

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)

الفصل الدراسي الأول - الدور الأول

للعام الدراسي ١٤٤٧/١٤٤٦ هـ - ٢٠٢٤ / ٢٠٢٥ م

تنبيه:
- المادة: الأحياء.
- الأسئلة في (١٨) 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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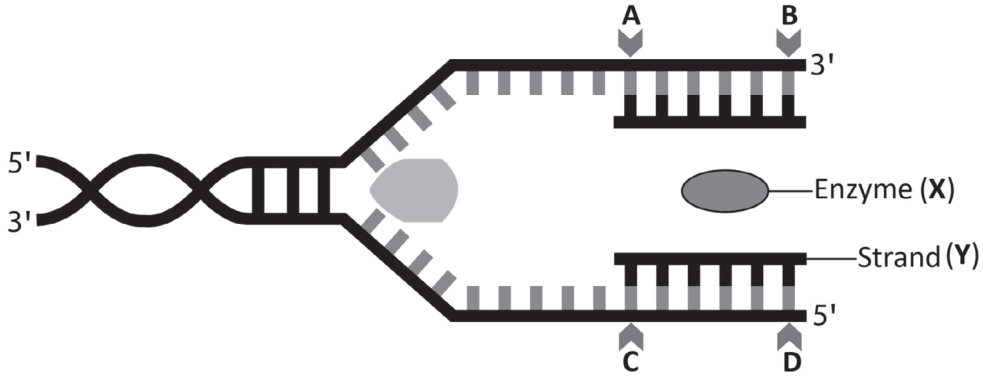
Question 1: Multiple Choice Items (14 marks)

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

1) Which of the following descriptions is related to DNA structure?

- ○ Each two nucleotides form a peptide bond.
- ○ Uracil links with adenine by two hydrogen bonds.
- ○ Each two nucleotides form a phosphodiester bond.
- ○ Guanine links with cytosine by two hydrogen bonds.

2) The diagram below shows the process of DNA replication.



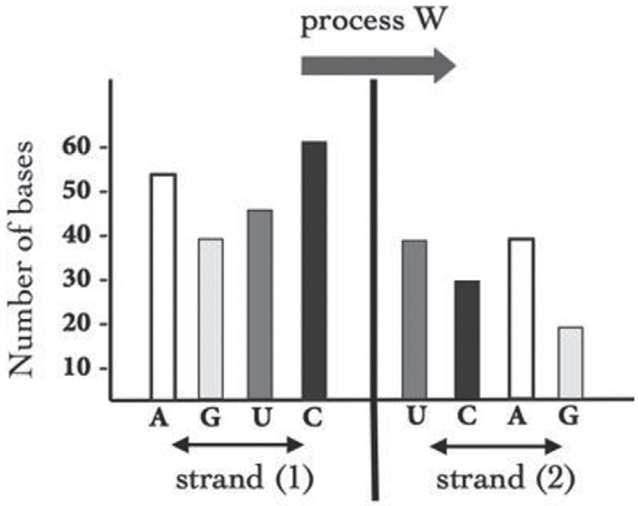
Which row is correct regarding the binding position of enzyme (**X**) and the name of the strand (**Y**)?

	Binding position	Name of the strand **(Y)**
○	B and C	Lagging
○	A and D	Lagging
○	B and C	Leading
○	A and D	Leading

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Question 1 continued

3) The following chart illustrates the number of nitrogenous bases during a biological process.



Which of the following is correct about strand (**2**) and the process (**W**)?

	Strand (**2**)	Process (**W**)
☐	Mature m-RNA	Transcription
☐	Growing m-RNA	Transcription
☐	Growing m-RNA	Modification
☐	Mature m-RNA	Modification

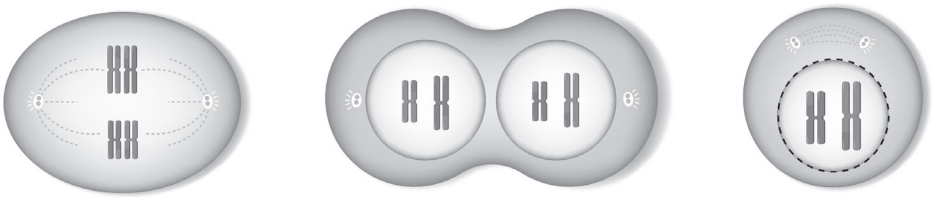
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Question 1 continued

4) The diagram below shows phases (**1**, **2** and **3**) of meiosis.



(1) (2) (3)

What are the names of the three phases (**1**, **2** and **3**)?

	1	2	3
☐	Metaphase I	Telophase I	Prophase I
☐	Anaphase I	Metaphase II	Anaphase II
☐	Prophase II	Telophase II	Anaphase I
☐	Metaphase I	Telophase I	Prophase II

5) In a breed of cattle, the coat colour is determined by two alleles: one allele for red (R) and the other allele for white (W). When both alleles are present, the cattle exhibit a roan coat.

If a roan cow (RW) is crossed with a solid red bull (RR), what are the possible phenotypes of the offspring?

☐ Red

☐ White

☐ Roan or red

☐ Roan or white

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Question 1 continued

6) What are the genotypes of the parents in a family with male children, half of whom are affected by haemophilia, while the other half are healthy, and all the daughters are unaffected by the disease?

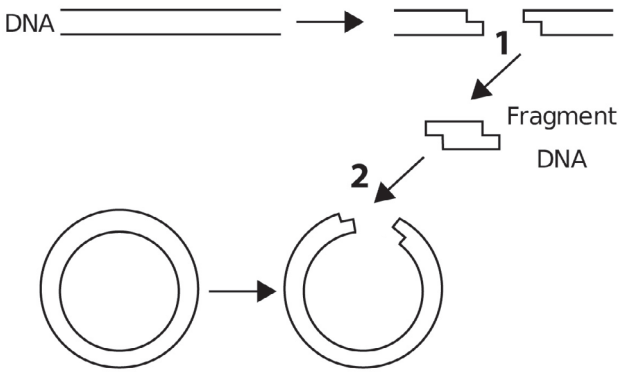
- ☐ Father: X^hY, Mother: X^HX^h.
- ☐ Father: X^HY, Mother: X^HX^h.
- ☐ Father: X^HY, Mother: X^HX^H.
- ☐ Father: X^hY, Mother: X^HX^H.

7) A small sample of DNA was obtained from a fossil. A polymerase chain reaction (PCR) was used to amplify the amount of DNA obtained from the sample.

Which of the following statements is **not correct** about the process of PCR?

- ☐ The annealing and extension of the DNA occur at different temperatures.
- ☐ The annealing and denaturation of the DNA occur at different temperatures.
- ☐ DNA polymerase catalyses the additions of nucleotides to a DNA strand.
- ☐ DNA polymerase catalyses the pairing of primers with complementary nucleotides.

8) The figure below shows one of the steps of genetic engineering.



In step **2**, what should the technician do to complete the process successfully?

- ☐ The plasmid and the target DNA must have blunt ends.
- ☐ The plasmid and the target DNA must be cut by a polymerase.
- ☐ The target DNA must come from the same species as the bacteria.
- ☐ DNA ligase must be used to rejoin the plasmid and the target DNA nucleotides.

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Question 1 continued

9) Salty soils can inhibit the growth of crop plants, such as tomatoes, particularly in coastal areas. Scientists have genetically modified some species of tomato to increase their salt tolerance by introducing a gene for a sodium-pump protein, into the genome of tomato plants.

Which method should be used to obtain the DNA fragment that contains the gene for the sodium pump protein?

- ▢ Artificial DNA by RNA polymerase.
- ▢ RNA polymerase to create cDNA from mRNA.
- ▢ A gene synthesis to produce the desired fragment.
- ▢ Restriction exonucleases to cut the gene from the salt tolerant species.

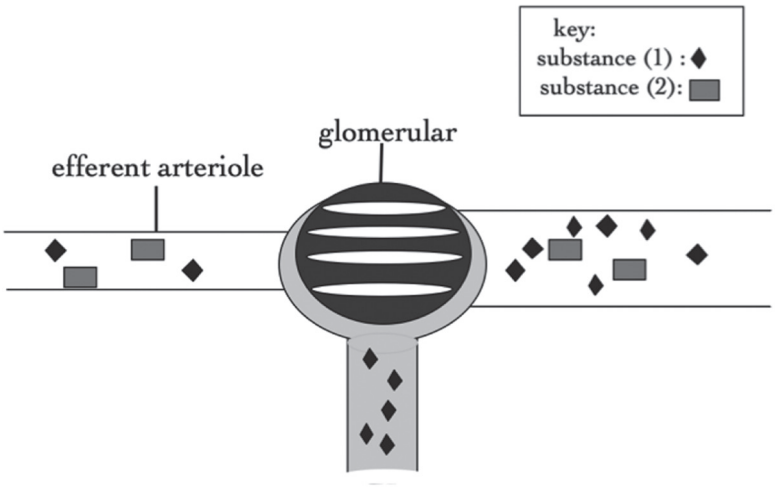
10) Which of the following is correct about the transport mechanism in distal convoluted tubules?

- ▢ Active transport of Na^+ ions into the tissue fluid.
- ▢ Passive transport of Na^+ ions into the tissue fluid.
- ▢ Active transport of Na^+ ions into the filtrate.
- ▢ Passive transport of Na^+ ions into the filtrate.

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Question 1 continued

11) The figure below illustrates one step of the urine formation process.



Which of the following rows is correct about substance (**1**), substance (**2**) and name of the step?

	Substance (**1**)	Substance (**2**)	Name of the step
○	Glucose	Protein	Reabsorption
○	Glucose	Protein	Ultrafiltration
○	Protein	Glucose	Reabsorption
○	Protein	Glucose	Ultrafiltration

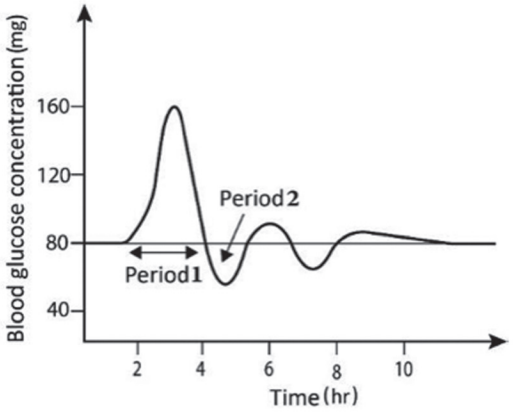
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Question 1 continued

12) The graph below shows a fluctuation in blood glucose concentration readings over 10 hours after consuming a meal.



Which of the following rows is correct about periods (**1** and **2**)?

	Period 1	Period 2
☐	Glucagon is secreted	Alph-cells respond
☐	Alph-cells respond	G-protein is activated
☐	Insulin is secreted	Beta-cells respond
☐	Beta-cells respond	G-protein is activated

13) The activity of the enzyme ATPase increases during muscle contraction. The table below shows four solutions of different components, prepared by a student to investigate the activity of ATPase.

Solution	Components
1	ATP, myosin, actin and tropomyosin.
2	ATP, myosin, actin and troponine.
3	ATP, myosin, actin, tropomyosin and calcium ions.
4	ATP, myosin, tropnine, tropomyosin and calcium ions.

Which solution has the highest activity of the enzyme ATPase?

☐ 1 ☐ 2

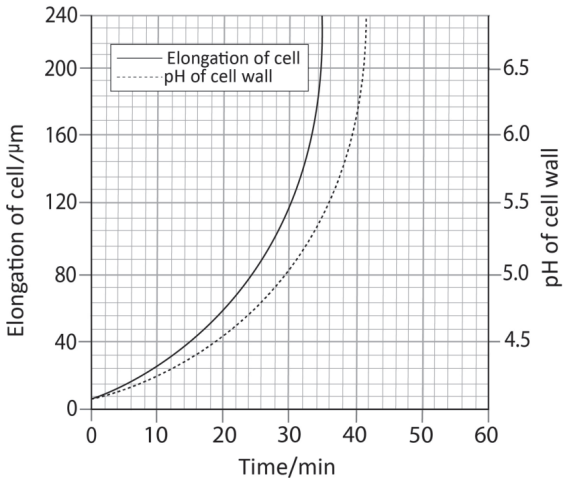
☐ 3 ☐ 4

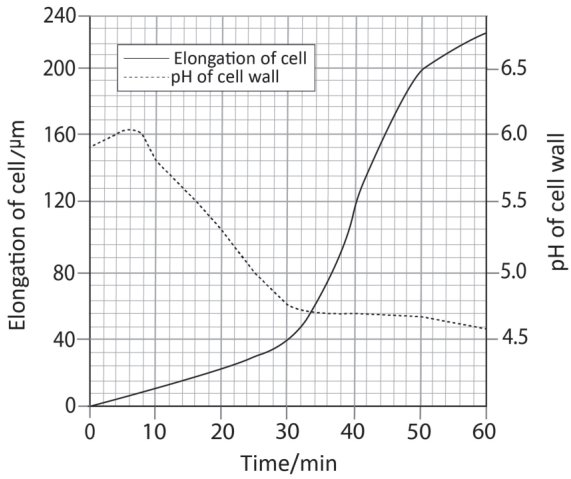
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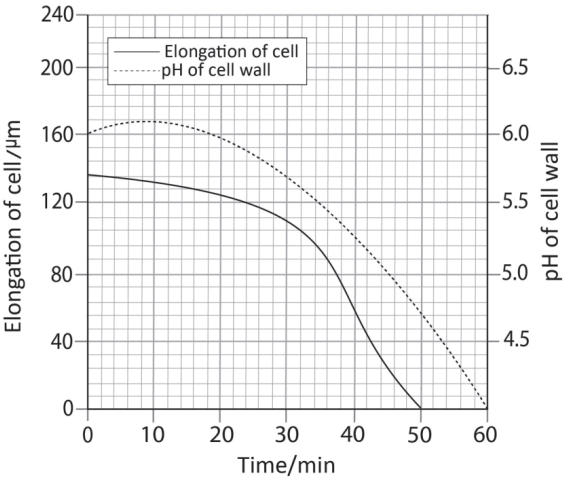
Question 1 continued

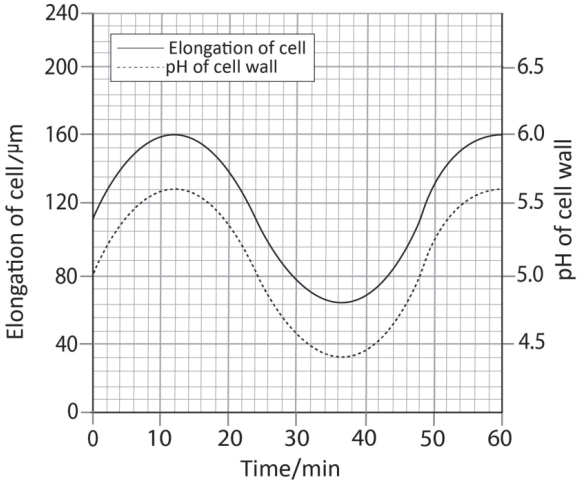
14) Auxin is a plant hormone that causes plant cell elongation. A group of students investigated the effect of auxin on the pH of a cell wall and cell elongation. The pH of the cell wall and cell elongation were measured over a period of 60 minutes.

Which curve represents the relationship between the pH of the cell wall and the cell elongation?









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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.

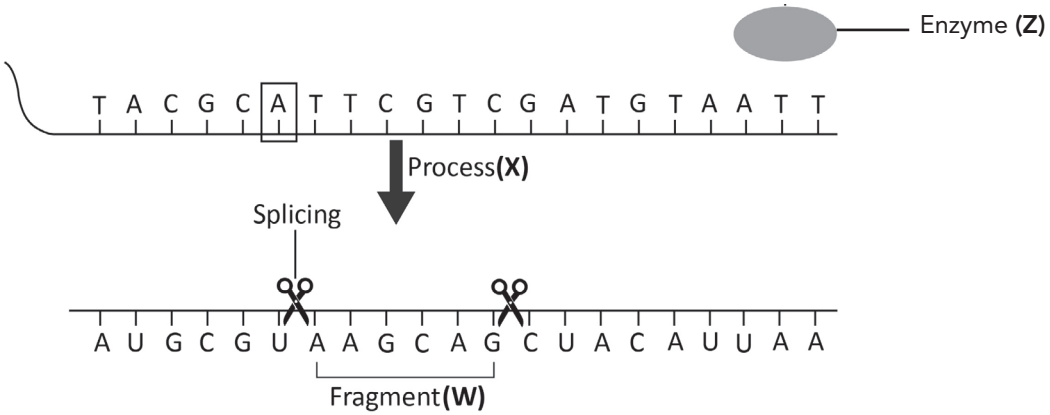
15) Describe the ATP structure.

_____

_____ [3]

16) The figure below shows one step of the protein synthesis process. A mutation takes place in the gene and replaces the sixth base (**C**) by base (**A**).

(**Note**: mRNA codons table on page 19)



a. Name the following:

- Process (**X**): _____
- Fragment (**W**): _____ [2]

b. Describe the genetic code feature that is represented in the figure above.

_____

_____ [1]

c. According to the figure, predict how this mutation affects a person. Explain your answer.

_____

_____ [2]

d. Write the amino acid sequence resulting from this mutation.

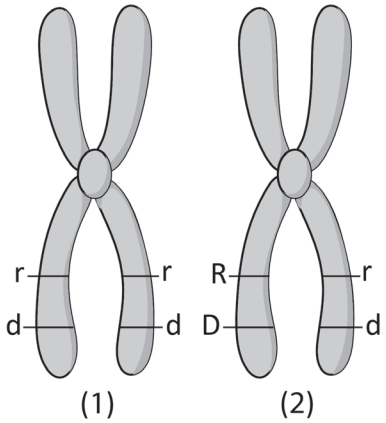
_____ [2]

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Question 2 continued

17) Red hair and freckles are traits that often appear together in individuals. The gene for red hair (R/r) is located on chromosome 16, along with another gene that influences the development of freckles (D/d).

The figure below illustrates two chromosomes: (**1**) for a father with brown hair and no freckles and (**2**) for the chromosome of a mother with red hair and freckles.



a. State the genetic term used for this inheritance pattern.

_____ [1]

b. Construct a genetic diagram to illustrate the parents' gametes, children's genotypes and the children's phenotypes.

_____

_____

_____

_____

_____

_____

_____

_____ [5]

c. Explain why the genotypes of the offspring will change if two genes are located in separate chromosomes.

_____

_____ [1]

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Question 2 continued

18) a. Describe one difference between repressible enzymes and inducible enzymes.

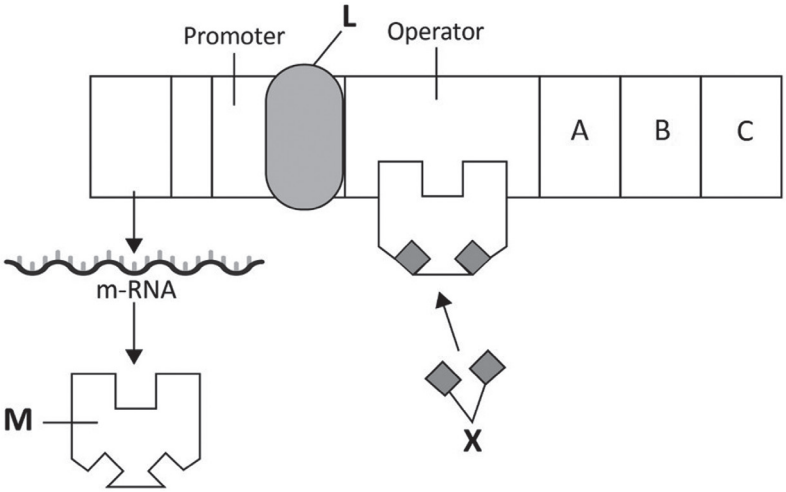
- Repressible enzymes: _____

_____

- Inducible enzymes: _____

_____ [2]

b. The diagram below shows part of a DNA in a bacterium that regulates the production of product (**X**) in a cell.



(i) Define the term structural genes.

_____

_____ [1]

(ii) Name the structures (**L**) and (**M**):

- L: _____
- M: _____ [2]

(iii) Predict the type of enzyme required to produce product (**X**). Explain your answer.

_____

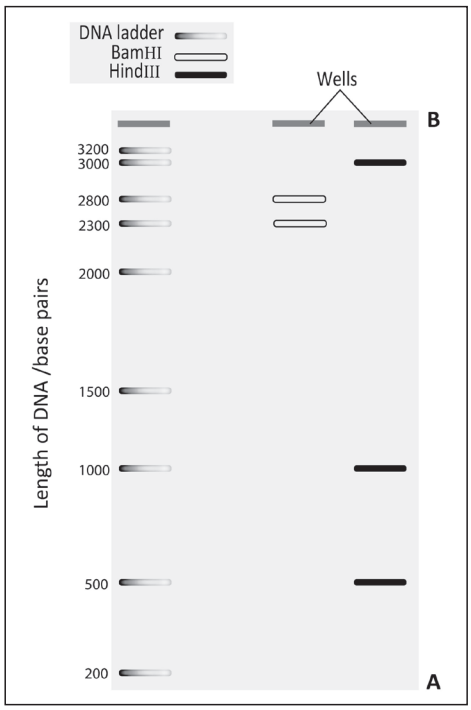
_____

_____ [2]

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Question 2 continued

19) A student wanted to investigate the effect of two different restriction endonuclease enzymes BamHI and HindIII on a linear DNA fragment. The student used two tubes containing a buffered solution of linear DNA fragments. After 45 minutes the student obtained the results shown below.



a. Explain why the DNA fragments move from B to A. (Give two reasons).

_____

_____ [2]

b. Suggest two features of BamHI and HindIII that can be observed from the figure above.

_____

_____ [2]

c. What is the effect of BamHI and HindIII on a linear DNA fragment?

_____ [1]

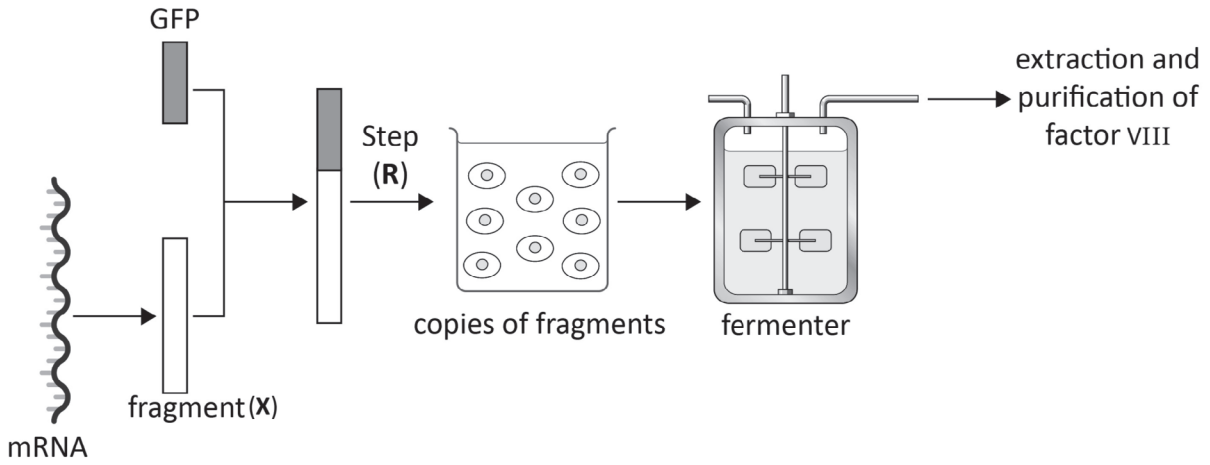
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Question 2 continued

20) Haemophilia is a genetic disorder in which blood fails to clot. Factor VIII is a protein used to treat haemophilia. Hamsters can be genetically engineered to produce Factor VIII. The diagram below shows the stages of this process.



a. State two **other** sources used to obtain genes that can be transferred into an organism.

_____

_____ [2]

b. Name the type of fragment (**X**).

_____ [1]

c. Explain why it is easier to obtain the Factor VIII gene from mRNA, rather than getting it directly from DNA that is removed from human cells.

_____

_____ [1]

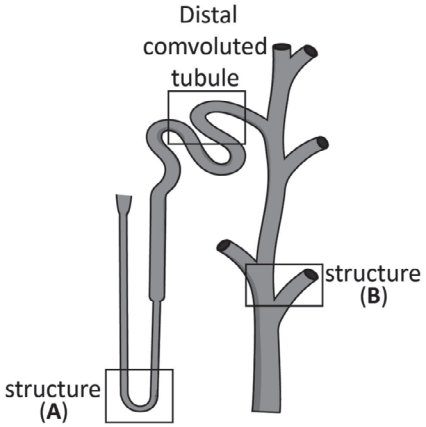
d. What must be added in step (**R**) to produce copies of fragments?

_____ [1]

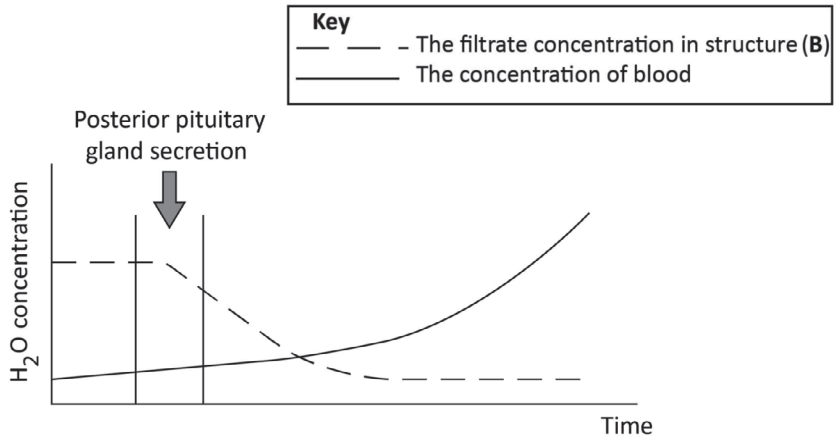
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Question 2 continued

21) The figure below shows part of a nephron and the graph demonstrates the effect of the posterior pituitary gland secretion on the H_2O concentration in structures (**A**) and (**B**).



Figure



Graph

a. Name the hormone responsible for osmoregulation.

_____ [1]

b. Use the graph to explain the effect of the posterior pituitary gland secretion on H_2O concentration in the blood.

_____

_____ [1]

c. Illustrate the effect of the posterior pituitary gland secretion in the cell membrane of structure (**B**).

_____ [1]

d. How does structure (**A**) contribute to the formation of concentrated urine?

_____

_____ [1]

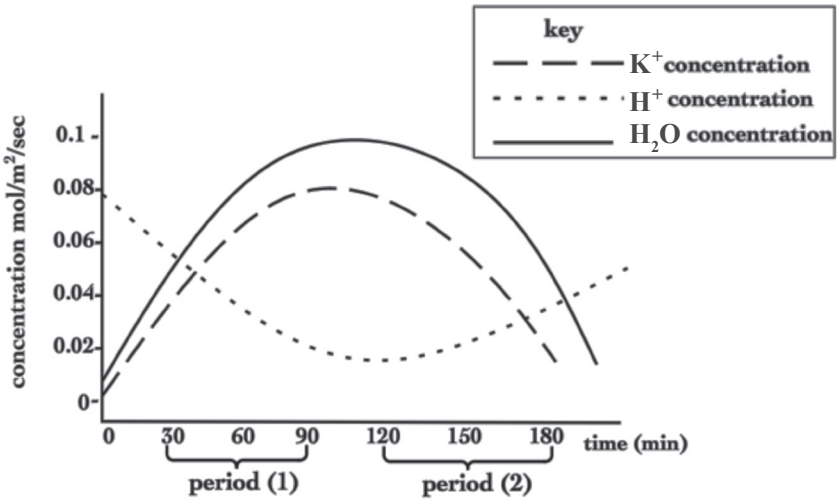
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Question 2 continued

22) The graph below shows the hemostasis in a plant according to the opening and closing stomata.



a. Describe how the cell wall structure of the guard cells adapted to its function. (Write 3 points).

_____

_____

_____ [3]

b. Use the graph to describe the relationship between the H^+ concentration and H_2O concentration.

_____ [1]

c. Predict two environmental factors that cause the changes in H^+ and K^+ concentration in the guard cells in period (**1**).

_____

_____ [2]

d. What is the condition of the stomata aperture in period (**2**)? Explain your answer.

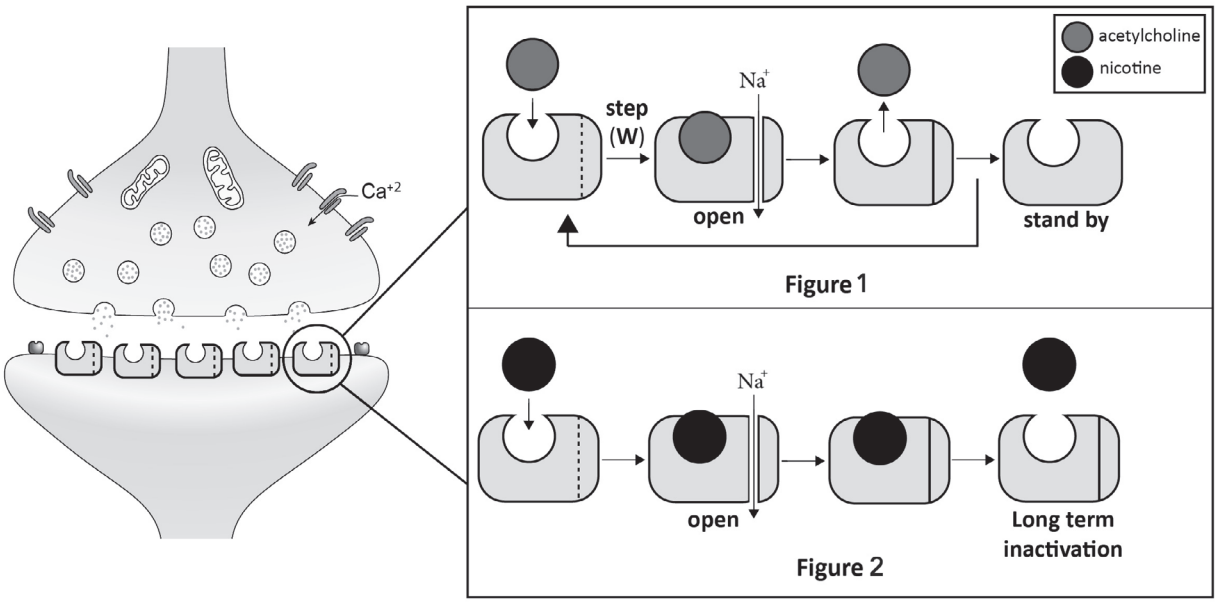
_____

_____ [2]

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Question 2 continued

23) Figure **1** shows the normal condition of acytelcholine action and figure **2** shows the pathological condition when nicotine interacts with acytelcholine.



a. What is the role of Ca^{+2} ions?

_____

_____ [1]

b. From figure 1, explain step (**W**).

_____

_____

_____ [2]

c. From figure 2, suggest the effect of nicotine on the nerve impulses.

_____

_____ [1]

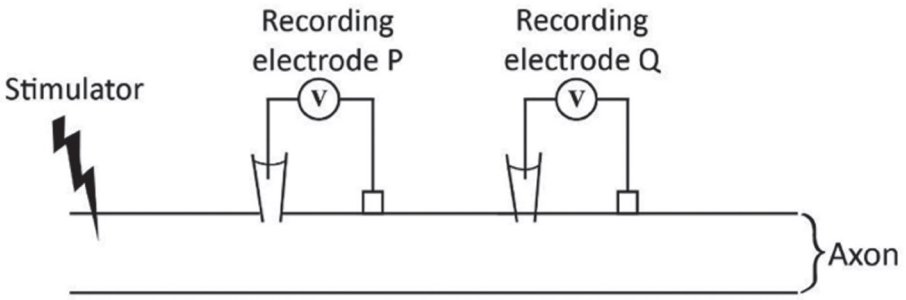
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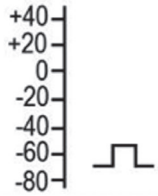
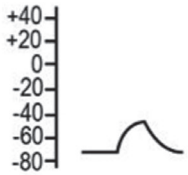
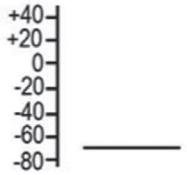
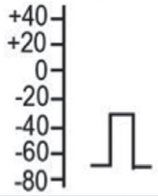
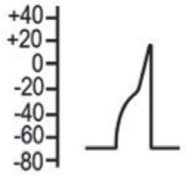
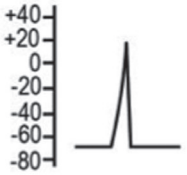
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Question 2 continued

24) The figure below shows how a stimulator was used to change the potential difference across an axon membrane. Two electrodes, **P** and **Q**, were used to record any potential differences produced after stimulation. The experiment was repeated 2 times, using a different stimulus potential each time.



	Stimulus potential / mV	Potential difference recorded at P / mV	Potential difference recorded at Q / mV
First attempt			
Second attempt			

a. State the type of neurones that:

- transmit the response from the brain to the response organ.

_____

- transmit impulses from the receptor to the brain.

_____ [2]

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Question 2 continued

b. Explain the results of the first attempt and the second attempt.

_____

_____

_____

_____ [2]

c. Predict what would happen to the speed of the nerve impulses if the intensity of the stimulus was increased in second attempt.

_____ [1]

d. Explain why the cell in site **Q** cannot receive another stimulator.

_____

_____ [1]

[End of Examination]

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	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

mRNA Codons Table

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نموذج إجابة امتحان دبلوم التعليم العام- المدارس ثنائية اللغة

للعام الدراسي: 1446/1445هـ - 2025/2024م

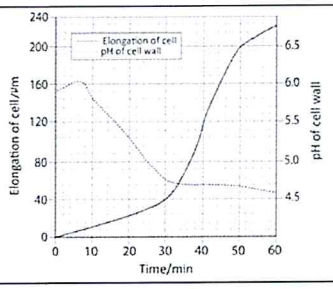
الفصل الدراسي: الأول – الدور: الأول

المـادة: الأحيـاء

Note: Answer guide in (8) sheets. Total marks:70

Part 1: Multiple Choice **Each Question: 1 mark** **Total: 14 marks**

Q	Ch	Answer	Page		Outcome	Level of learning
			Cambr	Hodd		
1	1	Each two nucleotides form a phosphodiester bond.	145	122	1.1.3	Knowledge
2	1	Binding position: B and C; Name of strand (Y): lagging	149	125-126	1.2.1	Applying
3	1	strand (2): mature m-RNA; process (W): Modification	151-153	131-133	1.4.3	Applying
4	2	1: Metaphase I; 2: Telophase I; 3: Prophase II	431	346	2.1.4	Knowledge
5	2	Roan or red	437-439	355-356	2.4.2	Applying
6	2	Father: X^HY, Mother: X^HX^h	440-441	358-359	2.4.2	Reasoning
7	3	DNA polymerase catalyses the pairing of primers with complementary nucleotides.	555-556	461	3.3.1	Knowledge
8	3	DNA ligase must be used to rejoin the plasmid and the target DNA nucleotides.	544/548	458/462	3.1.1 3.2.1	Applying
9	3	A gene synthesis to produce the desired fragment.	546	467	3.1.3	Reasoning
10	4	Active transport of Na^+ ions into the tissue fluid.	357 - 359	305-308	4.1.7	Knowledge
11	4	Substance (1): Glucose; Substance (2): Protein; Name of the step: Ultrafiltration	354-355	304	4.1.6	Applying
12	4	Period 1: Beta-cells respond; Period 2: G- protein is activated	364 - 367	296-297	4.3.2	Reasoning

13	5	3	410	334	5.3.2	Applying
14			415	339	5.4.1	Applying

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Part 2: Extended Response Chapter 1 (10 marks): 3 Knowing 5 Applying 2 Reasoning

Q		Answer	Mark	Page		outcome	Level of learning
				Cambr	Hodd		
15		Phosphate group (1**mark**), ribose (**1mark**) and adenine (**1mark**). **Or** Phosphate group and adenosine (**3 mark**).	3	145	122	1.1 .1	Knowledge
16	a.	-transcription (**1mark**) -intron (**1mark**)	2	152	132	1.4.3	Applying
	b	Some amino acids are coded by more than one triplet. **Or** it is a three-letter code, known as a triplet code.	1	151	129	1.3.1	Applying
	c.	No effect (**1 mark**) Because Arginine is coded by both CGG and CGU. (**1 mark**)	2	154	134-138	1.5.2	Reasoning
	d	Met –Arg- Leu -His **Or** methionine- Arginine -leucine -Histidine **One mark for two correct amino acids in order and two marks for four correct amino acids in order.**	2	153	137	1.4.1	Applying



Part 2: Extended Response. Chapter 2 (14 marks): 4 Knowing 7 Applying 3 Reasoning

<table>
<tr><th colspan="2">Q</th><th>Answer</th><th>Mark</th><th colspan="2">Page</th><th>outcome</th><th>Level of learning</th></tr>
<tr><th></th><th></th><th></th><th></th><th>Cambr</th><th>Hodd</th><th></th><th></th></tr>
<tr><td rowspan="3">17</td><td>a.</td><td>Autosomal linkage</td><td>1</td><td>445-446</td><td>364</td><td>2.4.3</td><td>Knowledge</td></tr>
<tr><td>b.</td><td>Parents' gametes: (1 mark)
(rd) (RD) (rd)
or
<table><tr><td>Gametes</td><td>(RD)</td><td>(rd)</td></tr><tr><td>(rd)</td><td>(RD)(rd)</td><td>(rd)(rd)</td></tr></table>Children's genotypes: (2 marks)
(RD)(rd), (rd)(rd)
Children's phenotypes: (2 marks)
Red hair freckles
Brown hair no freckles</td><td>5</td><td>445-446</td><td>364</td><td>2.4.3</td><td>Applying</td></tr>
<tr><td>c.</td><td>crossing over would occur between the genes leading for more possible gametes (recombinant).</td><td>1</td><td>434-435</td><td>348-349</td><td>2.2.2</td><td>Reasoning</td></tr>
<tr><td rowspan="2">18</td><td>a.</td><td>Repressible enzymes:
Any one of the following:
- Generally produced continuously, but their production can be halted.
- They are formed unless a signal, such as an excess of product, turns their production off.
-An enzyme that is normally produced, and whose synthesis is prevented by the presence of an effector.
Inducible enzymes
Any one of the following:
- Produced under specific conditions, such as the presence of a particular substrate.
- A substance controls the expression of one or more genes, structural genes, involved in the metabolism of that</td><td>2</td><td>455</td><td>374-375</td><td>2.6.1</td><td>Knowledge</td></tr>
</table>

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		substance. In the absence of the substrate, gene action is switched off. - An enzyme that is synthesized only when its substrate is present.					
	b.	A gene code for a structural protein, or an enzyme or an RNA molecule not involved in regulation.	1	453	374	2.6.1	Knowledge
		ii. - **L**: RNA polymerase - **M**: Repressor	2	453-455	374-375	2.6.2	Applying
		iii. Repressible enzymes. (**1mark**) **Explanation**: The excess of product (X) turns its production off by binding the product X (effector) to the repressor (B)that helps it to bind to the operator, which inhibits or stops the synthesis of enzyme.(**1mark**)	2	453-455	374-375	2.6.2	Reasoning

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Part 2: Extended Response. Chapter3 (10 marks): 3 Knowing 5 Applying 2 Reasoning

Q		Answer	Mark	Page		outcome	Level of learning
				Cambr	Hodd		
19	a.	- Smaller fragments move faster than larger fragments. (**1mark**) - DNA fragments are negatively charged and move towards the anode (+). (**1mark**)	2	557	468	3.3.2	Applying
	b.	**Any two of the following:** - BamH1 cuts the DNA fragment in one place and produces two fragments. - HindIII cuts the DNA fragment in two places and produces three fragments. - Largest/smallest fragments are produced when cut by HindIII. - BamH1 fragment lengths are 2800bp and 2300bp - HindIII fragment lengths are 3000bp,1000bp and 500bp	2	545-557	462 - 468	3.2.1 3.3.2	Reasoning
	c.	Cuts the DNA at specific sequence of bases	1	545	462	3.2.1	Knowledge
20	a.	-extracted from the DNA of a donor organism. -synthesized chemically from nucleotides.	2	545-546	466-467	3.1.3	Knowledge
	b	cDNA	1	551	466	3.2.3	Applying
	c	mRNA has been edited / does not contain introns / mRNA codes for single protein	1	546	460	3.1.3	Applying
	d	Insert the promoter with the desired gene	1	552	464	3.2.2	Applying

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Part 2: Extended Response. Chapter 4 (12 marks): 4 Knowing 6 Applying 2 Reasoni

Q		Answer	Mark	Page		outcome	Level of learning
				Cambr	Hodd		
21	a.	ADH or antidiuretic.	1	360	307	4.2.1	Knowledge
	b.	After the pituitary gland secretes ADH enters the blood and reduces the loss of water in the urine.	1	360	307-308	4.2.1	Applying
	c.	Increases the membrane permeability to water more than usual.	1	360	310	4.2.1	Applying
	d.	Create very high concentration of sodium and chloride ions in the tissue fluid which will enable a lot of water to be reabsorbed from collecting duct.	1	358	306-307	4.2.1	Applying
22	a.	**Any three of the following:** -Thick cell walls that face the air outside the leaf and the stomatal pore. -The outer wall has a thick waxy cuticle and is often extended into ledges. The walls facing the adjacent epidermal cells are much thinner. -The cell walls have no plasmodesmata. - cellulose microfibrils are arranged into bands around the cell.	3	371-372	312	4.4.1	Knowledge
	b.	An inverse relationship, as the concentration of hydrogen ions increase inside the guard cells, the water concentration decreases and vice versa.	1	373-374	313-314	4.4.3	Applying
	c.	Increasing light intensity low CO_2 concentration in leaf spaces.	2	372-374	312-314	4.4.3	Applying
	d.	Close (**1mark**) Because the water concentration decreases in the guard cells **Or** the K+ ions decrease in the guard cells. **Or** H^+ ions increase in the guard cells. (**1mark**)	2	373-374	313-314	4.4.3	Reasoning

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Part 2: Extended Response. Chapter 5 (10 marks): 3Knowing 5Applying 2 Reasoning

Q		Answer	Mark	Page		outcome	Level of learning
				Cambr	Hodd		
23	a.	Causes synaptic vesicals to move towards the presynaptic membrane and fuse it.	1	404	327	5.2.7	Knowledge
	b.	ACh molecule binds to the receptor of sodium channels in the postsynaptic membrane **(1 mark)** The receptor goes through a conformational change and opens to allow sodium ions to diffuse into the postsynaptic neurone **(1 mark)**	2	404	327	5.2.7	Applying
	c.	The refractory period takes a long time/Nicotine slows down the transmission rate of action potentials or nerve impulses Or it amplifies the post synaptic transmission.	1	403 / 397	325 / 327	5.2.4 5.2.7	Reasoning
24	a.	- Motor neurones. - Sensory neurones.	2	390	319-320	5.2.1	Knowledge
	b.	First attempt is low threshold **or** does not give action potential. **(1 mark)** Second attempt is above the threshold **or** gives an action potential. **(1 mark)**	2	395-396	325	5.2.4	Applying
	c.	The speed of the nerve impulses would not change.	1	397	325	5.2.4	Applying
	d.	There are sufficient Na^+ for stimulation of the adjacent region of axon therefore the impulse is propagated(from P to Q).	1	395-396	324-325	5.2.4	Reasoning

END OF THE MARKING GUIDE





امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

الفصل الدراسي الأول - الدور الثاني

للعام الدراسي ١٤٤٦ - ١٤٤٧ هـ - ٢٠٢٤ / ٢٠٢٥ م

تنبيه:
- المادة: الأحياء.
- الأسئلة في (١٥) 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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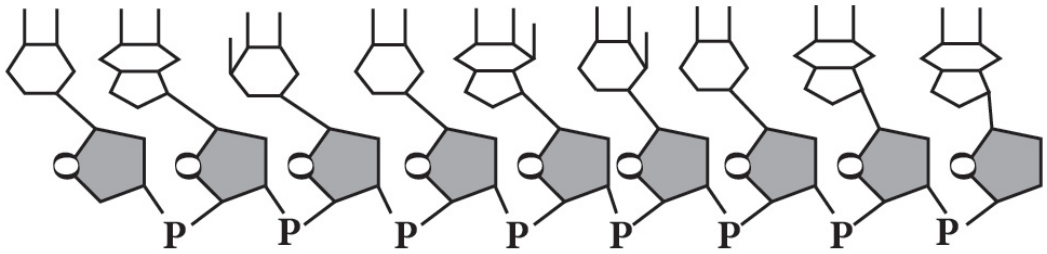
Question 1: Multiple Choice Items (14 marks)

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

1) Which of the following statements correctly describes the leading strand during DNA replication?

- ⬭ Replicated from 5′ to 3′ continuously.
- ⬭ Replicated from 3′ to 5′ continuously.
- ⬭ Replicated from 3′ to 5′ as Okazaki fragments.
- ⬭ Replicated from 5′ to 3′ as Okazaki fragments.

2) The diagram below shows one strand of a DNA molecule.



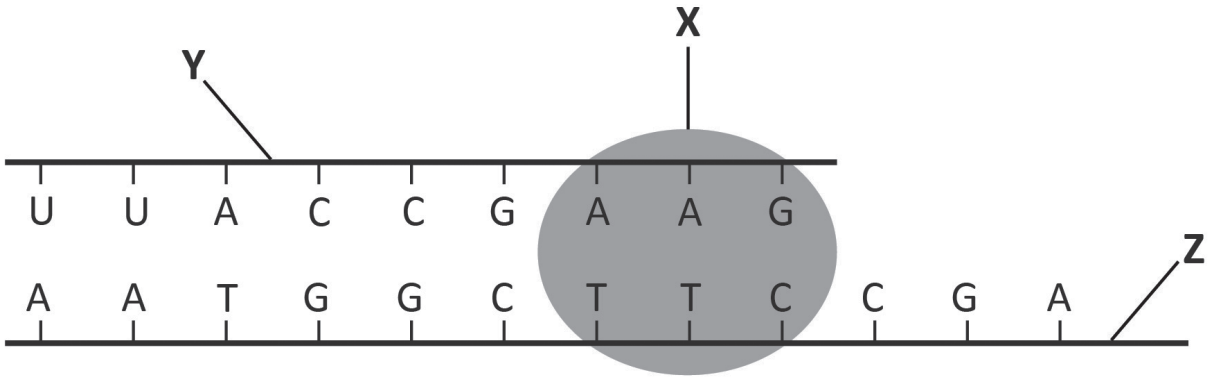
Which of the following represents the anticodons sequence for this strand?

- ⬭ TACTGCTAA
- ⬭ ATGACGATT
- ⬭ AUGACGAUU
- ⬭ UACUGCUAA

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3) The figure below shows a biological process in a cell.



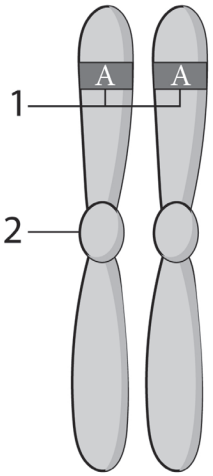
Which row represents the correct labelling of (**X**, **Y** and **Z**)?

	X	Y	Z
○	DNA polymerase	m-RNA	Template strand
○	RNA polymerase	m-RNA	Template strand
○	RNA polymerase	Complementary strand	Non-template strand
○	RNA polymerase	Complementary strand	m-RNA

4) The opposite figure shows chromosomes in the anaphase of meiosis I.

What terms are the numbers (**1** and **2**) in the figure referring to?

	1	2
○	Homozygous	Chiasma
○	Heterozygous	Chiasma
○	Homozygous	Centromere
○	Heterozygous	Centromere



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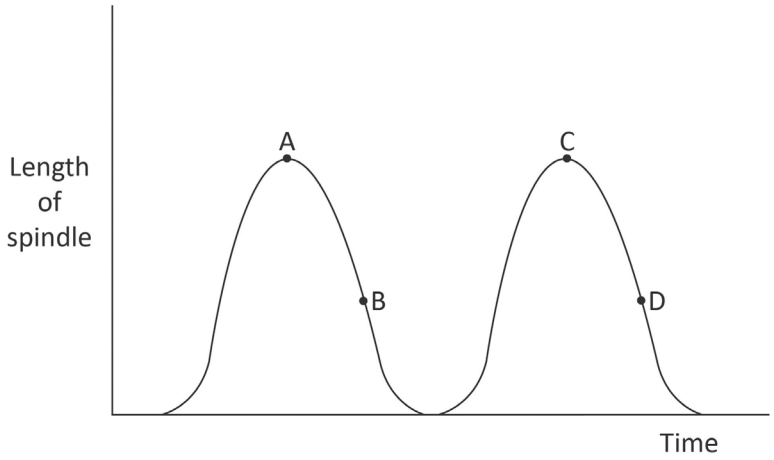
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5) Oestrogen is a steroid hormone that enters the cell and binds to its receptor in the cytoplasm. The receptor-oestrogen complex binds to the promoter region of DNA to activate protein synthesis.

What is the function of the receptor-oestrogen complex?

- ▢ A repressor that inhibits the gene expression.
- ▢ A repressor that enhances the gene expression.
- ▢ A transcription complex that inhibits the gene expression.
- ▢ A transcription complex that enhances the gene expression.

6) The graph below shows the length of the spindle in a cell during meiosis.



Which part of the graph represents the point where chromatids separate at their centromeres and move towards opposite poles?

- ▢ A
- ▢ B
- ▢ C
- ▢ D

7) What type of DNA is in the plasmid after a gene is inserted from another organism?

- ▢ Recombinant DNA
- ▢ Complementary DNA
- ▢ Separated DNA
- ▢ Original DNA

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8) **A** and **B** represent some of the enzymes that are used in a synthesizing a gene from mRNA.

mRNA $\xrightarrow{\text{A}}$ cDNA $\xrightarrow{\text{B}}$ double strand DNA

Which row shows the correct names of enzymes (**A** and **B**)?

	A	B
☐	Restriction endonuclease	DNA ligase
☐	DNA polymerase	Reverse transcriptase
☐	Reverse transcriptase	DNA polymerase
☐	DNA ligase	DNA polymerase

9) The figure **A** represents the position of the recognition sites for the restriction enzymes BamHI, EcoRI, HaeIII and SalI in a DNA molecule. The figure **B** represents DNA segments on a gel electrophoresis resulting from digestion with the restriction enzymes.

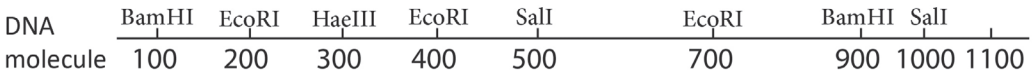


Figure **A**

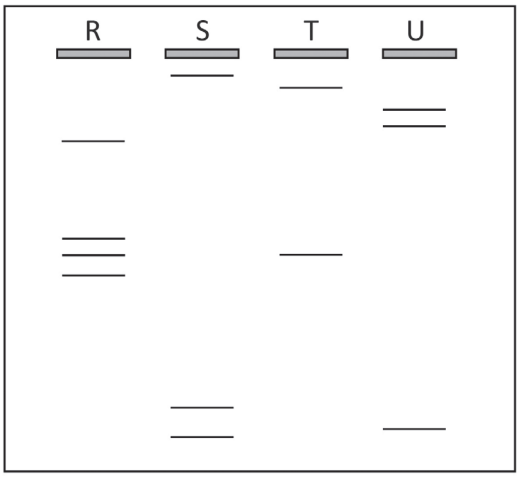


Figure **B**

Which enzyme will give fragments in the well labelled (**S**)?

☐ BamHI ☐ HaeIII

☐ EcoRI ☐ SalI

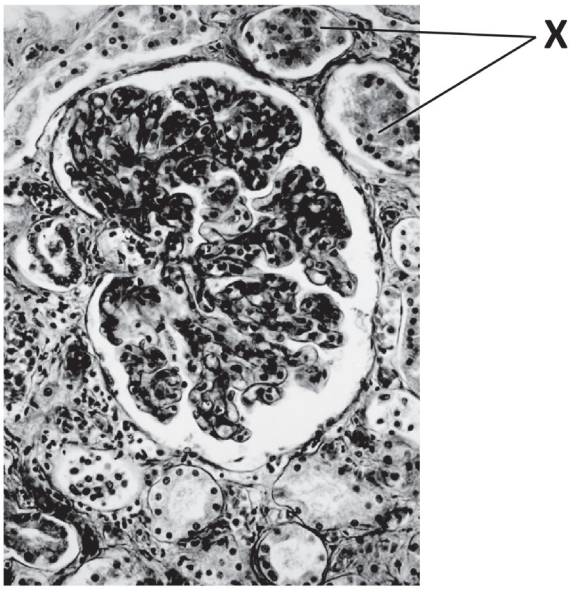
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10) What enzyme is used in the test strip for measuring the concentration of glucose in urine and that changes the colour of the pads?

- ⬭ Peroxidase
- ⬭ Glucose Oxidase
- ⬭ Protein kinase
- ⬭ Phosphorylase kinase

11) The photomicrographs below show two parts in a nephron.



The parts labelled (**X**) are related to the:

- ⬭ Glomerulus
- ⬭ Proximal convoluted tubule
- ⬭ Loop of Henle
- ⬭ Distal convoluted tubule

12) A patient has a condition known as (diabetes insipidus) resulting from a lack of antidiuretic hormone (ADH) secretion.
Which of the following statements describes what the patient is suffering from?

- ⬭ High blood sugar levels.
- ⬭ Decrease frequency of urination.
- ⬭ High water potential in the medulla
- ⬭ Intense thirst and drinking a large amount of water.

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13) **Figure 1** shows the cholinergic synapse of a normal person, and **figure 2** shows a person suffering from myasthenia gravis. Myasthenia gravis is an autoimmune disease that affects the cholinergic synapse. One of the symptoms of myasthenia gravis is reduced muscle contraction.

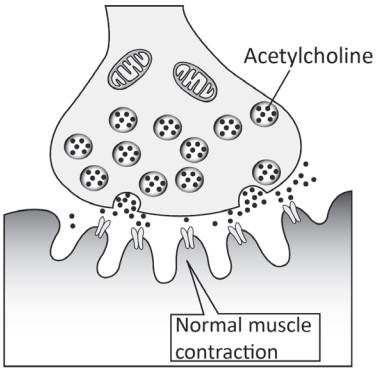


Figure1

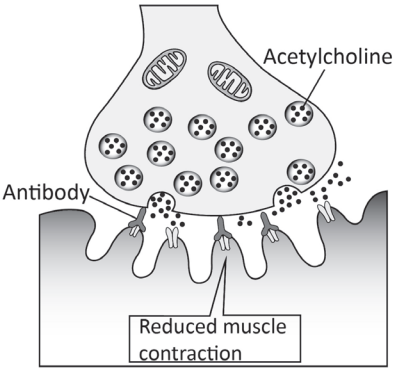
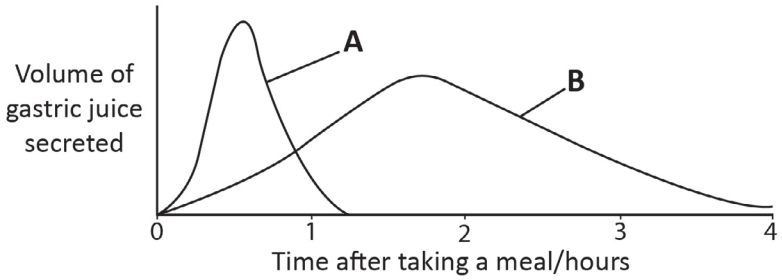


Figure2

Which statement describes the action of the antibodies?

- ☐ Stimulates the secretion of acetylcholine.
- ☐ Stimulates the breakdown of acetylcholine.
- ☐ Prevents the reabsorption of acetylcholine.
- ☐ Prevents the binding of acetylcholine to the receptor

14) The cells in the stomach wall release gastric juice after taking a meal. The graph below shows how the volume of gastric juice produced by two types of stimulators (**A** and **B**) change after the meal.



Which statement explains the results in the graph?

- ☐ The response in curve **A** takes a long time, and is stimulated by the hormonal nervous system.
- ☐ The response in curve **A** takes a short time, and is stimulated by the central nervous system.
- ☐ The response in curve **B** takes a long time, and is stimulated by the central nervous system.
- ☐ The response in curve **B** takes a short time, and is stimulated by the hormonal nervous system.

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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.

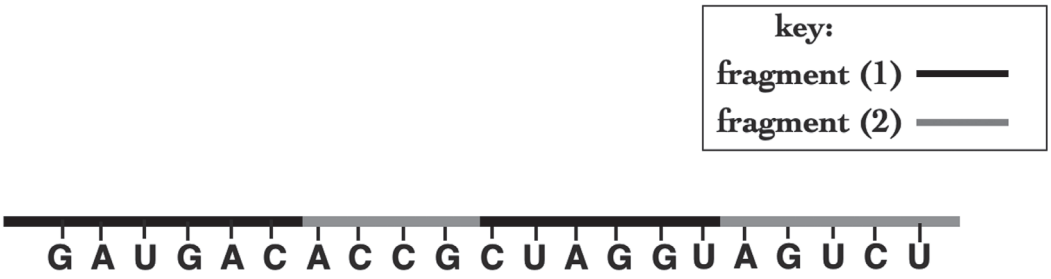
15) Write **three** features of the genetic code.

_____

_____

_____ [3]

16) The figure below shows a primary transcription chain. Fragments labelled (**2**) of this chain will be removed in the next step. (**Note**: mRNA codons table on page 16)



a. Name the following:

- The enzyme corresponding to the production of primary chain:

  _____

- The next step: _____
- The fragment labelled (**1**): _____ [3]

b. During the production of this chain, deletion mutation occurred in one of the fragments labelled (**2**). What is the effect of this mutation in the resulting peptide? Explain your answer.

_____

_____ [2]

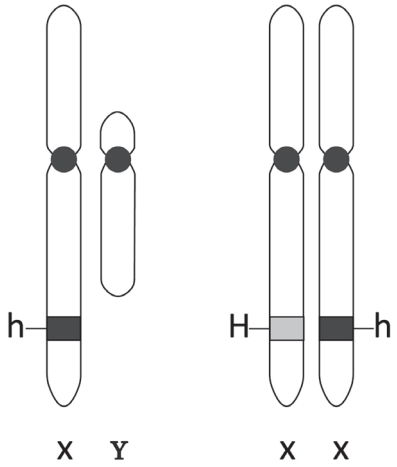
c. Write the amino acid sequence resulting from the previous chain.

_____ [2]

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17) Fabry disease is a disorder caused by the deficiency of an enzyme that leads to the accumulation of a specific type of fat in the body. The figure below shows two parents' chromosomes that carry the recessive allele (**h**) of Fabry disease.



a. Define the recessive allele.

_____

_____ [1]

b. What type of inheritance does Fabry disease represent?

_____ [1]

c. Referring to the figure, write the children's genotypes and phenotypes.

i. Children's genotypes

- Males: _____, _____
- Females: _____, _____ [2]

ii. Children's phenotypes (affected/ unaffected).

- Males: _____, _____
- Females: _____, _____ [2]

d. Explain how unaffected Fabry disease parents are able to have an affected son.

_____

_____

_____ [1]

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18) a. In mice, fur colour is controlled by two genes, **A/a** and **B/b**. The **B** allele codes for black fur and is dominant over the **b** allele, which codes for brown fur. Gene **A/a** is necessary for pigment production. Mouse with the recessive (**a**) allele is unable to produce pigment and is albino regardless of the allele present of fur colour gene **B\b**.

i. Write the phenotypes of the fur colour for the following genotypes:

- AaBb: _____
- aabb: _____ [2]

ii. Predict the parents' genotypes of two possible crossings that produce only brown mice offspring.

- Parents' genotypes of crossing (1): _____
- Parents' genotypes of crossing (2): _____ [2]

b. Albinism is caused by a mutation in human genes.

Explain the interaction between the genes and the enzymes that leads to albinism referring to the name of gene and its coded enzyme and the production of melanin.

_____

_____

_____

_____

_____ [3]

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19) The polymerase chain reaction (PCR) is an application of gene technology.

The following statements illustrate the steps of the PCR, but they are **not in order**.

A- The DNA sample is mixed in a PCR tube with **Q**, **R** and Taq polymerase, then the mixture is put into a PCR machine

B- The mixture is treated to allow *Taq* polymerase to use **R** to assemble a complementary DNA.

C- The mixture is treated to allow **Q** to attach to each strand of DNA.

D- The mixture is treated to separate DNA strands.

a. State the role of using PCR

_____ [1]

b. Name the substances (**Q**) and (**R**).

i. Q: _____

ii. R: _____ [2]

c. What step (symbol) indicates the second step?

_____ [1]

d. Suggest why DNA polymerase from a human is not suitable for use in a PCR machine instead of *Taq* polymerase.

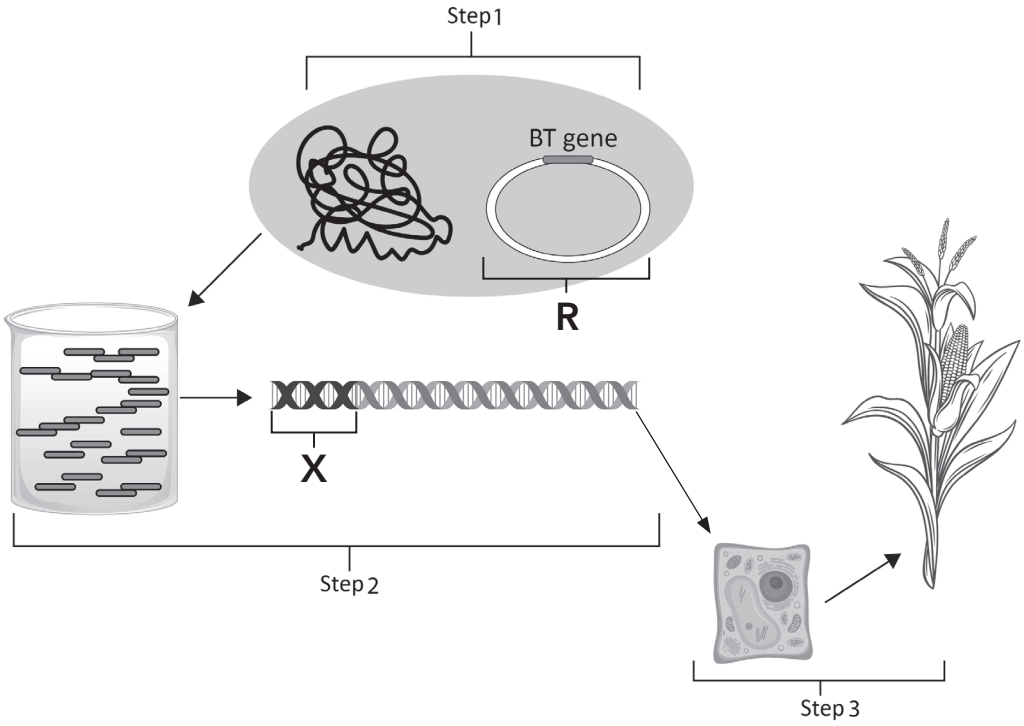
_____ [1]

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20) The figure below shows the steps of genetic engineering in the BT toxin in a corn plant.



a. Explain how the structure (**R**) was formed.

[2]

b. Explain why the BT toxin will not be produced if the fragment labelled (**X**) is absent.

[1]

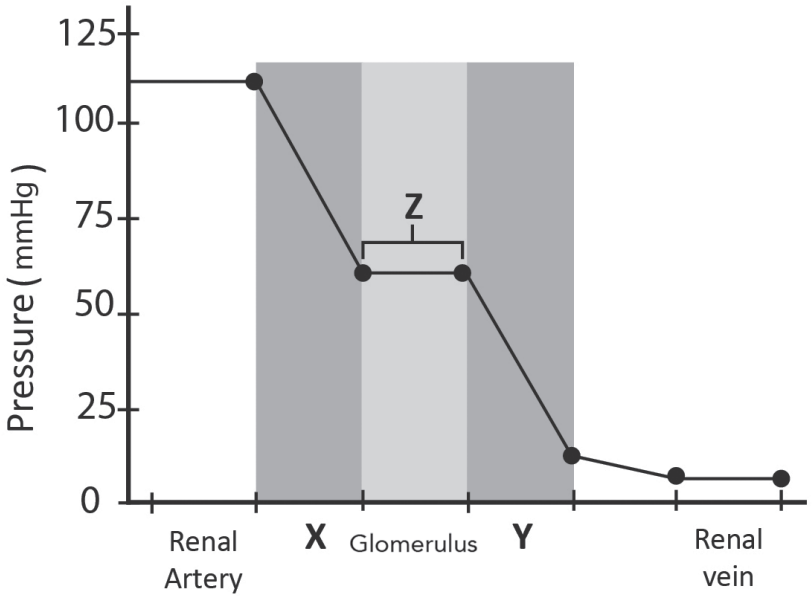
c. State two advantages to farmers of growing the genetically engineered crop plants, rather than spraying the leaves with the toxin.

[2]

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21) The graph below shows the change in blood pressure at different parts of kidney during one step of urine formation.



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

X : _____

Y : _____ [2]

b. Explain why the blood pressure was higher at structure (**X**) than at structure (**Y**).

_____

_____

_____ [1]

c. Predict what will happen if process (**Z**) does not take place. (Write two results)

_____

_____

_____

_____ [2]

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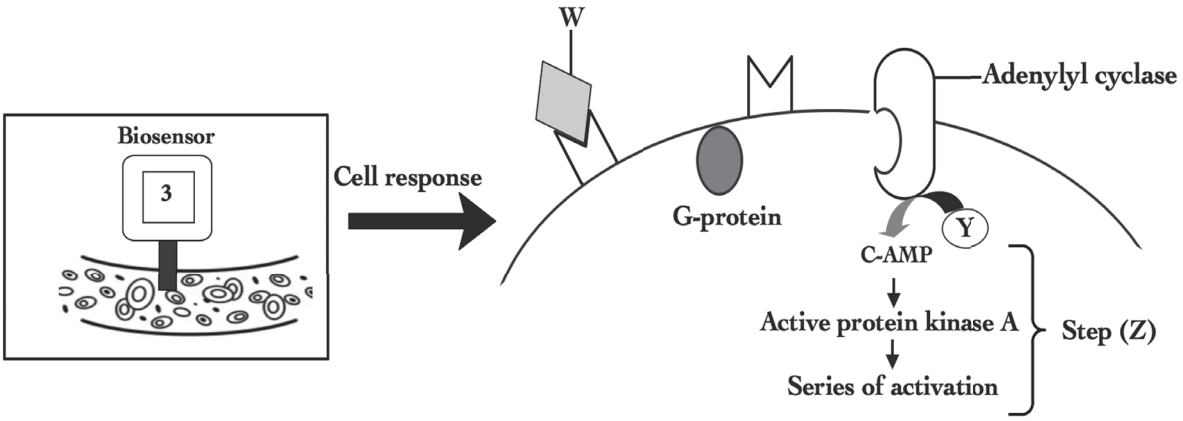
22) a. State **three** factors that may affect the stomatal response.

_____

_____

_____ [3]

b. The diagram below explains the body's response and restoration of internal balance according to the biosensor result.



i. What is the main function of the G-protein?

_____

_____ [1]

ii. Name the substances (**W** and **Y**):

W: _____

Y: _____ [2]

iii. Predict the final product in step (**Z**).

_____ [1]

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23) **Figure 1** shows the transmission of nerve impulses in a neurone cell, while **figure 2** shows the change in the membrane potential of an axon over time.

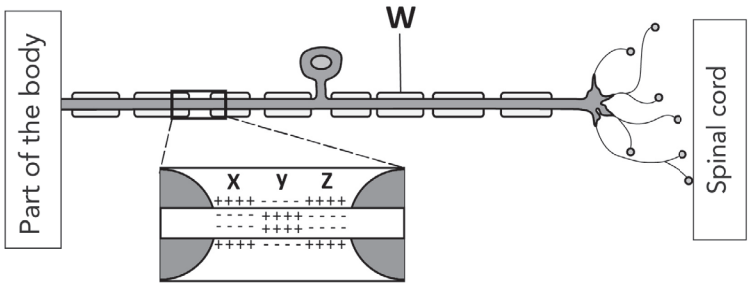


Figure 1

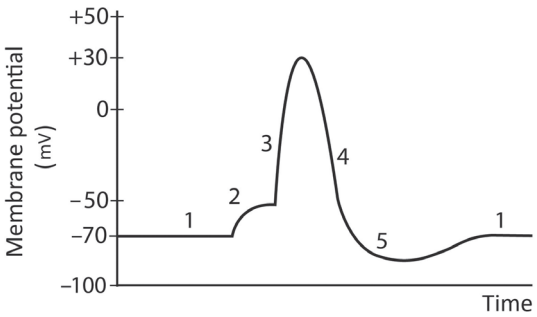


Figure 2

a. What is the value of membrane potential in the following:

- Resting potential: _____
- Action potential: _____ [2]

b. Referring to **figure 1**, identify which part of axon (**X**, **Y** or **Z**) that correspond to membrane potential labelled (**3**) in **figure 2**.

_____ [1]

c. What type is the neurone above? Provide evidence from **figure 1**.

- Type of neurone: _____
- Evidence: _____

_____ [2]

d. If structure (**W**) is missing, describe the effect on the transmission of nerve impulses.

_____

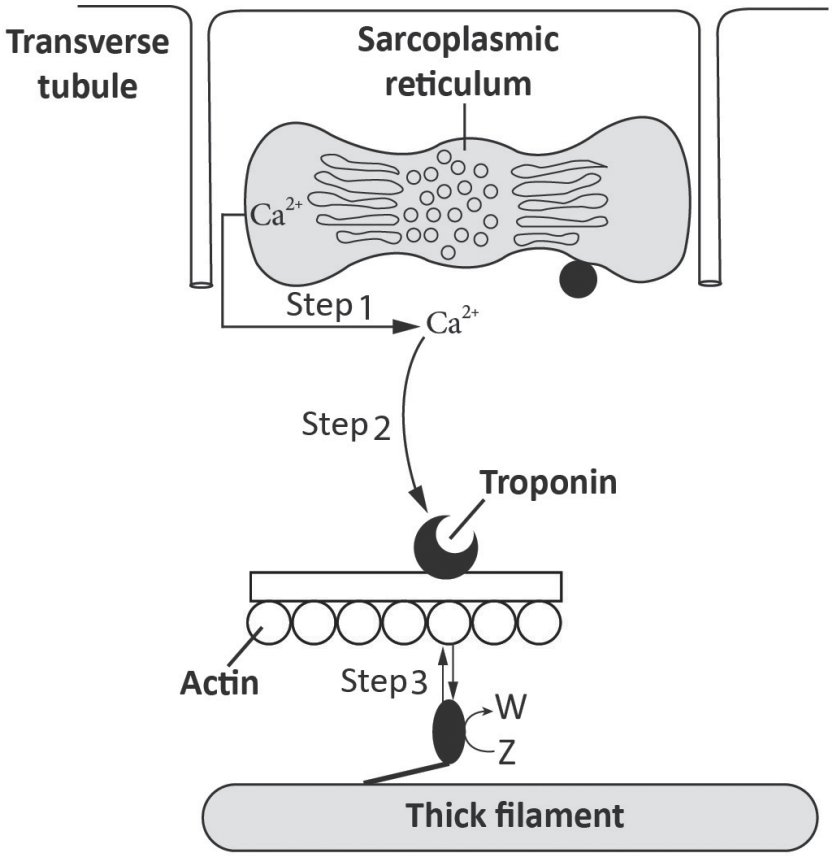
_____ [1]

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24) The figure below shows the steps of muscle contraction and relaxation.



a. What is the name of the model shown in the figure above?

_____ [1]

b. Explain step (**2**) and step (**3**).

_____

_____

_____

_____ [2]

c. If structure (**Z**) is inhibited by a chemical, suggest the effect on product (**W**).

_____ [1]

[End of Examination]

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	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

mRNA Codons Table

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Note: Answer guide in (6) sheets. Total marks:70

Part 1: Multiple Choice **Each Question: 1 mark** **Total: 14 marks**

Q	Ch	Answer	Page		Out come	Level of learning
			Cambr	Hodd		
1	1	Replicated from 5’ to 3’ continuously.	149	126	1.2.1	Knowledge
2		UACUGCUAA	153	132	1.4.1	Application
3		X: RNA polymerase; Y: m-RNA; Z: Template strand	152	132	1.4.1	Application
4	2	1: Homozygous; 2: Centromere	428-430	343-344	2.1.2	Knowledge
5		A transcription complex that enhances the gene expression.	455-456	375-377	2.6.3	Application
6		D	431	346	2.1.4	Reasoning
7	3	Recombinant DNA	544	458	3.1.1	Knowledge
8		A: Reverse transcriptase; B: DNA polymerase	545-547	459	3.2.1	Application
9		BamHI	545/556	462/468	3.3.2	Reasoning
10	4	Peroxidase	368	299	4.3.3	Knowledge
11		Proximal convoluted tubule	353	303	4.1.5	Application
12		Intense thirst and drinking large amounts of water.	361	308	4.2.1	Reasoning
13	5	Prevents the binding of the acetylcholine to the receptor.	404	327	5.2.7	Application
14		The response in curve **A** takes a short time, and is stimulated by the central nervous system.	388-399	318-319	5.1.1	Application

Part 2: Extended Response Chapter 1 (10 marks): 3 Knowledge 5 Application 2 Reasoning

Q		Answer	Mark	Page		Out come	Level of learning
				Cambr	Hodd		
15		**Any three of the following:** - It is a three-letter code, known as a triplet code. This means that three bases make the code for one amino acid. - The code is universal. - The code has punctuations. - The code is described as redundant/ degenerate **or** some amino acids are coded for by more than one triplet.	3	150	129	1.3.1	Knowledge
16	**a.**	- RNA polymerase. (**1 mark**) - Modification. (**1 mark**) - Exons. (**1 mark**)	3	152	132	1.4.3	Application
	b.	No effect. (**1 mark**) Because it is not coded to amino acids. (**1 mark**)	2	152	132	1.4.3	Reasoning
	c.	Aspartic acid – Aspartic acid - leucine – glycine **or** Asp- Asp- Leu- Gly. (**One mark for two correct amino acids in order and two marks for four correct amino acids in order**)	2	153	134-135	1.4.1	Application

Part 2: Extended Response. Chapter 2 (14 marks): 4 Knowledge 7 Application 3 Reasoning

Q		Answer	Mark	Page		Out come	Level of learning
				Cambr	Hodd		
17	a.	An allele that affects the phenotype of the organism only when the dominant allele is absent or not present.	1	437	357	2.3.1	Knowledge
	b.	Sex linked inheritance **or** X-linked inheritance.	1	440-441	358-359	2.4.1	Application
	c.	**i.** - Males: X^HY, X^hY (**1 mark**) - Females: X^HX^h, X^hX^h (**1 mark**)	2	440-441	358-359	2.4.2	Application
		ii. - Males: 1 affected and 1 unaffected. (**1 mark**) - Females: 1 affected and 1 unaffected. (**1 mark**)	2	440-441	358-359	2.4.2	Application
	d.	The mother is a **carrier** of the Fabry allele (X^HX^h) who will not show any symptoms but can pass the affected allele to a son on his X chromosome so he will be affected (X^hY)	1	440-441	358-359	2.4.2	Reasoning
18	a.	**i.** - Black (**1 mark**) - Albino (**1 mark**)	2	445-446	363	2.4.3	Application
		ii. - AAbb × AAbb (**1 mark**) - AAbb × Aabb (**1 mark**)	2	445-446	363	2.4.3	Reasoning
	b.	A mutation in the gene *TRY* (**1 mark**) results in either the absence of tyrosinase **or** the inactivation of the tyrosinase (**1 mark**), so tyrosine will not be converted into DOPA and dopaquinone **or** the first two steps of conversion tyrosine into melanin cannot take place. (**1 mark**)	3	451-452	369	2.5.1	Knowledge

Part 2: Extended Response. Chapter3 (10 marks): 3 Knowledge 5 Application 2 Reasoning

Q		Answer	Mark	Page		Out come	Level of learning
				Cambr	Hodd		
19	a.	Used to amplify a sample of DNA.	1	555-556	461	3.3.1	Knowledge
	b.	**Q**: Primers **R**: dNTPs (Deoxynucleotide Triphosphates)	2	555	461	3.3.1	Application
	c.	D	1	555-556	461	3.3.1	Application
	d.	DNA polymerase is not heat-stable and it will not work at high temperatures.	1	556	461	3.3.1	Reasoning
20	a.	DNA isolation/ cut and isolate the desired gene (BT toxin gene) and cut the plasmid with the same restriction endonuclease. (**1mark**) Link the gene to the plasmid by DNA ligase and form the recombinant plasmid. (**1 mark**)	2	548	462	3.1.2	Application
	b.	Because RNA polymerase cannot bind to mRNA strand to start transcription.	1	552	464	3.2.2	Reasoning
	c.	**Any two of the following:** - Reduced pesticide use/ BT maize reduces the need for chemical insecticides, leading to lower production costs and reduced environmental impact. Farmers use fewer chemical sprays, which is beneficial for both the environment and worker safety. - Increased yield and quality/by protecting the crop from insect damage, BT maize produces higher yields - Sustainability/ the reduction in chemical pesticide use contributes to more sustainable farming practices, decreasing the negative impacts on the surrounding ecosystems and biodiversity.	2	571	484	3.5.1	Knowledge

Part 2: Extended Response. Chapter 4 (12 marks): 4 Knowledge 6 Application 2 Reasoning

Q		Answer	Mark	Page		Out come	Level of learning
				Cambr	Hodd		
21	a.	**X**: Afferent arteriole. **Y**: Efferent arteriole.	2	356	304-305	4.1.6	Application
	b.	Because the diameter of the afferent arteriole is wider than that of the efferent arteriole, causing pressure inside the glomerulus.	1	356	304	4.1.8	Application
	c.	The small substances (glucose, water, ions) will not move from the blood capillaries to Bowman's capsule **or** small substances will not filtrate (**1 mark**), so the concentration will increase in the blood flow (**1 mark**).	2	356	304	4.1.6	Reasoning
22	a.	**Any three of the following:** - Light intensity. - CO_2 concentration. - Change in the temperature. - Water stress.	3	372	312-314	4.4.3	Knowledge
	b.	**i.** Activation of adenylyl cyclase enzyme that produces cAMP from ATP.	1	367	297	4.3.2	Knowledge
		ii. **W**: Glucagon **Y**: ATP	2	367	297	4.3.2	Application
		iii. Glucose	1	367	298	4.3.2	Application

Part 2: Extended Response. Chapter 5 (10 marks): 3Knowledge 5Application 2 Reasoning

Q		Answer	Mark	Page		Out come	Level of learning
				Cambr	Hodd		
23	a.	- (-70 mV) (**1mark**) - (30 **or** 40 mV) (**1mark**)	2	396-397	323-324	5.2.4	Knowledge
	b.	Y	1	396	324	5.2.4	Application
	c.	Type: sensory neurone. (**1mark**) Evidence: (**1mark**) transmits impulses to the spinal cord **or** the body cell is in the middle of the exon.	2	390-391	320	5.2.1	Application
	d.	Decrease the speed of transmitting nerve impulses.	1	391/ 399	320	5.2.5	Reasoning
24	a.	Sliding filament model.	1	410	334	5.3.2	Knowledge
	b.	**Step (2):** Ca^{2+} binds to troponin. Then, tropomyosin moves to expose myosin-binding sites on the actin filament. (1mark) **Step (3):** myosin heads form cross-bridges (charged myosin head) filament with thin filaments. (1 mark)	2	410-412	334	5.3.2	Application
	c.	Decreases or stops hydrolysis of ATP to ADP+Pi.	1	410	334	5.3.2	Reasoning

END OF THE MARKING GUIDE