتم تصحيحها

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Question 1: Multiple Choice Items (14 marks)

There are 14 multiple-choice items worth two marks each.
Shade in the bubble (○) next to the **correct** answer for each of the following items.

1) A gene mutation is the result of a change in the sequence of:

○ genes ○ bases
○ codons ○ alleles

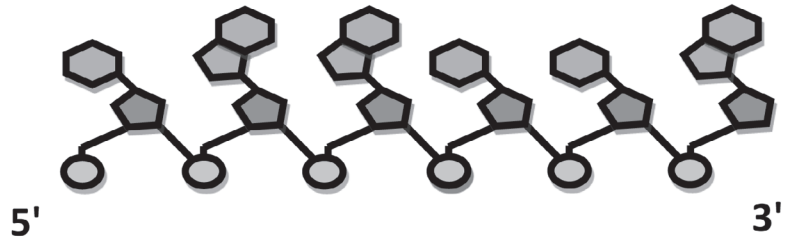
2) One RNA molecule is made up of sub-units called:

○ nucleotides ○ amino acids
○ nitrogen bases ○ phosphates groups

3) How many codons are required to make a polypeptide that contains 300 amino acids?

○ 101 ○ 301
○ 300 ○ 601

4) What is the correct sequence of the nucleotides in this DNA strand?



○ ACCGAC ○ GCCAAT
○ TAACTG ○ CTTAAT

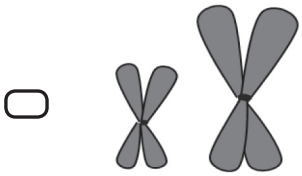
5) A double stranded DNA molecule has 30% of Adenine (A) bases.

What is the percentage of Cytosine (C) in this molecule?

○ 15% ○ 20%
○ 30% ○ 40%

Question 1 continued

6) Which of the following diagrams represents homologous chromosomes?



7) The table below shows the order of events of cell division in the first phase of meiosis I.

Which row represents the correct order?

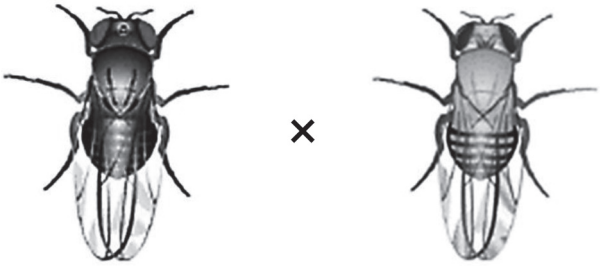
☐	1. Crossing over between homologous chromosomes.	2. Condensation of chromosomes.	3. Pairing of homologous chromosomes.
☐	1. Pairing of homologous chromosomes.	2. Condensation of chromosomes.	3. Crossing over between homologous chromosomes.
☐	1. Pairing of homologous chromosomes.	2. Crossing over between homologous chromosomes.	3. Condensation of chromosomes.
☐	1. Condensation of chromosomes.	2. Pairing of homologous chromosomes.	3. Crossing over between homologous chromosomes.

Question 1 continued

8) Which of the following crosses will give a birth ratio of 25% to a child who has blood group (O)?

- ☐ (B) heterozygous × (A) heterozygous
- ☐ (A) homozygous × (B) homozygous
- ☐ (A) heterozygous × (B) homozygous
- ☐ (B) heterozygous × (A) homozygous

9) The diagram below shows the body color of two drosophila flies in a cross experiment.



What are the parent's genotypes if the phenotypes ratio of the offspring was 1:1 normal to ebony body?

- ☐ Nn × Nn
- ☐ Nn × nn
- ☐ NN × nn
- ☐ nn × nn

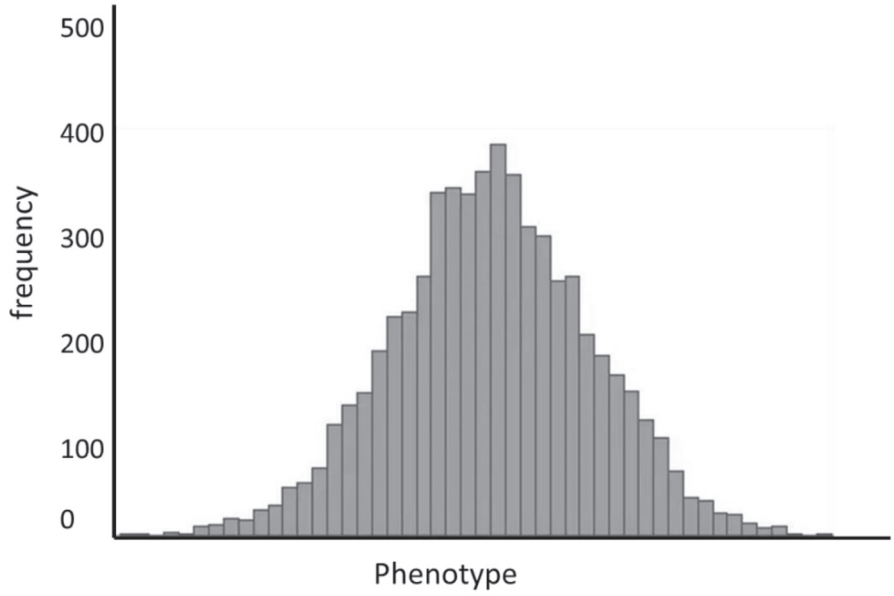
10) In a mammal species the coat color of males is always grey or yellow or brown or black. However in females it can be either just one color the same as males or a combination of any two of these colors.

The inheritance pattern for coat color in this species must be:

- ☐ Autosomal linkage, multiple genes and full dominance.
- ☐ Sex linked, multiple alleles and co-dominance.
- ☐ Autosomal linkage, co-dominance and multiple alleles.
- ☐ Sex linked and full dominance.

Question 1 continued

11) The graph below shows the variation in phenotypes in human population sample for a trait.

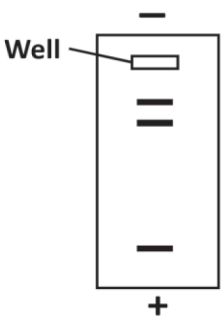


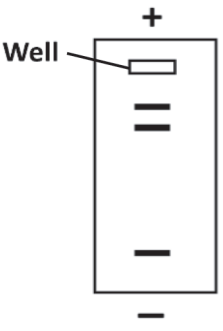
The graph represents all the following traits **except**:

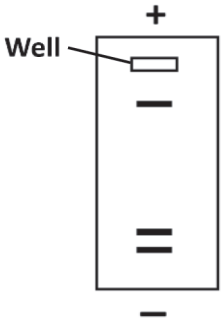
- ▢ arm span.
- ▢ blood groups.
- ▢ length of thigh bone.
- ▢ skin color.

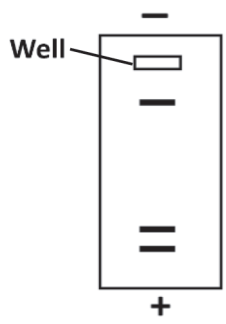
12) A DNA strand has been cut into three fragments 108 kbp, 65 kbp and 57 kbp.

Which of the following shows the result of gel electrophoresis of these fragments?

▢ 

▢ 

▢ 

▢ 

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Question 1 continued

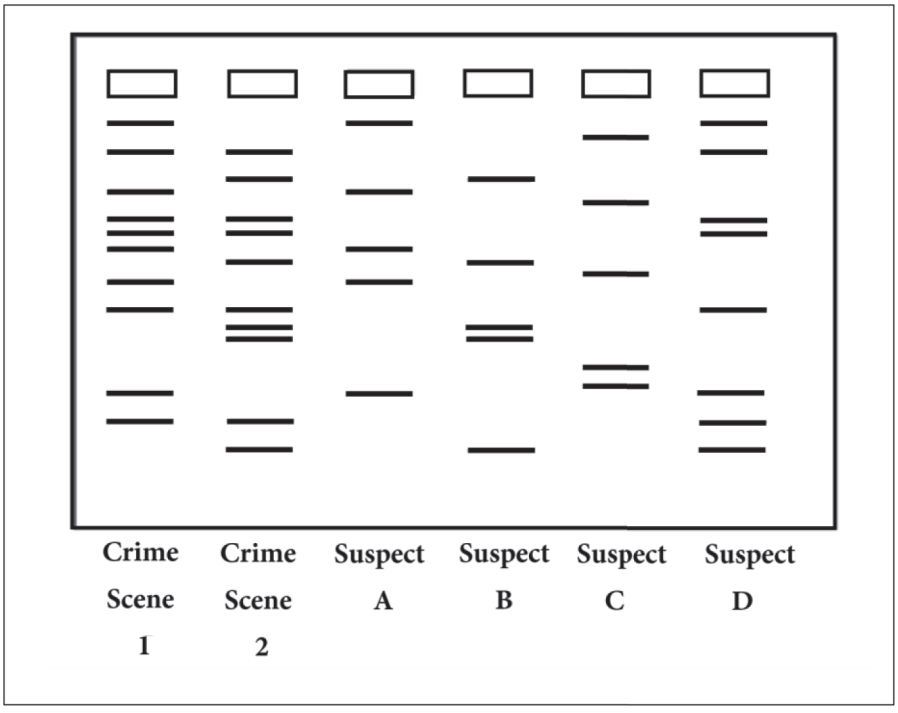
13) The following four procedures are used to insert foreign DNA.

1. Microinjection of a growth-hormone regulating gene into a fertilized egg.
2. Microinjection of ß-carotene gene.
3. Microinjection of a herbicide resistance gene.
4. Microinjection of an insecticide producing gene.

Which of these procedures are used in the production of genetically modified salmon?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4

14) The diagram below shows the result of a DNA profile of samples collected from two crime scenes and four suspects (A,B,C and D).



Which suspect was present at both crime scenes?

- ☐ A
- ☐ B
- ☐ C
- ☐ D

Question 2: Extended Responses (56 marks)

Write your answer for each of the following questions in the space provided.
Be sure to show all your work, including the correct units where applicable.

15) A double stranded DNA molecule is shown below.

Strand 1: 5' ATG AAT ACC ATA G A G T A G TTA GAG 3'

Strand 2: 3' TAC TTA TGG TAT C T C A T C AAT CTA 5'

a. Which DNA strand will be transcribed? _____

Explain your answer.

_____

_____

b. Write the polypeptide chain that is the result of this transcription.

_____

c. What type of bonds are formed between amino acids?

_____

d. What are the effects that will happen if:

– T is substituted by **A**? _____

– C is substituted by **T**? _____

Do not write in this space

Do not write in this space

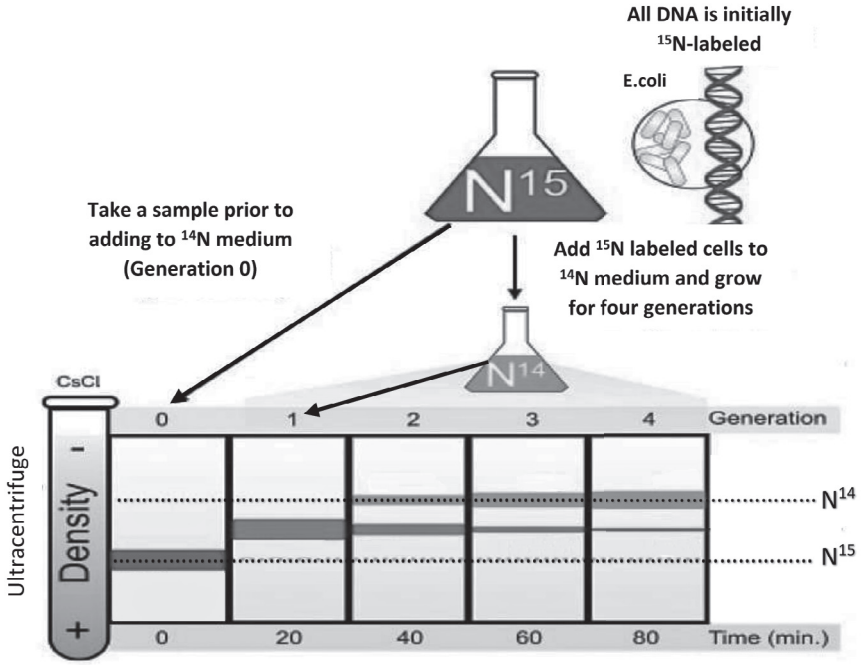
Question 2 continued

m-RNA codon's table

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

Question 2 continued

16) a. The figure below shows the results of Meselson and Stahl's experiment to prove the semi-conservative replication of DNA.



(i) Define: The semi-conservative replication of DNA?

_____

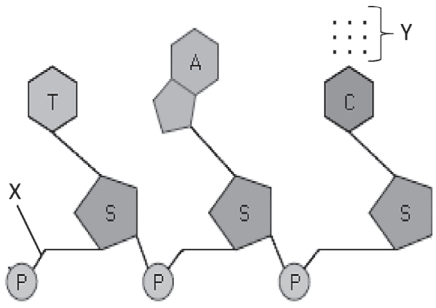
_____

(ii) Explain: why the DNA strands at the beginning of experiment (0 time) have the highest density.

_____

_____

b. The figure opposite shows a part of DNA.



(i) Name the bonds labelled (X) and (Y).

X: _____

Y: _____

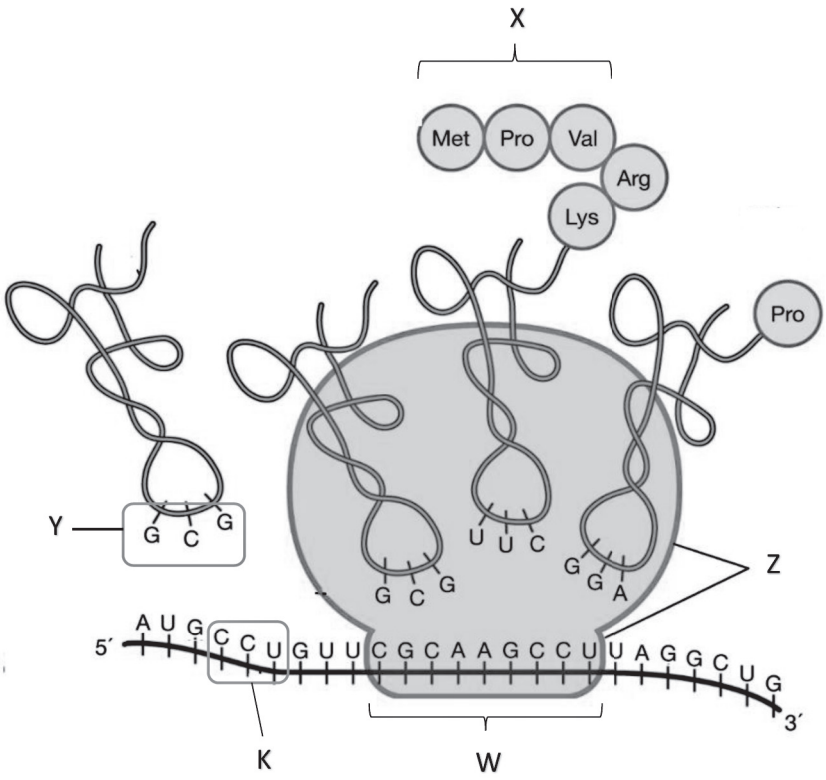
(ii) Write one reason to prove that this molecule is not RNA molecule.

_____

Do not write in this space

Question 2 continued

17) The diagram below shows the process involved in protein synthesis.



a. Name the parts (X) and (Z).

X: _____

Z: _____

b. What is the anti-codon label? _____

c. Write the DNA codes for the parts (Y) and (K).

Y: _____

K: _____

d. What is the **complementary** DNA strand for coding strand of the part (W)?

_____

Question 2 continued

18) In the Camellia flower, the gene of the flower color is controlled by two alleles, one codes for red (R) and the other allele codes for white (W). When a white Camellia flower was crossed with a red Camellia, all of the individual flowers in the first generation (F1) had flower petals spotted with white and red.

a. What is an allele?

_____

_____

b. If the first generation (F1) were self-crossed, find the following for the second generation (F2):

(i) Genotypes; use the following Punnett grid.

Gametes		

(ii) Ratio of the phenotypes.

_____

_____

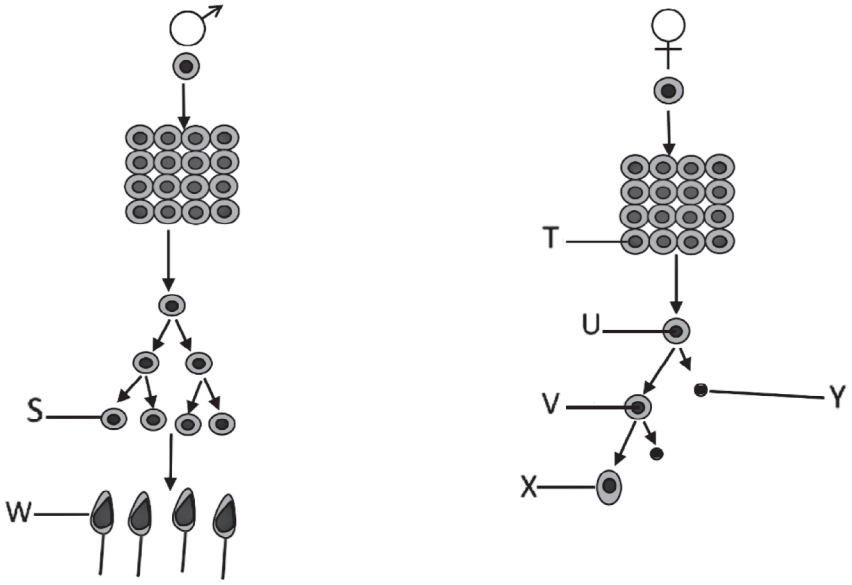
c. Write the genotypes of the parents of (F1).

Parent 1 genotype: _____

Parent 2 genotype: _____

Question 2 continued

19) The diagram below shows the formation of sperms and ova in mammals.



a. Name the following:

– Type of cell division that produces the cell (S): _____

– The process by which the structures (W) and (X) were produced:

_____

b. If the nucleus (T) contains 40 chromosomes, what would be the number of the chromosomes in:

– Nucleus (U)? _____

– Nucleus (V)? _____

c. Why it is important that the nucleus (V) contains this number of chromosomes?

_____

_____

d. Predict what might happen to the cell (X) if the cell (Y) was not produced.

_____

_____

Question 2 continued

20) In a dark skinned family, a girl was born with a very pale skin and hair, and her irises were pale blue.

a. State the following:

(i) The scientific name for this condition.

_____

(ii) Describe the gene enzyme interaction that results in the absence of skin pigment.

_____

_____

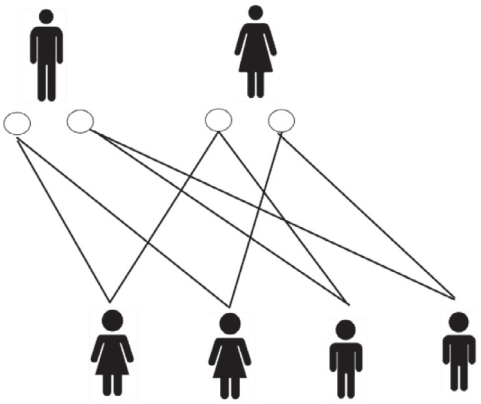
_____

b. The diagram opposite shows the incidence of color blindness in a girl. The phenotypes of the parents and brothers are unknown.

However, her sister has normal vision.

(Use the symbol B for the dominant allele and b for the recessive allele)

Find the following:



(i) Phenotypes of offspring.

- Males: _____

- Females: _____

(ii) Parents genotypes:

- Mother genotype: _____

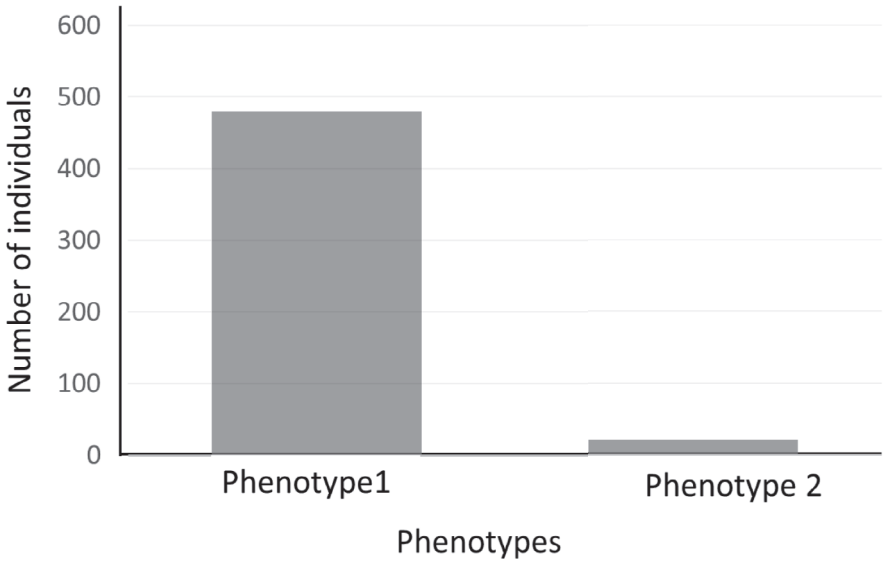
- Father genotype: _____

Do not write in this space

Do not write in this space

Question 2 continued

21) A sample of 500 individuals from a human population were investigated for their variation of an inherited trait. The bar chart below represents the phenotypic variation of this trait in the population.



a. What is the type of variation for this trait? (continuous or discontinuous).

_____

b. Give an example of a trait in a human which displays the opposite type of variation to the one that represented by the bar chart.

_____

c. Explain the genetic basis of the variation in the trait as demonstrated in the bar chart plot above.

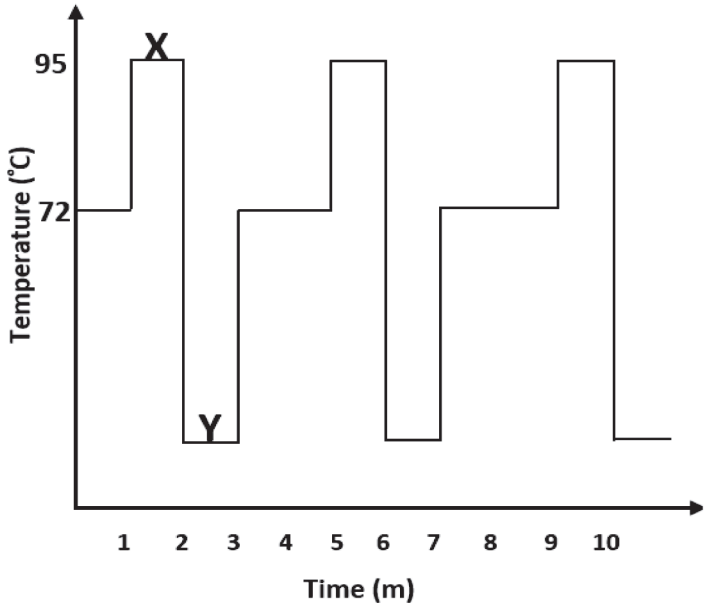
(Highlight the number of genes and or alleles that are controlling this trait)

_____

_____

Question 2 continued

22) The graph below shows how temperature changes during the repeated cycles of a polymerase chain reaction (PCR).



a. State the events in the periods labelled (X) and (Y).

(X) _____

(Y) _____

b. If there were 500 molecules of DNA at the start, how many copies of the DNA will be there after 10 minutes?

_____

c. State briefly the goal of PCR.

_____

_____

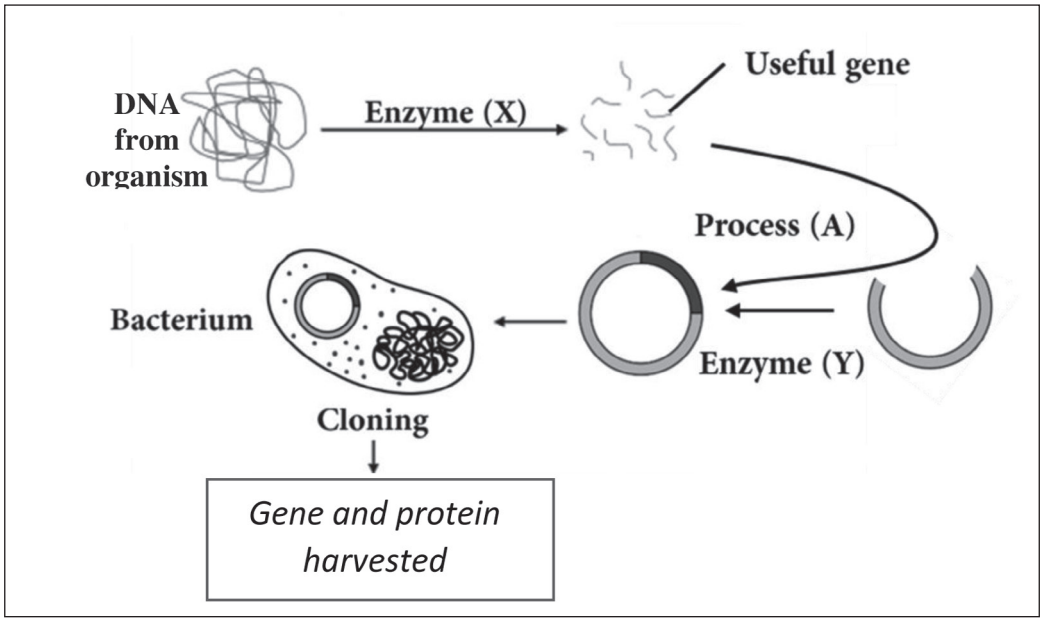
d. What is the role of DNA polymerase?

_____

_____

Question 2 continued

23) The diagram below shows an outline of the processes involved in the production of useful genes and proteins by genetic engineering.



a. Name the enzymes (X) and (Y).

Enzyme (X): _____

Enzyme (Y): _____

b. Name the enzyme which will be used to open the vector.

_____

c. Give an example of the vector._____

d. Describe the process (A).

_____

_____

_____

e. Outline the process which takes place inside the bacterium.

_____

_____

Question 2 continued

24) a. Transgenic tomato plants have been developed to have a gene from *Bacillus thuringiensis* inserted into their genome. The gene codes for a microbial pesticide which makes these plants resistant to gypsy moth caterpillars.

(i) Explain how pesticide protects the transgenic tomato plants from the gypsy moth caterpillars.

(ii) Suggest one possible disadvantage of introducing insecticide resistance into crop plants.

b. Transgenic wheat plants have been developed which are resistant to herbicides such as glyphosate.

Explain how transgenic wheat plants are not destroyed by glyphosate.

[End of Examination]

مُسَوَّدَة

مُسَوَّدَة

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٤٣ هـ - ٢٠٢١ / ٢٠٢٢ م

الدور الثاني - الفصل الدراسي الثاني

تنبيه:
- المادة: الأحياء.
- الأسئلة في (١٦) صفحة.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (▭) وفق النموذج الآتي:

س - عاصمة سلطنة عمان هي:

▭ القاهرة ▭ الدوحة

■ مسقط ▭ أبوظبي

ملاحظة: يتم تظليل الشكل (■) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ■ **غير صحيح** ▭ ◉ ◔ ✗ ✓

مُسَوَّدَة، لا يتم تصحيحها

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Question 1: Multiple Choice Items (14 marks)

There are 14 multiple-choice items worth two marks each.
Shade in the bubble (⬭) next to the **correct** answer for each of the following items.

1) Which of the following sentences is true about the mutation of sickle cell anemia?

- ⬭ Increases the ability to carry oxygen in the red blood cells.
- ⬭ Increases the number of red blood cells.
- ⬭ Affects the gene β-hemoglobin of red blood cells.
- ⬭ Occurs in all types of blood cells.

2) Which structural feature is found in double stranded DNA?

- ⬭ An equal ratio of adenine to thymine in each strand.
- ⬭ Twice as many pentose sugars as phosphate groups.
- ⬭ Each base is bonded together by two hydrogen bonds.
- ⬭ Each purine and pyrimidine is paired with a complementary base.

3) Which tube shows the result in one generation of the semi-conservative replication of DNA?

⬭ 

⬭ 

⬭ 

⬭ 

Question 1 continued

4) What mRNA sequence results from the transcription of the following DNA segment:

5' TAC AGC CAT 3'?

- ☐ 5' AUG TCG GUA 3'
- ☐ 3' AUG UCG GUA 5'
- ☐ 3' UAC AGC CAU 5'
- ☐ 3' AUG GCU GUA 5'

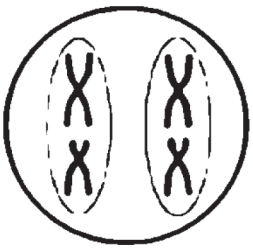
5) A double stranded DNA molecule has bases 15% of which are cytosine.

What is the percentage of the purines bases?

- ☐ 15%
- ☐ 35%
- ☐ 50%
- ☐ 70%

6) The diagram below shows different phases of meiosis I.

Which one is the telophase?

- ☐ 
- ☐ 
- ☐ 
- ☐ 

7) All of the following are aims of gametogenesis in animals except for:

- ☐ the growth of embryonic tissues.
- ☐ the reduction of the number of chromosomes.
- ☐ the formation of gametes.
- ☐ sexual reproduction.

Do not write in this space

Do not write in this space

Question 1 continued

8) What is the probability of giving birth to a child affected by sickle cell anemia if one of his parents is a carrier and the other is affected:

- ☐ 100%
- ☐ 75%
- ☐ 50%
- ☐ 0%

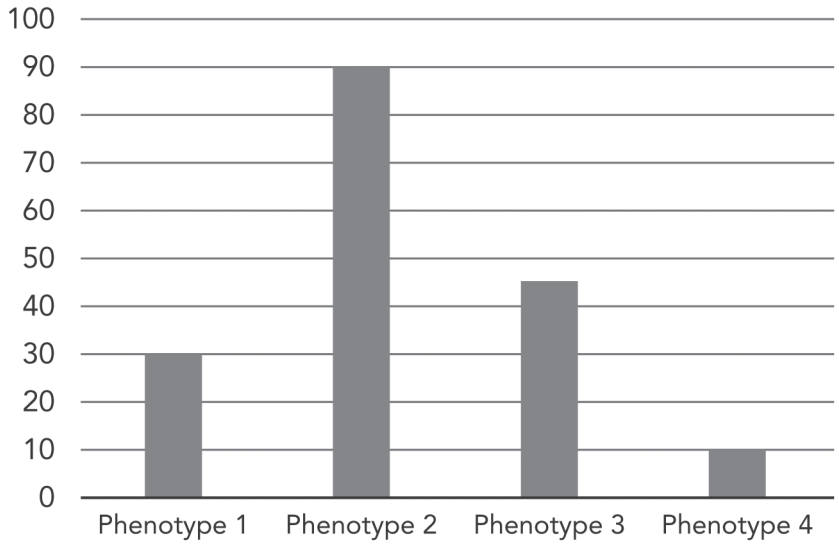
9) In a cross experiment of two pea plants, the resulting offspring were **61 tall** and **59 short**. Therefore, the genotypes of the parents must be:

- ☐ Tt × Tt
- ☐ tt × tt
- ☐ TT × tt
- ☐ Tt × tt

10) In an animal the fur color is controlled by two genes. The first gene controls the production of the pigment while the second gene controls the expression of the pigment. The inheritance pattern of the fur color in this animal is:

- ☐ Multiple genes.
- ☐ Multiple alleles.
- ☐ Autosomal linkage.
- ☐ Sex linkage.

11) The bar chart below shows the variation in the phenotypes in a human population sample.

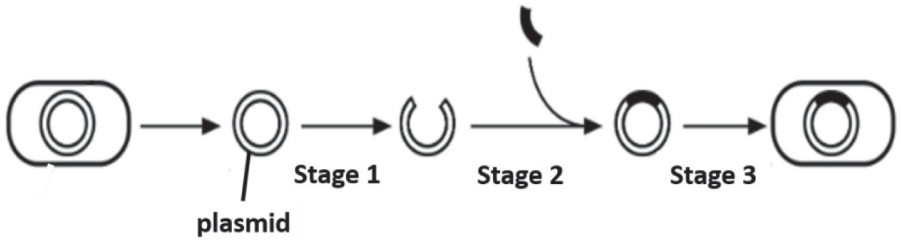


The human trait that this graph might represent is:

- ☐ Skin color.
- ☐ Eye color.
- ☐ Body height.
- ☐ Body weight.

Question 1 continued

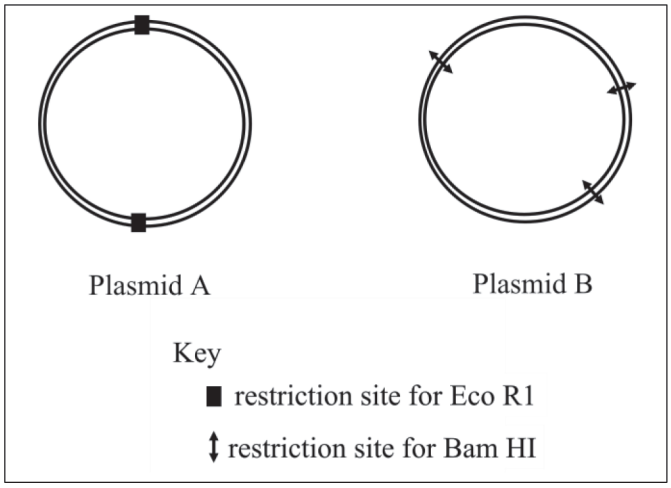
12) The diagram below shows the different stages involved in genetic engineering.



Which row in the table below shows the number of stages in this process in which ligase and endonuclease are involved?

	Stage involving ligase	Stage involving endonuclease
○	1	3
○	1	2
○	2	1
○	3	2

13) The diagram below shows two bacterial plasmids with restriction sites for two different restriction endonucleases, Eco R1 and Bam H1.

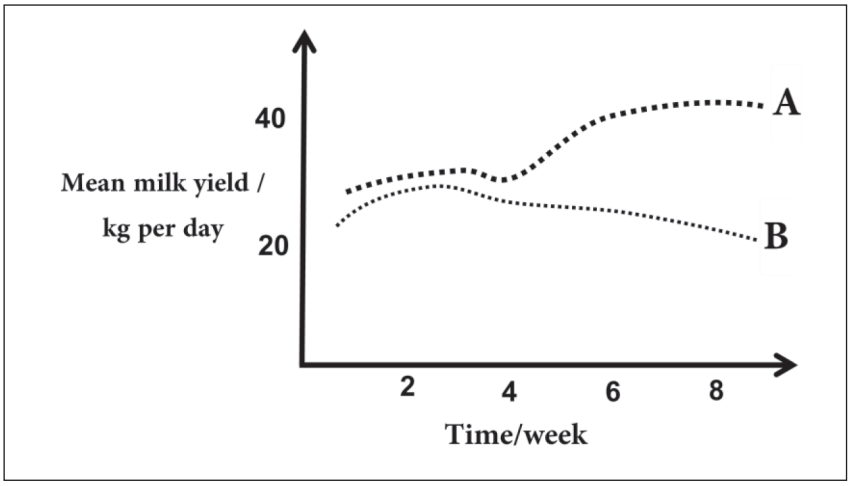


Question 1 continued

What is the number of fragments produced if the plasmids were cut with the restriction endonucleases as shown above?

	Plasmid A	Plasmid B
○	2	3
○	3	2
○	1	2
○	3	4

14) Bovine somatotropin (BST) is a protein hormone that stimulates growth in cows. Genetic engineering techniques were used to make bacteria produce BST. The effect of BST on milk production cows was investigated. The milk yield intake was recorded each day for each cow in two groups, A and B.



Which group received BST treatment? And which week did they start?

	Group received BST treatment	Week
○	A	3
○	B	3
○	B	4
○	A	4

Question 2: Extended Responses (56 marks)

Write your answer for each of the following questions in the space provided.
Be sure to show all your work, including the correct units where applicable.

15) The figure below shows in order triplet bases in nucleic acid. (6 marks)

DNA strand	X	TAC	
RNA strand	UAA		Z
Anti - Codon		Y	GCA

a. What type of nucleic acids contains:

- Codon? _____

- Anticodon? _____

b. Give the triplet bases (X), (Y) and (Z).

(X): _____

(Y): _____

(Z): _____

c. From m-RNA codon's table opposite, write the codons that record the amino acids chain in the correct order.

5' _____ 3'

Do not write in this space

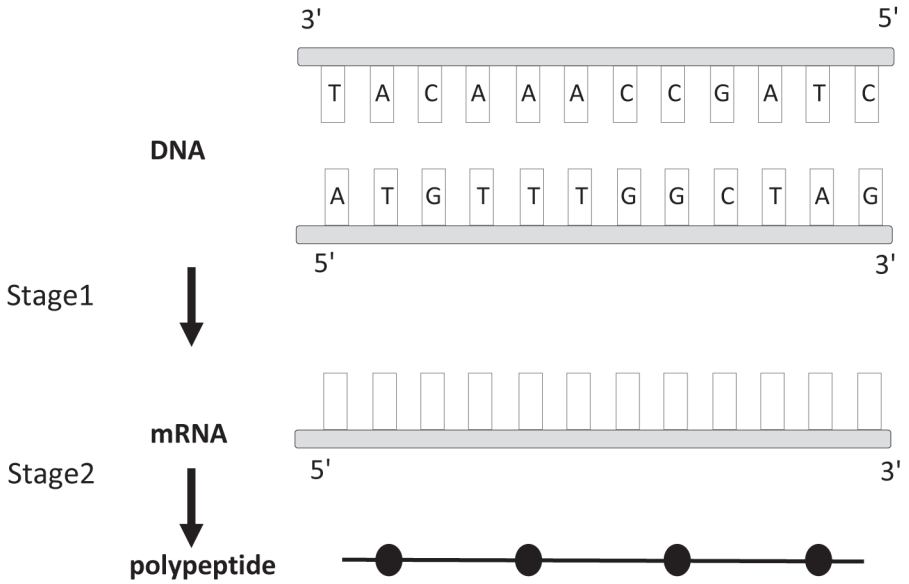
Question 2 continued

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

m-RNA codon's table

Question 2 continued

16) The diagram below shows the processes of protein synthesis. (5 marks)



a. Where does the protein synthesis take place within a cell?

_____

b. Name: stage 1 and stage 2.

Stage 1: _____

Stage 2: _____

c. Describe the role of tRNA in stage 2?

_____

_____

d. Write the polypeptide that is formed from this process?

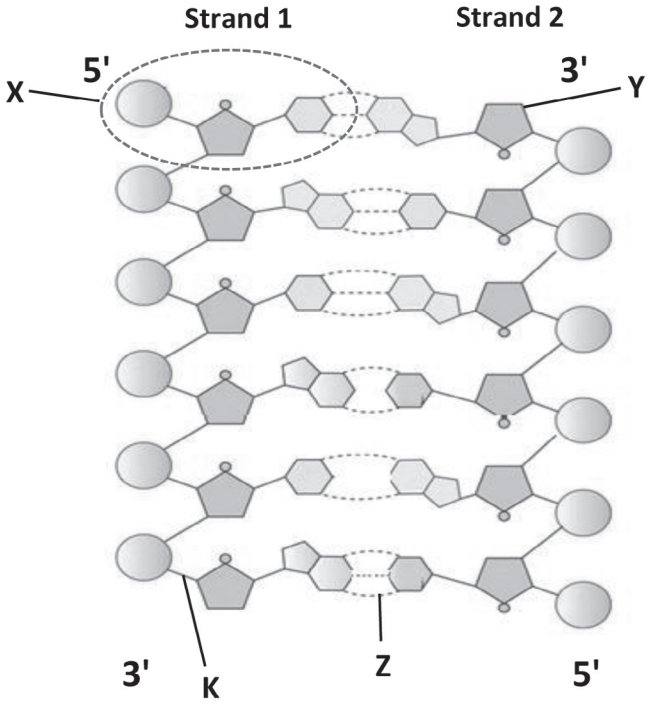
_____

Do not write in this space

Do not write in this space

Question 2 continued

17) The diagram below shows double strands of DNA. (7 marks)



a. Name the parts (X) and (Y)

X: _____ Y: _____

b. What is the role of part (Z) and (K)?

Z: _____

K: _____

c. Describe DNA as a polymer.

_____

_____

d. Give the sequence of bases:

- In strand 1: _____

- Transcription of strand 2: _____

Question 2 continued

18) In a plant species, there are two alleles for leaf color, either green or white in the homozygous state. In the heterozygous state they produce variegated leaves.

(6 marks)

a. What is the meaning of heterozygous?

_____

b. If two plants with variegated leaves were crossed, answer the following:

- The pattern of the inheritance of this trait: _____
- The phenotypes of the resulting offspring: _____
- The ratio of the offspring's phenotypes: _____

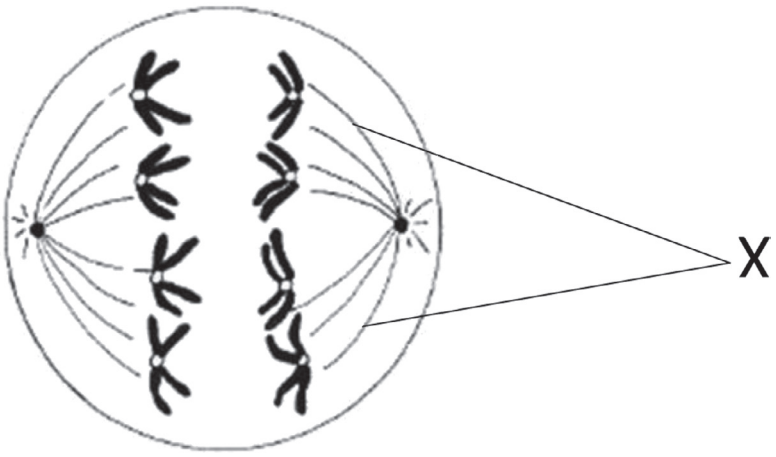
c. A mutation in the white allele has turned the allele into a recessive allele.

Predict the resulting phenotypes and the ratio from crossing two heterozygous parents affected by this mutation.

- Phenotypes: _____
- Ratio: _____

Question 2 continued

19) The diagram below shows a phase of meiosis. (6 marks)



a. Identify the following:

- The phase shown above. _____

- The structure (X). _____

b. What is the process that occurs during the preceding phase and accounts for a great deal of the genetic variation in the offspring?

_____

c. Name an event that occurs in the phase that follows.

_____

d. What is the number of chromosomes in the resulted cells?

_____

e. Predict what might happen if structure (X) was missing.

_____

Question 2 continued

20) a. Huntington's disease (HD) is an inherited disease in humans. (6 marks)

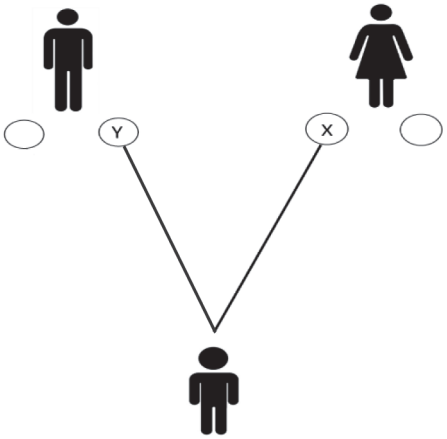
(i) State the type of (HD) inheritance.

_____

(ii) Explain the process of mutation that leads to the production of the defective allele and the rise of Huntington's disease.

_____

b. The diagram below represents a family. The son was diagnosed as hemophilic, although his parents don't show any hemophilia symptoms.



(i) What are the possible parental genotypes?

- Father: _____

- Mother: _____

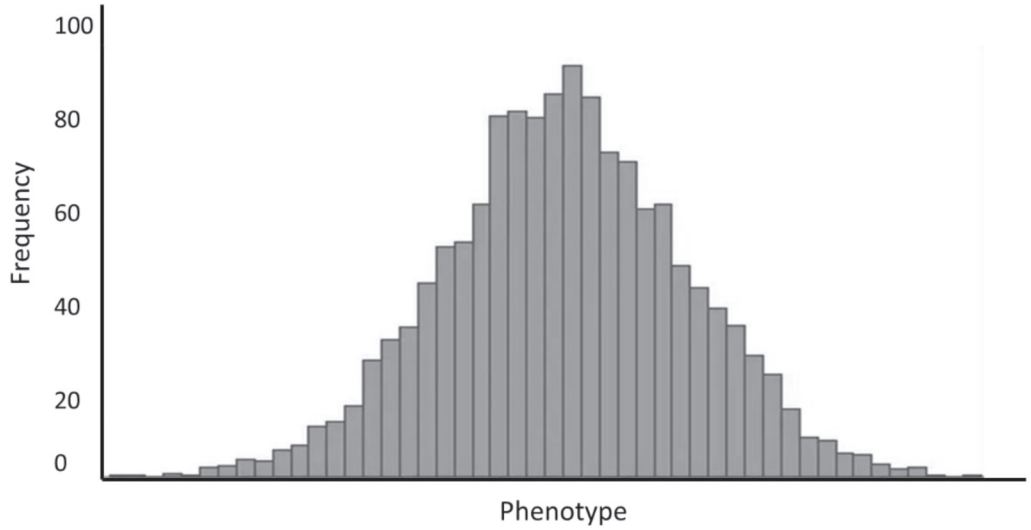
(ii) Find the probability of having another child with normal phenotype in the case of:

- A male: _____

- A female: _____

Question 2 continued

21) A scientist was studying the variation in body length in an animal population. He represented the results in the diagram below. (3 marks)



a. What type of variation does this trait follow?

_____

b. Give an example of a trait in humans with the similar type of variation to this trait.

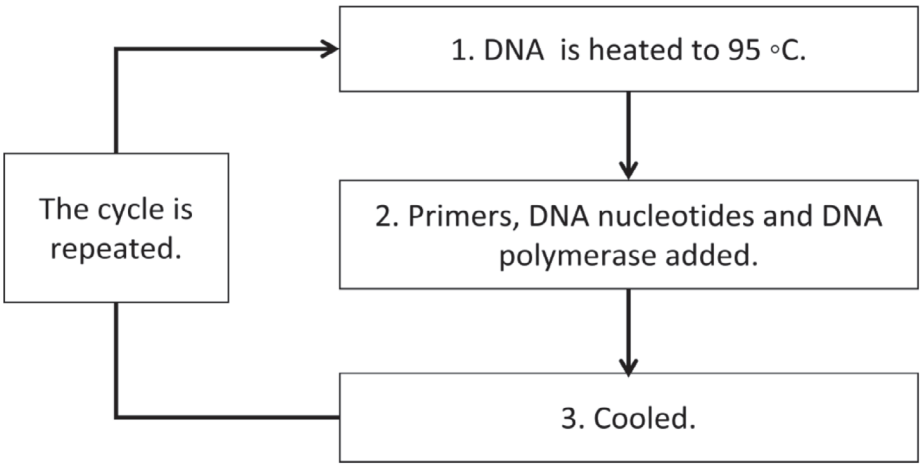
_____

c. Is this trait controlled by one gene with multiple alleles or multiple genes?

_____

Question 2 continued

22) The diagram below shows the main stages involved in the polymerase chain reaction PCR. (6 marks)



a. What is the role of the following:

- DNA polymerase? _____

- The primer? _____

b. Why are two different primers required?

_____

c. Explain why DNA is:

- heated in stage 1?

_____

- cooled in step 3?

_____

d. How many DNA molecules will be produced from one molecule of DNA after 4 complete cycles?

_____

Do not write in this space

Do not write in this space

Question 2 continued

23) a. Genetic engineering is used to transform bacterial cells. (6 marks)

(i) Define the term genetic engineering.

_____

(ii) What is the role of ligase enzymes in genetic engineering?

_____

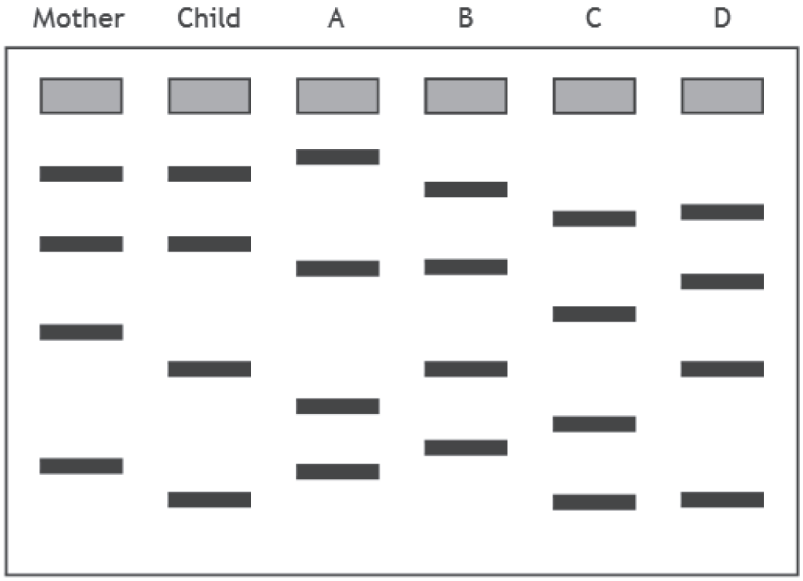
(iii) Explain how the same enzyme is used to cut both DNA and plasmid.

_____

(iv) Why must plasmid be introduced into a bacterial cell?

_____

b. DNA collected from a mother, a child and four men (A, B, C and D) in a paternity suit was analyzed .The DNA was enlarged using PCR and separated by gel electrophoresis as shown in the diagram below.

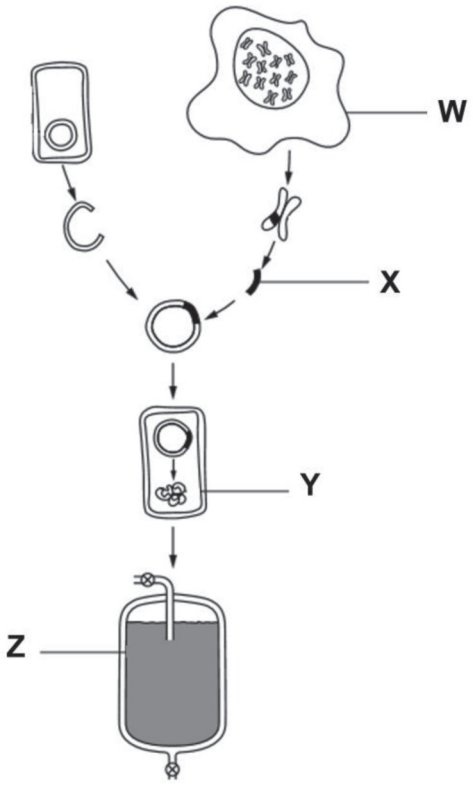


Identify from (A, B, C, and D) the man who is must probably the child's father.

_____

Question 2 continued

24) The diagram below shows how human insulin is produced using genetic engineering. (5 marks)



a. Identify the parts (X), (Y) and (Z).

(X): _____

(Y): _____

(Z): _____

b. Identify the cell labelled (W).

_____

c. State one advantage of producing human insulin by genetic engineering.

_____

[End of Examination]

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مُسَوَّدَة

مُسَوَّدَة

سلطنة عمان
وزارة التربية والتعليم

مركز القياس والتقويم التربوي
The Center for Educational Assessment and Measurement (CEAM)

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)
للعام الدراسي ١٤٤٢ هـ - ٢٠٢٠ / ٢٠٢١ م
الدور الأول

تنبيه:
- المادة: الأحياء.
- الأسئلة في (١٦) صفحة.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (▭) وفق النموذج الآتي:

س - عاصمة سلطنة عمان هي:

▭ القاهرة ▭ الدوحة

■ مسقط ▭ أبوظبي

ملاحظة: يتم تظليل الشكل (■) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ■ **غير صحيح** ▭ ◉ ◔ ☒ ☑

مُسَوَّدَة، لا يتم تصحيحها

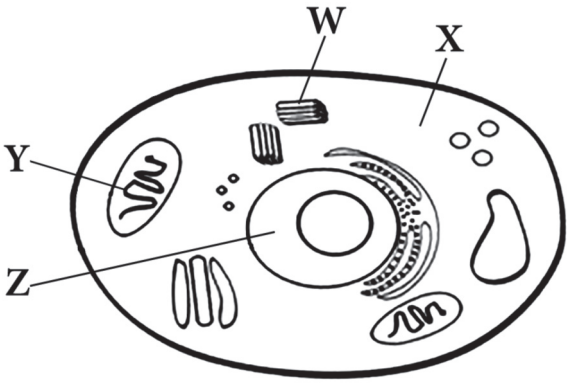
Do not write in this space

Question 1: Multiple Choice Items (12 marks)

There are 12 multiple-choice items worth two marks each.
Shade in the bubble (⬭) next to the **correct** answer for each of the following items.

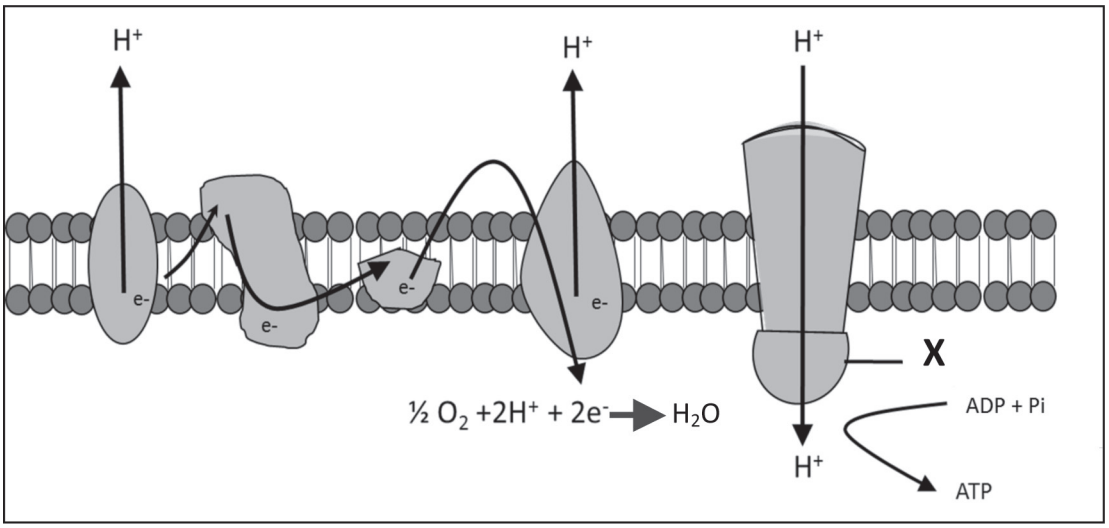
1) The diagram below shows an animal cell.

Which site indicates the stage of respiration that takes place in both aerobic and anaerobic respiration?



⬭ W
⬭ X
⬭ Y
⬭ Z

2) The diagram below shows one of the aerobic respiration stages in an animal cell.

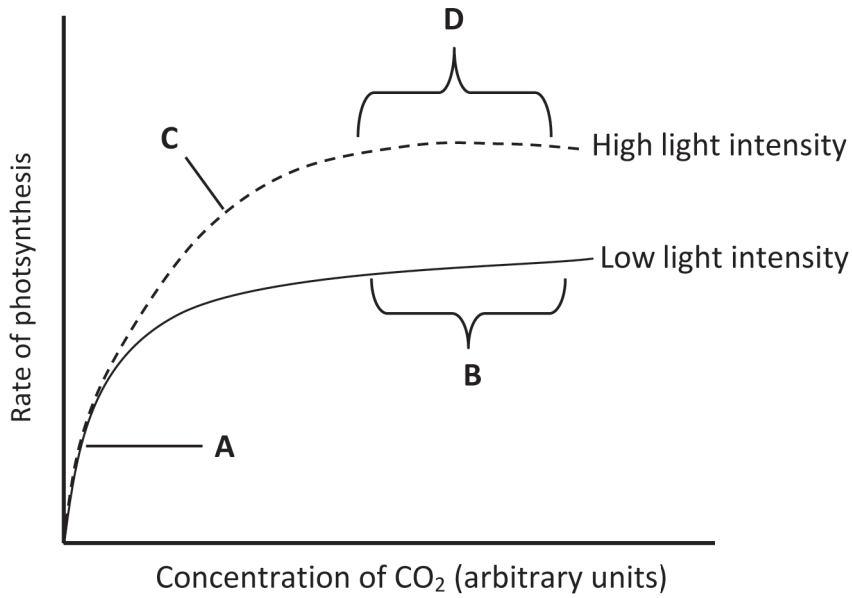


Which of the following statements is true about the structure labeled (X)?

⬭ A Co-enzyme which acts as a carrier for hydrogen ions.
⬭ Used to split water molecules to $2H^+$ and $½O_2$.
⬭ Involved in ADP phosphorylation.
⬭ Involved in ATP hydrolysis.

Question 1 continued

3) The graph below shows the effect of CO_2 concentration on the rate of photosynthesis at different light intensities.



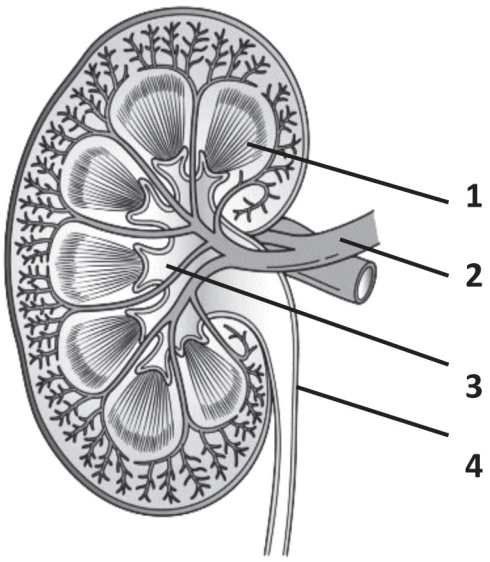
In which part of the graph is light intensity a limiting factor but CO_2 concentration is not?

- ☐ A
- ☐ B
- ☐ C
- ☐ D

4) The diagram below shows the structure of a human kidney.

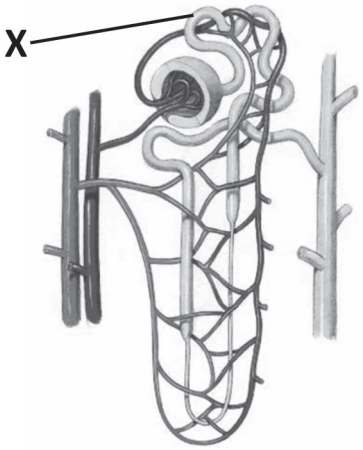
Which of the labeled structures is the medulla?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4



Question 1 continued

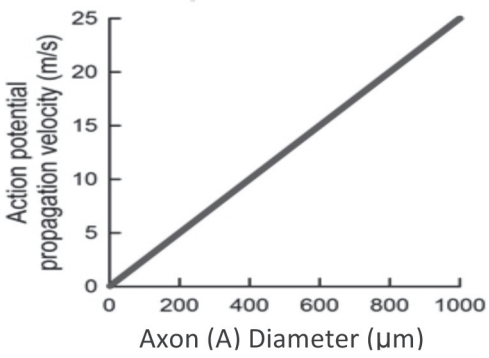
5) The diagram opposite shows the structure of a nephron.

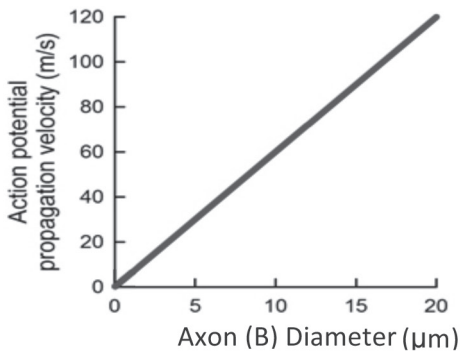


What is the main process that takes place at the part labeled (X)?

- ☐ Pressure filtration.
- ☐ Tubular excretion.
- ☐ Selective reabsorption.
- ☐ Reabsorption of water.

6) The graphs below show the velocity of action potential in two different axons (A) & (B).



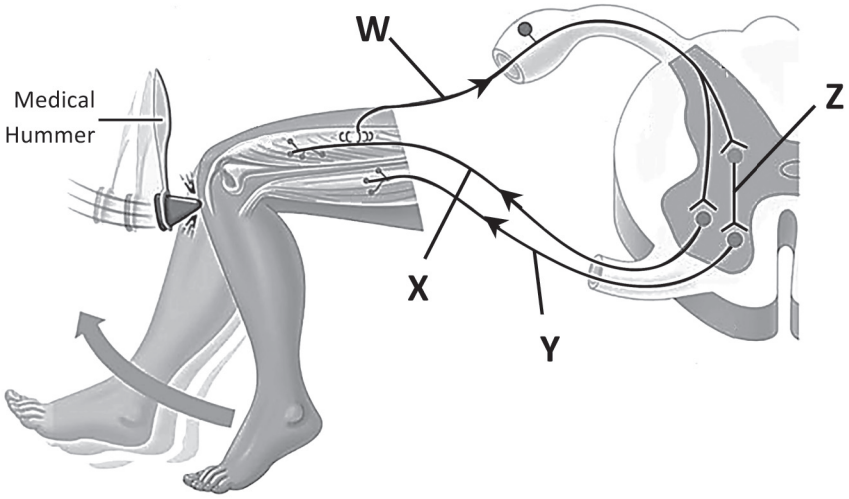


Which of the following shows the correct type of axons?

	A	B
☐	Non-myelinated	Myelinated
☐	Non-myelinated	Non-myelinated
☐	Myelinated	Non-myelinated
☐	Myelinated	Myelinated

Question 1 continued

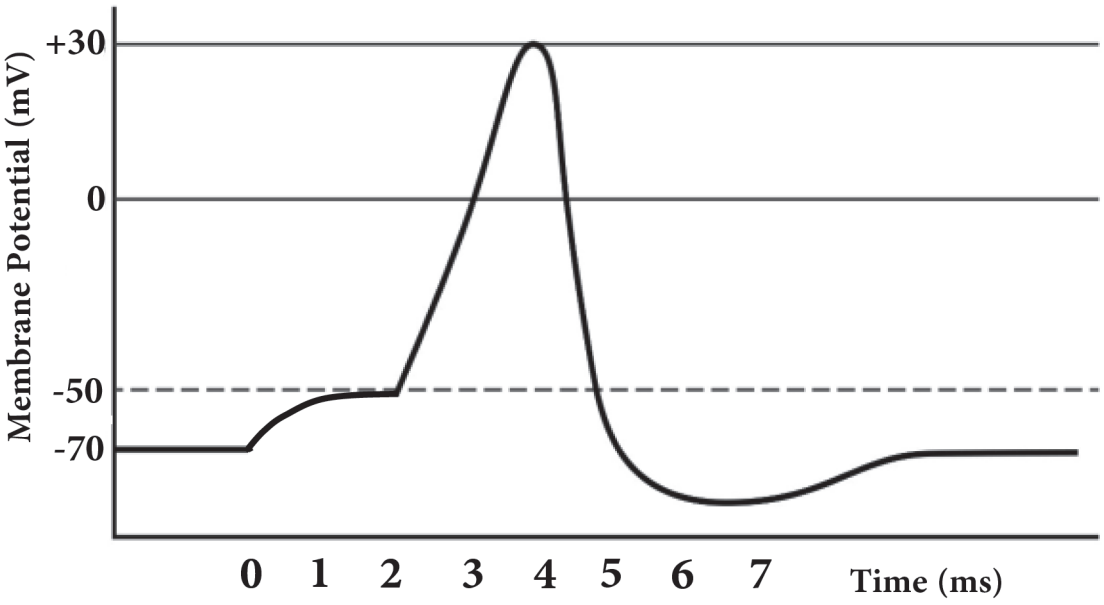
7) The diagram below shows a reflex action.



Identify the neurone which carries the impulse from the receptor to the CNS.

- ☐ W
- ☐ X
- ☐ Y
- ☐ Z

8) The graph below shows the change in the membrane potential of a neurone.



Question 1 continued

Which of the following shows the correct values of threshold potential and resting potential?

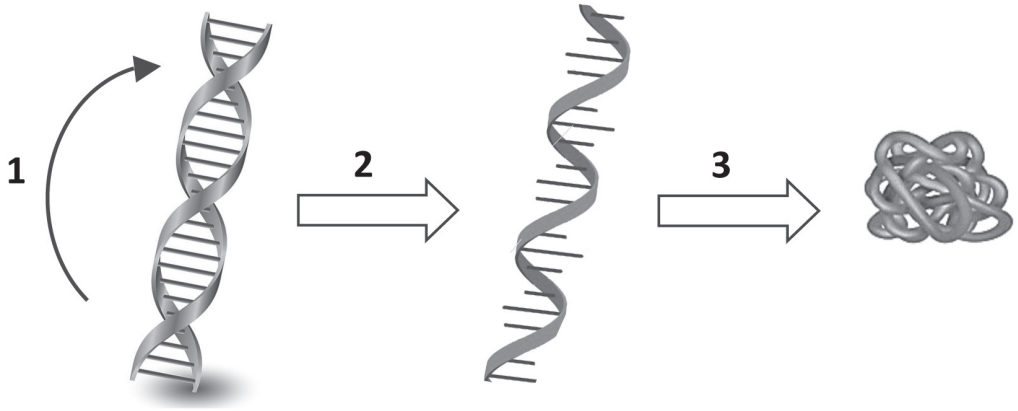
	Resting potential (mV)	Threshold potential (mV)
☐	-50	-70
☐	-70	-50
☐	+50	-70
☐	-70	+50

9) Identify the type of bond that is found between the nitrogenous bases of DNA.

☐ Peptide bonds ☐ Covalent bonds

☐ Hydrogen bonds ☐ Ionic bonds

10) The diagram below shows three processes that represent the flow of genetic information.

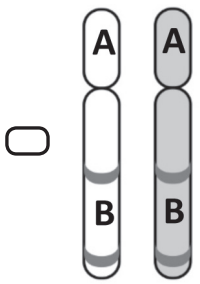


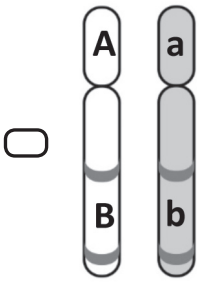
Which of the following represents the site of each process?

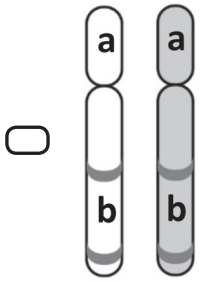
	(1)	(2)	(3)
☐	Cytoplasm	Cytoplasm	Cytoplasm
☐	Nucleus	Nucleus	Cytoplasm
☐	Cytoplasm	Cytoplasm	Nucleus
☐	Nucleus	Cytoplasm	Nucleus

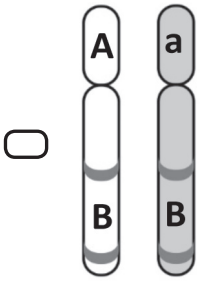
Question 1 continued

11) Which of the following is heterozygous for one character?

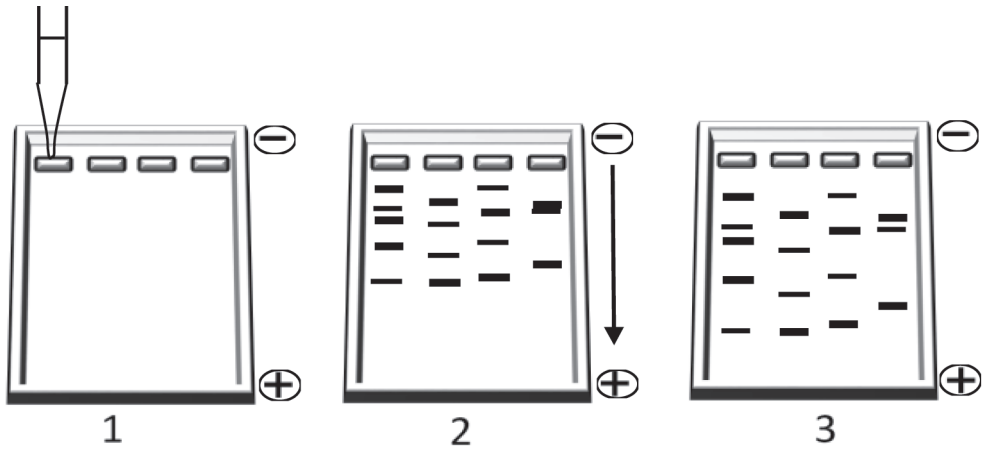








12) The diagram below shows the steps of DNA electrophoresis.



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Question 1 continued

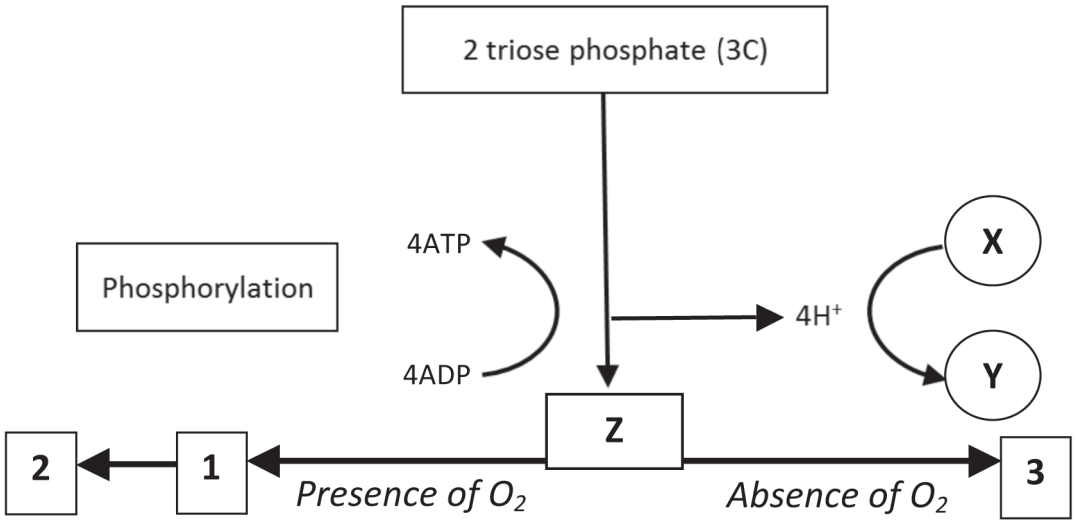
Which option shows the correct events in steps 1, 2 and 3?

	STEP 1	STEP 2	STEP 3
☐	DNA samples are loaded into the wells.	The fragments are separated by size.	Power is turned on and the DNA fragments migrate through gel.
☐	DNA samples are loaded into the wells.	Power is turned on and the DNA fragments migrate through gel.	The fragments are separated by size.
☐	Power is turned on and the DNA fragments migrate through gel.	The fragments are separated by size.	DNA samples are loaded into the wells.
☐	The fragments are separated by size.	DNA samples are loaded into the wells.	Power is turned on and the DNA fragments migrate through gel.

Question 2: Extended Responses (48 marks)

Write your answer for each of the following questions in the space provided.
Be sure to show all your work, including the correct units where applicable.

13) The diagram below illustrates the reactions of respiration in an animal cell. (7 marks)



a. Name the compounds labeled (X) and (Y):

X: _____

Y: _____

b. What are the stages that are labeled (1), (2) and (3)?

(1): _____

(2): _____

(3): _____

c. Predict the final compounds that will be formed at stages labeled (1) and (3).

(1): _____

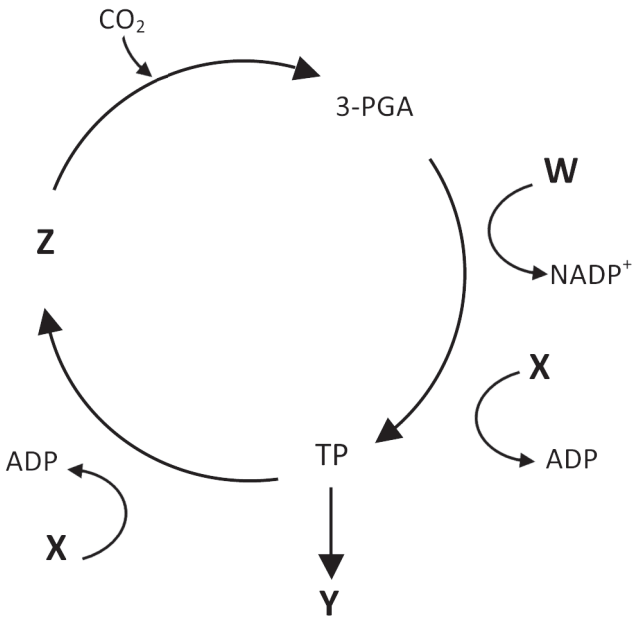
(3): _____

Do not write in this space

Do not write in this space

Question 2 continued

14) The diagram below shows one of the stages in photosynthesis. (5 marks)



a. Name the stage that this diagram represents.

_____

b. What is the role of the compounds labeled (W), (X) and (Z)?

X: _____

Y: _____

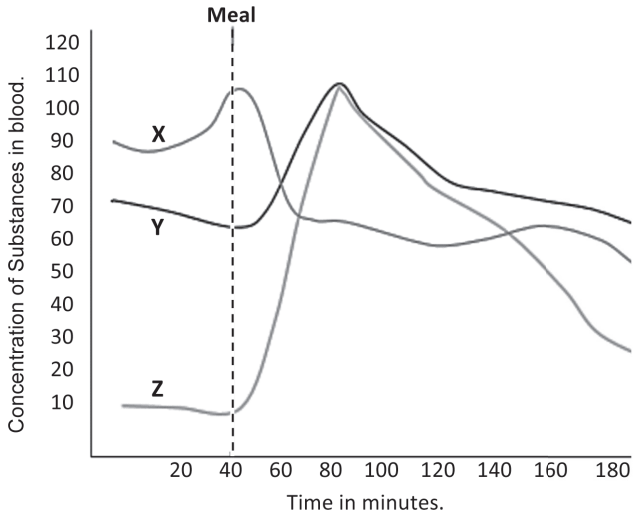
Z: _____

c. Predict what will happen to the concentration of the compound labeled (Y) when the concentration of CO_2 increases.

_____

Question 2 continued

15) The graph below shows the concentrations of three different substances in blood before and after a meal. (6 marks)



a. Name the substances labeled (X) and (Z).

X: _____ Z: _____

b. **(i)** The body's failure to regulate the level of substance labeled (Y) in the blood causes a disease.

Name the disease.

_____

(ii) State one of the common symptoms of this disease.

_____

c. After more than 20 minutes of taking the meal, explain the relationship between the concentration of the substance labeled (Y) and the substance labeled (Z).

_____

_____

d. Why does the concentration of the substance labeled (X) in the blood rise during exercise?

_____

_____

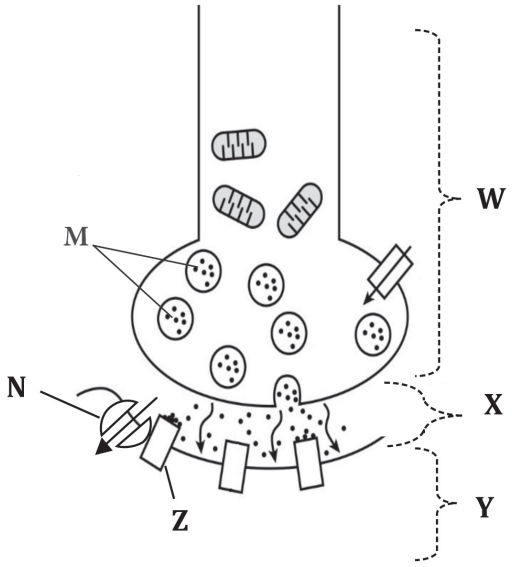
Do not write in this space

Do not write in this space

Question 2 continued

16) The diagram below shows a synapse. (6 marks)

a. Name the parts labeled (W), (X) and (Y):



W: _____

X: _____

Y: _____

b. What is the fate of the substance labeled (M) after it binds with the part labeled (Z)?

_____

c. If the two neurones are sensory and relay, in which neurone could the part labeled (Z) be found?

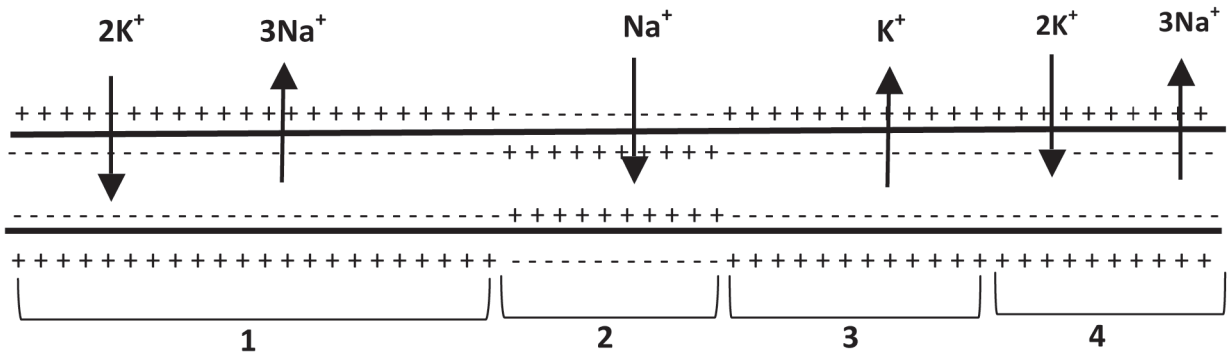
_____

d. What is the role of the part labeled (N)?

_____

Question 2 continued

17) The diagram below shows the transmission of an impulse in an axon. (7 marks)



a. Complete the following table:

Area of axon	Neurone situation (Exciting – Resting)	K^+/Na^+ pump (Open – Close)
1	Resting	_____
2	_____	Close
3	Exciting	_____

b. **(i)** Explain the events at the area labeled (3).

_____

_____

(ii) Write the number of the area that represents depolarization.

_____

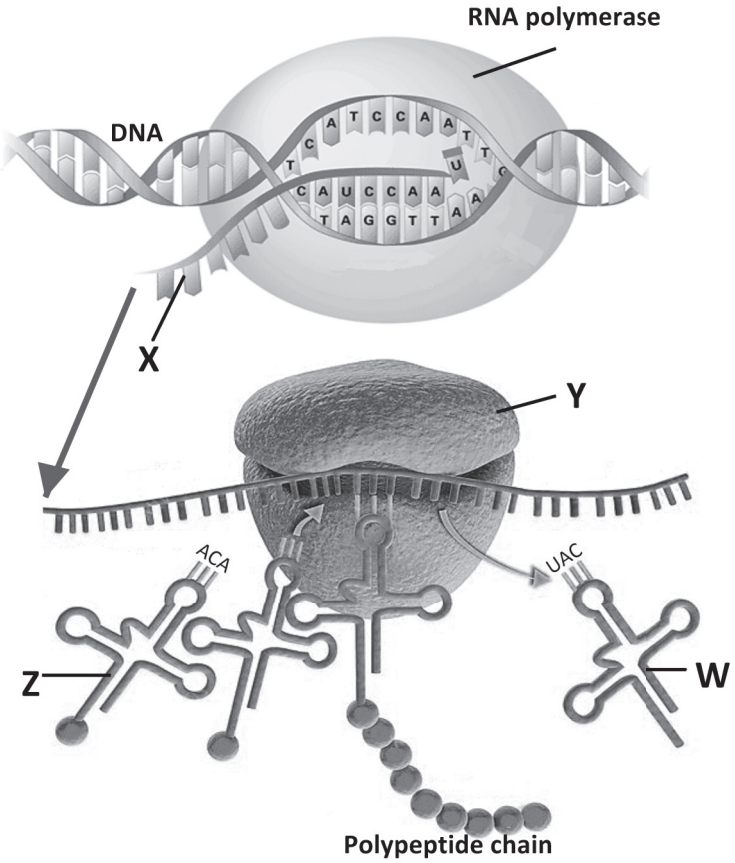
(iii) What state will occur at the end of the area labeled (4)?

_____

Do not write in this space

Question 2 continued

18) The diagram below shows the process of protein synthesis. (6 marks)



a. Name the parts labeled (X) and (Y):

X: _____ Y: _____

b. Complete the table below.

Use the following codon's table (on the next page) to find your answers.

	tRNA (Z)	tRNA (W)
Amino acid carried by each tRNA	_____	Met
Triplet code in DNA	ACA	_____
Codon in mRNA	UGU	_____

Question 2 continued

m-RNA codon's table

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

c. If a mutation in part of the DNA changes the triplet code (ACC) to (ACA), Write the new amino acid that will be added to the peptide.

_____

Do not write in this space

Do not write in this space

Question 2 continued

19) A man with normal colour vision is married to a carrier woman. (5 marks)

a. What type is this inheritance?

_____

b. Is the woman heterozygous or homozygous?

_____

c. Using the Punnett grid below, write the children's genotypes.

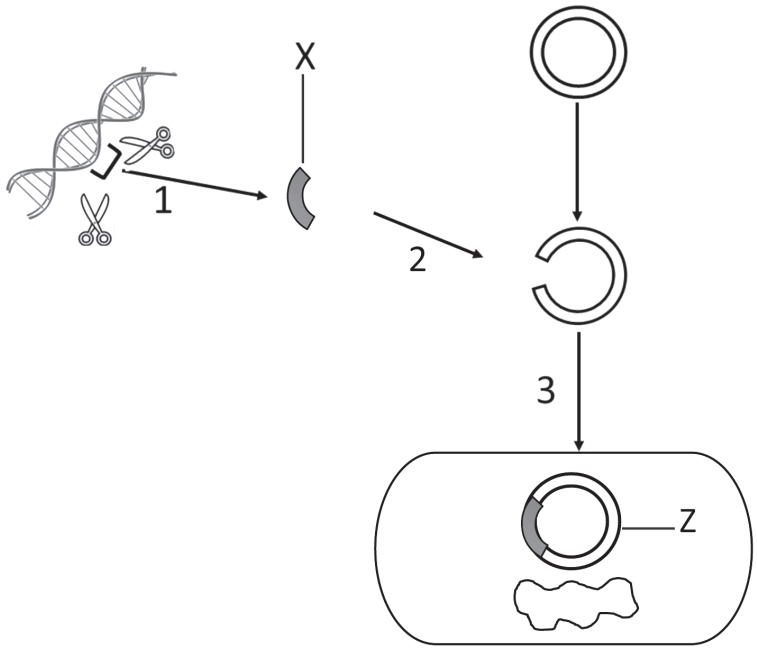
d. Find the probability of the birth of a carrier girl.

_____

Question 2 continued

20) The diagram below demonstrates the process of the production technology of a blood clotting protein. (6 marks)

a. Name the enzymes used in steps (1) and (2):



1: _____

2: _____

b. Predict what will happen to the production process in the following situations:

(i) No sticky ends were produced for part (X): _____

(ii) The step labeled (2) was not successful: _____

(iii) The part labeled (Z) lacks a promoter gene: _____

c. After step (3), the molecule labeled (Z) started to produce a blood clotting protein. What is the organelle involved in?

_____

[End of Examination]

مُسَوَّدَة

مُسَوَّدَة

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٤٢ هـ - ٢٠٢٠ / ٢٠٢١ م

الدور الثاني

تنبيه:
- المادة: الأحياء.
- الأسئلة في (١٣) صفحة.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (○) وفق النموذج الآتي:

س - عاصمة سلطنة عمان هي:

○ القاهرة ○ الدوحة

● مسقط ○ أبوظبي

ملاحظة: يتم تظليل الشكل (●) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ● **غير صحيح** ⊖ ◉ ◒ ⊗ ☑

مُسَوَّدَة، لا يتم تصحيحها

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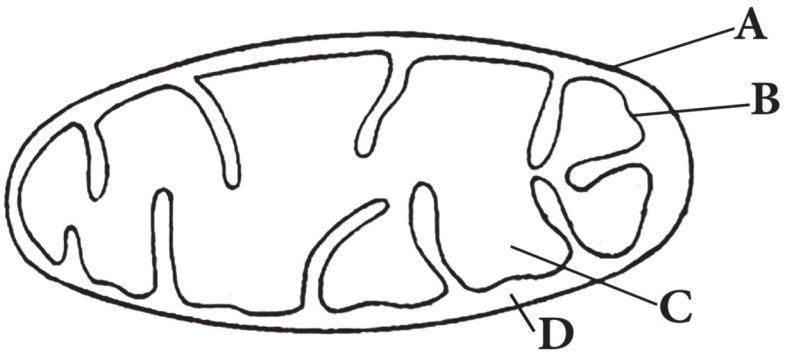
Question 1: Multiple Choice Items (12 marks)

There are 12 multiple-choice items worth two marks each.
Shade in the bubble (○) next to the **correct** answer for each of the following items.

1) The diagram below shows the structure of a mitochondrion.

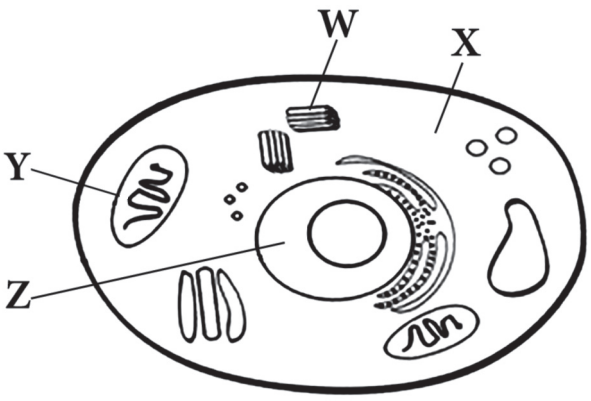


At which site is FAD reduced?

○ A ○ B

○ C ○ D

2) The diagram opposite shows an animal cell Identify the site of the respiration stage that produces 80% of the ATP energy.



○ W

○ X

○ Y

○ Z

3) At low light intensity, an increase in temperature:

○ stops the photosynthesis.

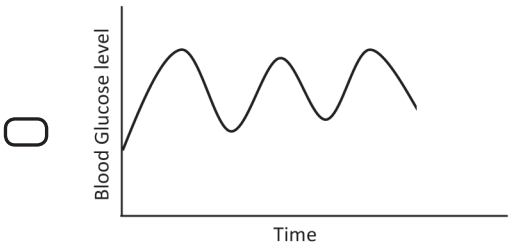
○ increases the rate of photosynthesis.

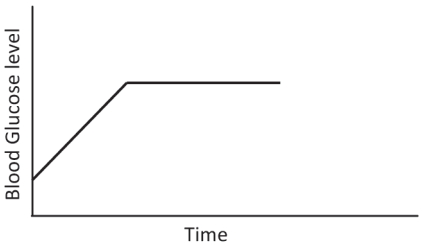
○ decreases the rate of photosynthesis.

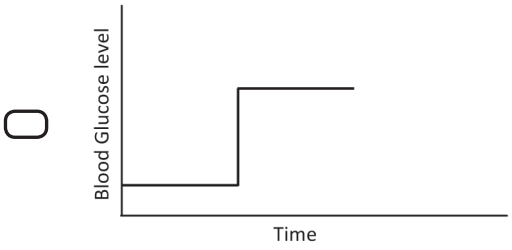
○ has no effect on the rate of photosynthesis.

Question 1 continued

4) Which graph best represents healthy blood glucose levels?

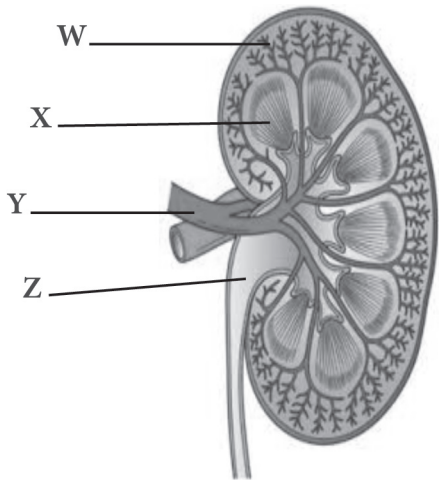






5) Bowman´s (Renal) capsule of the nephron is located in the part labeled:

- W
- X
- Y
- Z



6) Which of the following is correct when the membrane potential of a neurone drops below -70 mV?

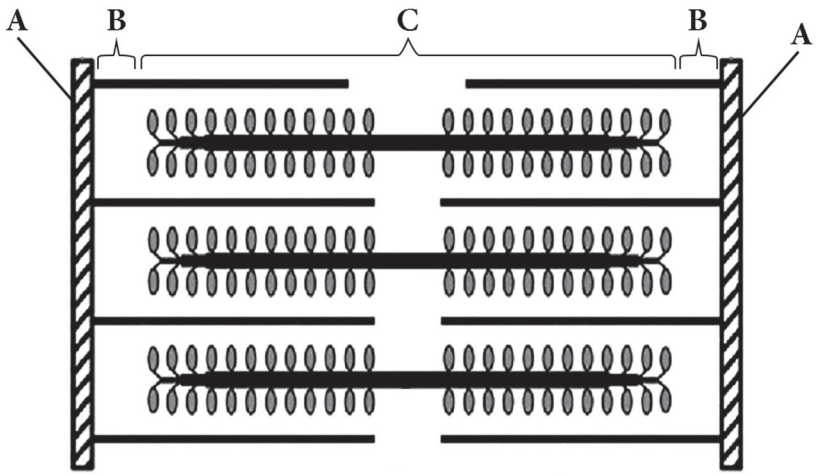
- Na^+ ions diffuse out.
- Na^+ ions diffuse in.
- K^+ ions diffuse out.
- K^+ ions diffuse in.

Do not write in this space

Do not write in this space

Question 1 continued

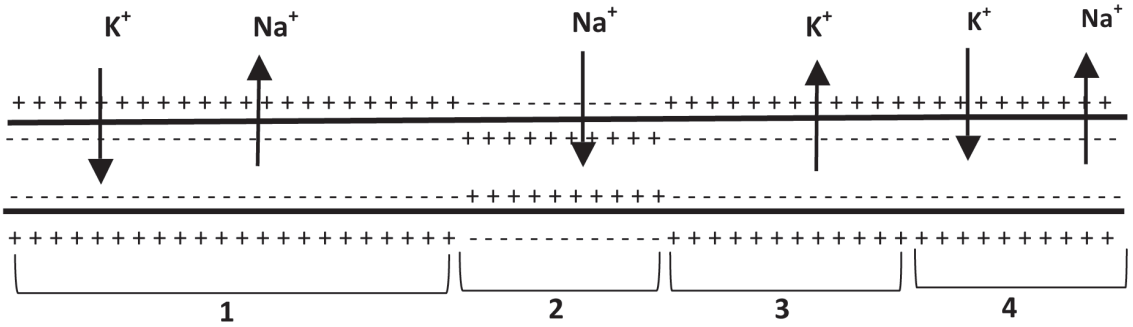
7) The diagram below shows the structure of a sarcomere.



Which of the following is correct about the changes in the parts labeled (A, B and C) during a muscle contraction?

	A	B	C
☐	Become closer	Become narrower	Doesn't change
☐	Doesn't change	Become wider	Become narrower
☐	Become farther	Become narrower	Become wider
☐	Become farther	Doesn't change	Become wider

8) The diagram below shows the changes in the membrane potential of an axon.



Which area represents the depolarization of the membrane potential?

☐ 1 ☐ 2

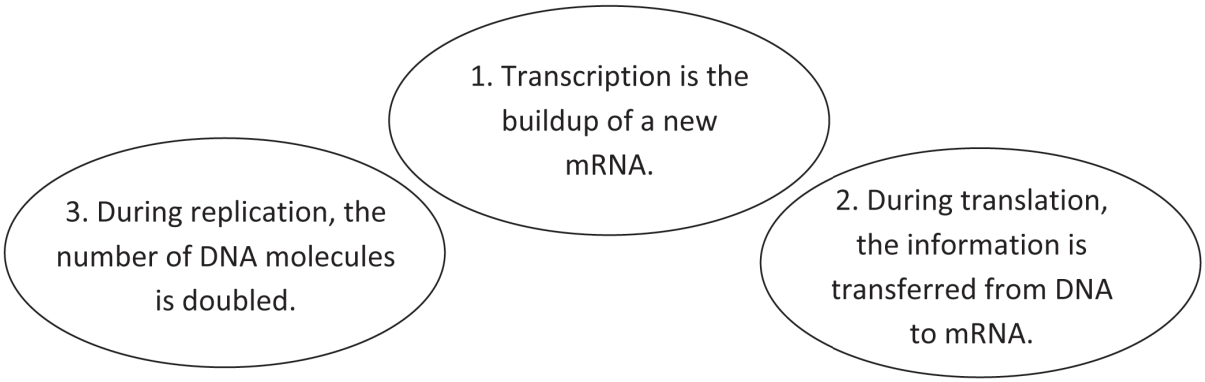
☐ 3 ☐ 4

Question 1 continued

9) The type of the bond between nucleotides in one strand of the DNA is:

- ☐ polar bond.
- ☐ hydrogen bond.
- ☐ sugar-phosphate bond.
- ☐ ionic bond.

10) The statements below describe three processes in the flow of genetic information.



The correct statements are:

- ☐ 1 & 2 only.
- ☐ 2 & 3 only.
- ☐ 1 & 3 only.
- ☐ 1, 2 & 3.

11) One of the following pairs of chromosomes is homozygous for two characters:

- ☐ 

- ☐ 

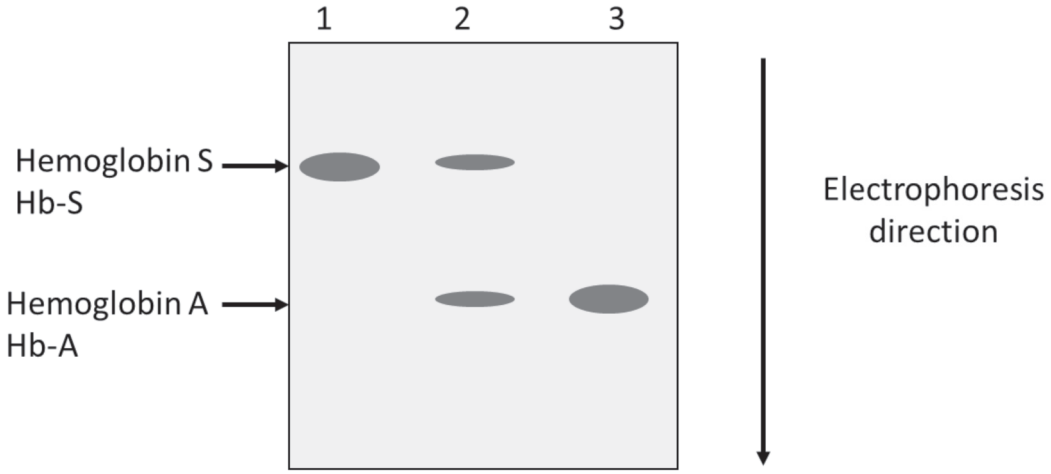
- ☐ 

- ☐ 

Do not write in this space

Question 1 continued

12) The diagram below shows the results of electrophoresis for **3** people who were tested for the presence of sickle cell anemia protein.



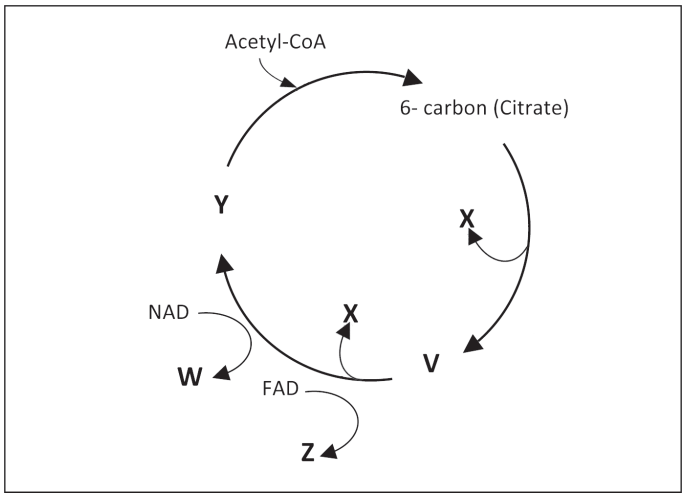
The sample/s belonging to unaffected person/s by sickle cell anemia is/are:

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 1 & 3

Question 2: Extended Responses (48 marks)

Write your answer for each of the following questions in the space provided.
Be sure to show all your work, including the correct units where applicable.

13) The diagram below shows one of the cellular respiration stages. (7 marks)



a. Name the compounds labeled (X) and (Y).

X: _____

Y: _____

b. Write the name of the following:

(i) The process of the production of the compound labeled (X).

_____

(ii) The reaction that produces the compound labeled (W).

_____

(iii) The stage that will utilize the compound labeled (Z).

_____

c. What is the number of carbon atoms in the compounds labeled (V) and (Y)?

V: _____

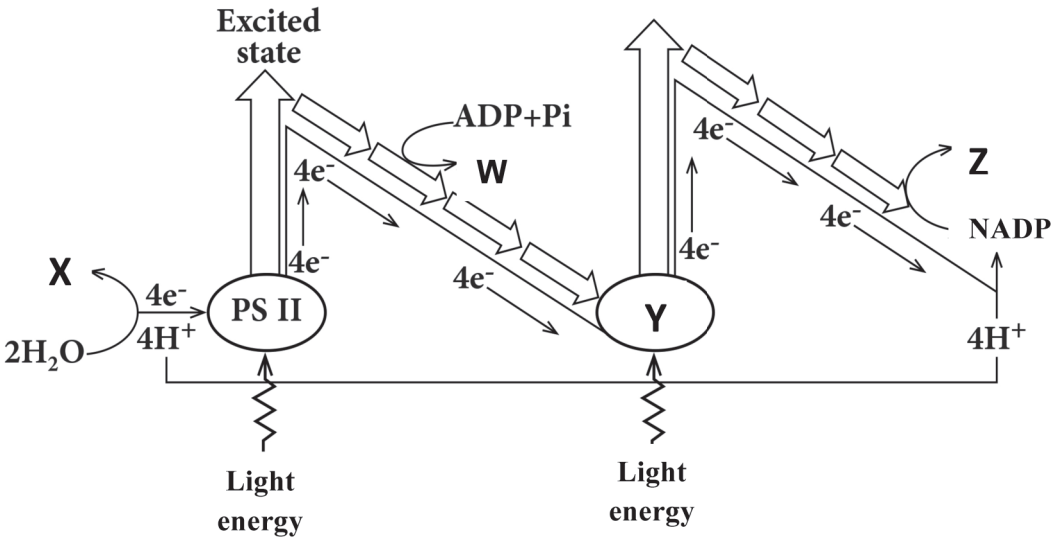
Y: _____

Do not write in this space

Do not write in this space

Question 2 continued

14) The diagram below shows the light - dependent stage of photosynthesis. (5 marks)



a. Name the molecule labeled (X).

_____

b. What is the type of the photosystem labeled (Y)?

_____

c. What is the role of the compound labeled (Z)?

_____

d. Where do these reactions take place in a chloroplast?

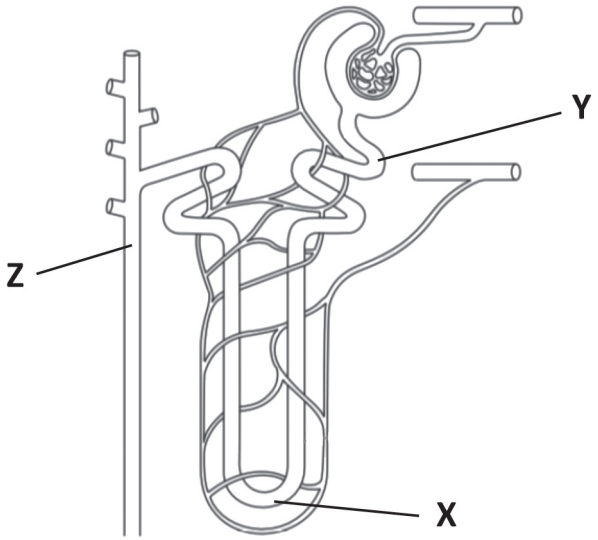
_____

e. Predict what will happen to the rate of the light independent reactions if the production of the compound labeled (Z) was inhibited.

_____

Question 2 continued

15. The figure below shows the structure of a nephron. (6 marks)



a. Name the parts labeled (X) and (Y).

X: _____

Y: _____

b. **(i)** Which part normally contains the lowest concentration of glucose?

_____

(ii) If the glucose concentration gets higher it may be a sign that the person has a disease. Identify the name of that disease.

_____

c. **(i)** Name the hormone that affects the permeability of the part labeled (Z).

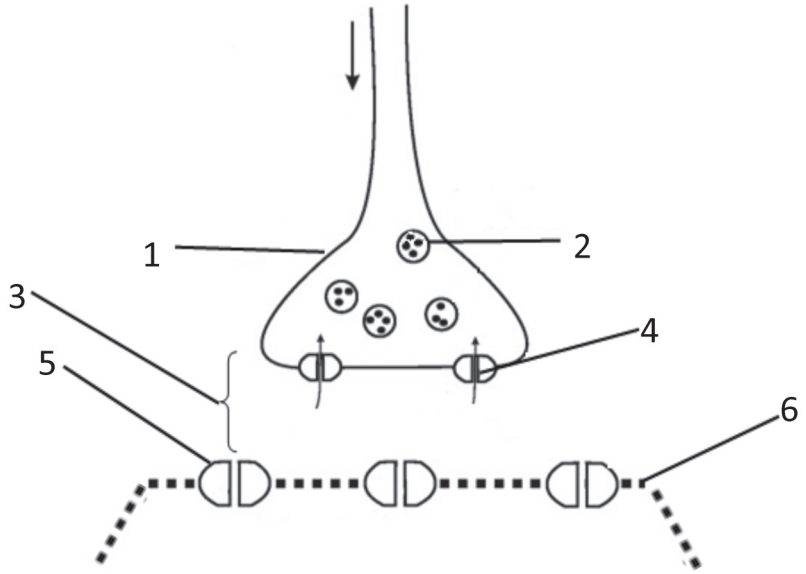
_____

(ii) What will be the level of that hormone in the blood of a small desert mammal?

_____

Question 2 continued

16) The diagram below shows the synapse between two neurones. (6 marks)



a. Name the parts labeled (1), (2) and (6):

(1): _____

(2): _____

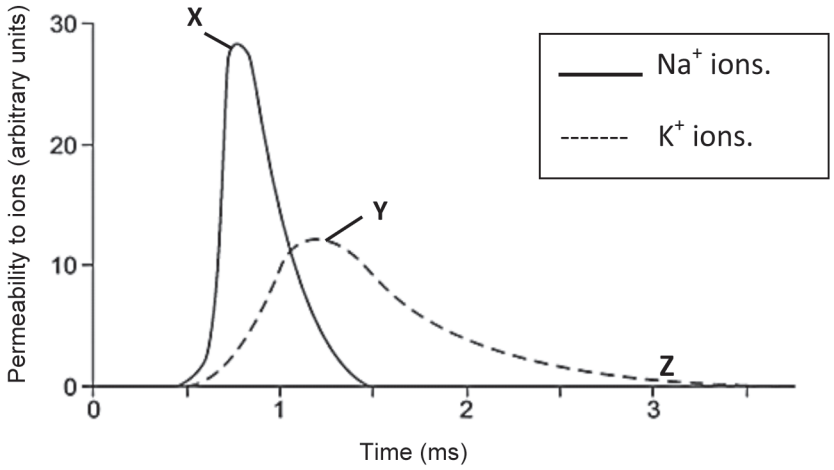
(6): _____

b. Match the parts labeled (3), (4) and (5) with their functions in the table below.

Function	Part
The sodium channels in the postsynaptic knob that allow sodium ions to diffuse in the postsynaptic neurone.	
The gap between two synaptic knobs that transmits the action potential chemically.	
The calcium gate that help the calcium ions to diffuse into the presynaptic neurone.	

Question 2 continued

17) The graph below shows the permeability of an axon's membrane for ions diffusion during the transmission of an impulse. (7 marks)



a. What is the state of the membrane potential at the points labeled (X) and (Z)?

X: _____

Z: _____

b. Between 0.5 ms and 0.7 ms permeability to sodium ions increases suddenly and sharply, what will be the effect of this change?

_____

c. Determine channels state at the points labeled (X) and (Y) in the table below:

	X	Y
Na^+ channels		
K^+ channels		

Do not write in this space

Question 2 continued

18) Protein synthesis is the process all cells use to make proteins. (6 marks)

a. What is the site of the processes below?

(i) Transcription: _____

(ii) Translation: _____

b. Complete the two different cases (1 & 2) in the table below:

	Triplet code	Codon	Anti-codon
1	ACC		ACC
2		GAA	

c. The following table shows a mutation in a DNA molecule.

	Original	Mutation
DNA triplet code	TTT	TTC
mRNA codon	AAA	AAG
Amino acid	Lysine	Lysine

Explain the effect of this mutation in the formed protein.

_____

Question 2 continued

19) A man with blood group **A** (heterozygous) is married to a woman with blood group **B** (heterozygous). (5 marks)

a. How many types of alleles are there in the inherited blood group gene?

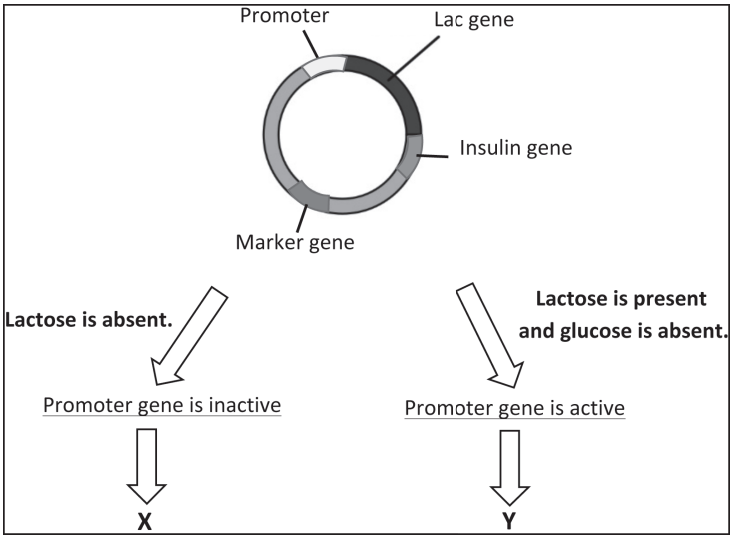
b. What is the mother's genotype?

c. Using the Punnett grid, find the children's genotypes.

d. What is the probability of the birth of a boy with blood group **O**?

Question 2 continued

20) The diagram below shows some of the steps of insulin production technology. (6 marks)



a. What is the function of:

(i) The promoter gene.

_____

(ii) The enzyme Ligase.

_____

b. Write an example of a marker gene that can be used in this technology.

_____

c. (X) and (Y) represents the process of production of insulin in a bacterial cell. Which of them represents the enhanced production of insulin?

_____

d. How can a blood clotting protein be produced instead of insulin?

_____

e. There are two insulin gene of different sizes. A scientist is not sure which size gene he has inserted in the plasmid.
Propose a method that will help the scientist to verify the size of the gene he used.

_____

[End of Examination]

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