

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 ١٤٤٨/١٤٤٧ هـ - ٢٠٢٥ / ٢٠٢٦ م

تنبيه:
- المادة: الأحياء.
- الأسئلة في (١٧) 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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1) Describe how the structure of phosphorylated nucleotide ATP differs from other nucleotides.

_____

_____

_____ [2]

2) **Figure 2-1** shows the structure of a nucleic acid molecule.

a. Which of the following represents **X** and **Q** in **Figure 2-1**?

(Shade the shape (⬭) corresponding to the correct answer).

	X	Q
⬭	Guanine	Adenine
⬭	Adenine	Cytosine
⬭	Cytosine	Adenine
⬭	Thymine	Cytosine

[1]

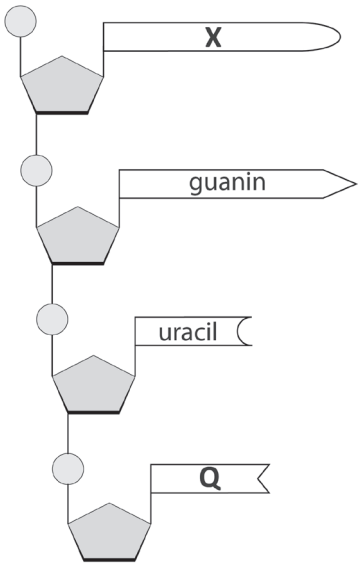


Figure 2-1

b. Describe the bond that links nucleotides together in **Figure 2-1** with reference to the name of the bond.

_____

_____

_____ [2]

3) Which of the following describes the process of modification?

(Shade the shape (⬭) corresponding to the correct answer).

⬭ Exons are removed by RNA polymerase.

⬭ Introns are removed by RNA polymerase.

⬭ Exons are joined to form a mature mRNA.

⬭ Introns are joined to form a mature mRNA. [1]

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4) **Table 4-1** shows the DNA sequence of the original gene coded for a functional protein. Gene A and gene B show the DNA sequence of the same gene found in other individuals. **Table 4-2** shows part of the codon table.

Original Gene	ATGAAACTGCCTTTC
Gene A	ATGAAACGCCTTTCA
Gene B	ATGAAACTGACTTTC

Table 4-1

Codons	Amino Acid
UUU	Phe
UAC	Tyr
GGA	Gly
AAG	Lys
GAC	Asp
ACU	Thr
CAC	His
GAU	Asp
UUG	Leu
GAC	Asp
AAA	Lys

Table 4-2

a. Explain why a mutation in gene **A** is likely to be more serious than a mutation in gene **B** with reference to the name of the mutation occurring in gene **A**.

_____

_____ [2]

b. Write the names of the amino acids produced in gene **B**.

_____ [1]

5) Bacteria grew in a medium containing heavy nitrogen (N^{15}) and after many replications of the bacterial DNA through cell divisions, the bacteria were moved into a medium containing light nitrogen (N^{14}). The bacteria divided once to produce the first generation, and divided again to produce the second generation.

Note: Hybrids DNA contain both heavy and light nitrogen.
Which of the following describes the type of nitrogen in the DNA molecule of the bacteria in the first and second generations?

(Shade the shape (⬭) corresponding to the correct answer).

	First generation	Second generation
⬭	All hybrids	Half hybrids, half light
⬭	All hybrids	All hybrids
⬭	Half hybrids, half light	All hybrids
⬭	Half hybrids, half light	Half hybrids, half light

[1]

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6) **Figure 6-1** shows one process of protein synthesis.

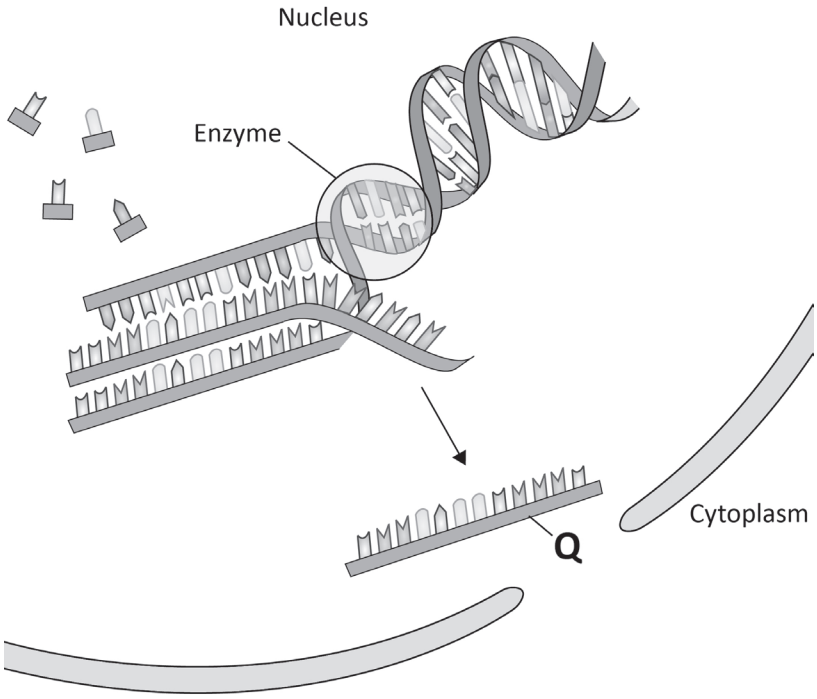


Figure 6-1

a. Describe how molecule **Q** is produced.

_____

_____

_____

_____

_____

_____

_____ [3]

b. If the complex used to transport molecule **Q** to the cytoplasm was inhibited, explain the effect on the **next** process.

_____

_____

_____ [1]

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7) **Figure 7-1** shows the behaviour of chromosomes in three different stages of a cell division (**A**, **B** and **C**).



Figure 7-1

a. Which of the following represents stage **A**?

(Shade the shape (⬭) corresponding to the correct answer).

⬭ Anaphase ⬭ Prophase I

⬭ Anaphase II ⬭ Prophase II [1]

b. Predict the term that describes the set of chromosomes in the resulting cell in **Figure 7-1**.

(Shade the shape (⬭) corresponding to the correct answer).

⬭ Haploid ⬭ Diploid

Explain your answer.

_____ [1]

c. Describe the behaviour of the nuclear envelope in stage **B** shown in **Figure 7-1**.

_____

_____ [1]

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8) **Figure 8-1** shows homologous chromosomes.

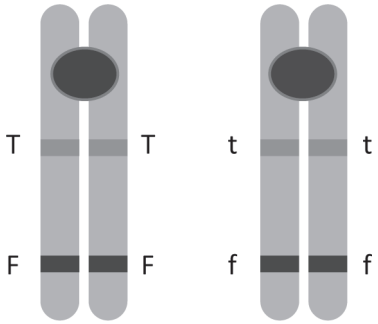
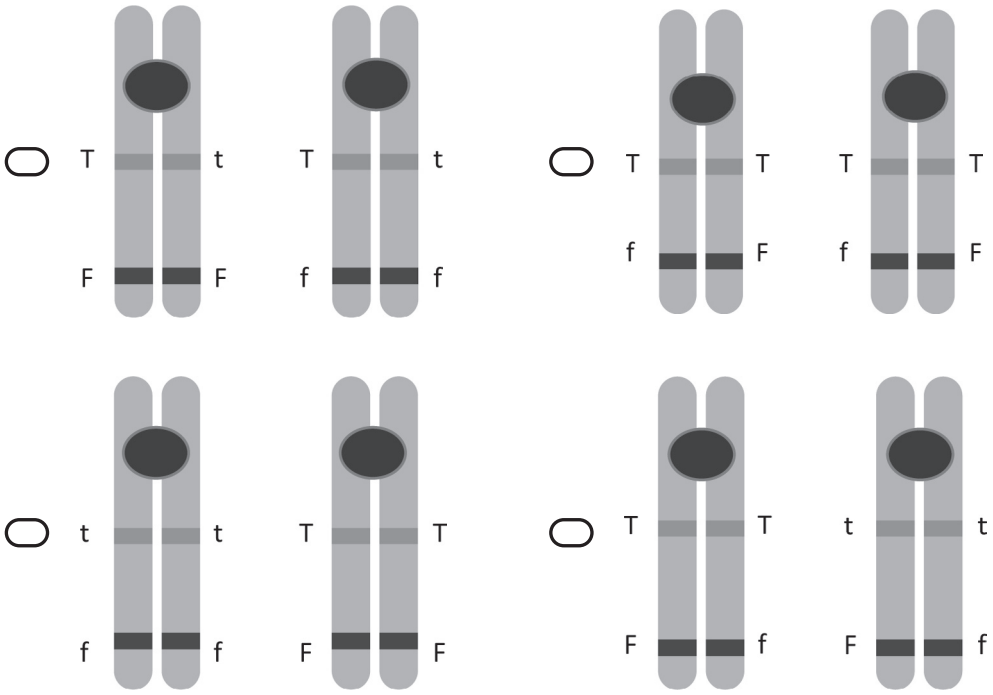


Figure 8-1

Which of the following represents the outcome of crossing over between the chromosomes if crossing over occurs?

(Shade the shape (⬭) corresponding to the correct answer).



[1]

9) Explain why a mother with hemophilia can pass the condition to all her sons, while none of her daughters inherit the disease.

_____

_____

_____

_____ [2]

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10) In mice, their coat colour is determined by two genes located on different chromosomes.

- The **A/a** gene controls the distribution of the pigment:
  - **A** gives an agouti (brown-yellow) coat.
  - **a** gives a black coat.
- The **B/b** gene controls pigment production:
  - **B** allows pigment to be produced.
  - **b** prevents the production of pigment, resulting in an albino mouse regardless of other genes.

a. Draw a genetic diagram to show the possible genotypes and phenotypes of the offspring of crossing heterozygous mouse (AaBb) with an albino mouse (aabb).

[5]

b. Explain the meaning of the term test cross.

[1]

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11) Which of the following describes transcription factors in eukaryotes?

(Shade the shape (⬭) corresponding to the correct answer).

⬭ Lipids that bind to RNA.

⬭ Lipids that bind to DNA.

⬭ Proteins that bind to RNA.

⬭ Proteins that bind to DNA. [1]

12) **Figure 12-1** shows a simplified pathway of TYR expression.

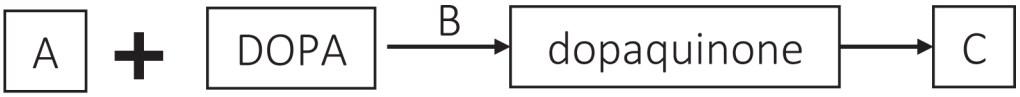


Figure 12-1

a. Identify enzyme **B**.

_____ [1]

b. Explain how genes can cause albinism, with reference to **B** and **C** in **Figure 12-1**.

_____

_____

_____

_____ [2]

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13) **Figure 13-1** shows the process of salmon genetic modification (GM).

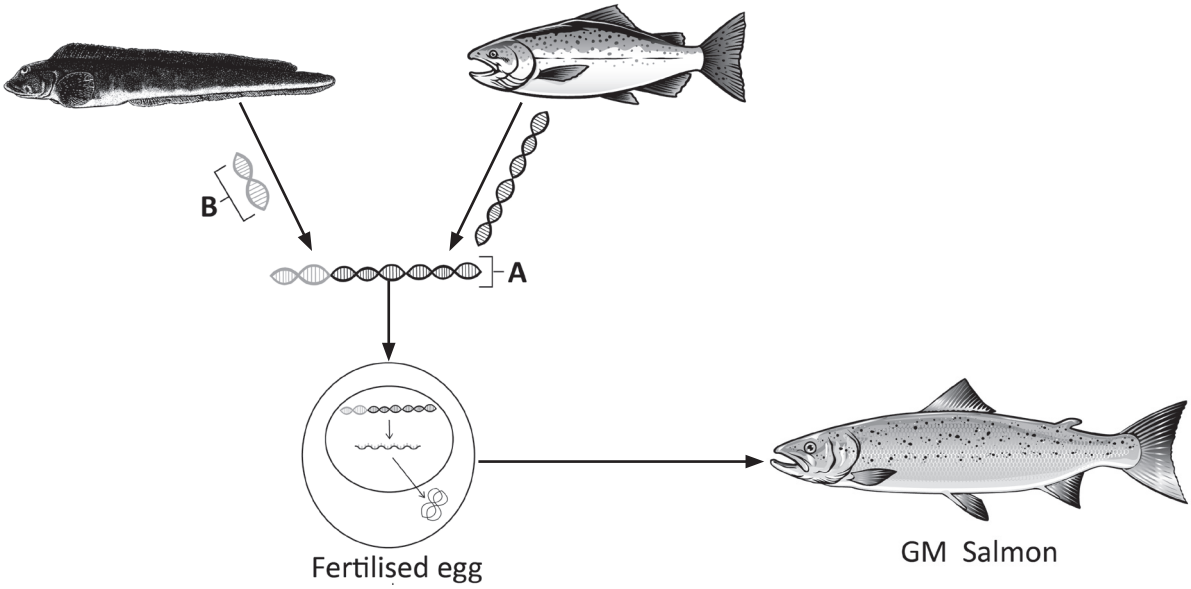


Figure 13-1

a. Describe the role of fragment **B** with reference to its name.

_____

_____

_____ [2]

b. **Figure 13-2** shows the weight of two Salmons **C** and **D** throughout the years.

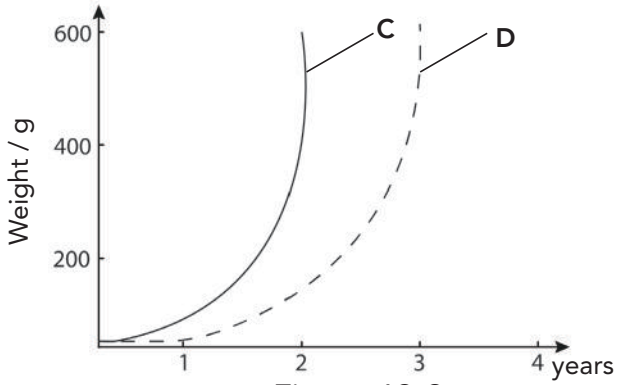


Figure 13-2

Which graph (**C** or **D**) in **Figure 13-2** represents the GM Salmon.

(Shade the shape (⬭) corresponding to the correct answer).

⬭ **C** ⬭ **D**

Explain your answer

_____

_____ [1]

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14) **Figure 14-1** shows temperature in different stages of PCR.

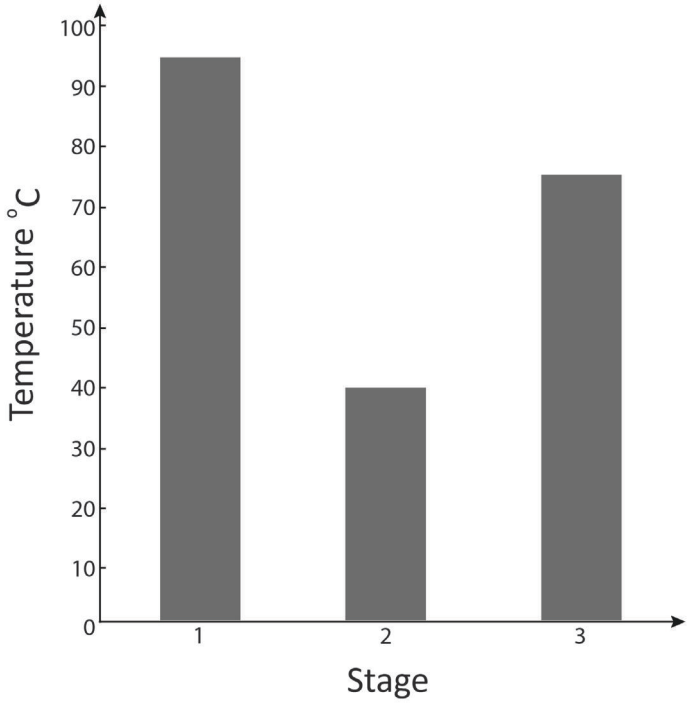


Figure 14-1

a. Which of the following represents the aim of stage 3 and the substance that is needed? (Shade the shape (⬭) corresponding to the correct answer).

	Aim of the stage	Substance needed
⬭	Allows the primer to stick	Primer
⬭	Adds nucleotides	Primer
⬭	Allows the primer to stick	Taq polymerase
⬭	Adds nucleotides	Taq polymerase

[1]

b. Explain why **stage 2** in **Figure 14-1** will not take place, if the temperature stayed constant as in **stage 1**.

_____

_____ [1]

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15) **Figure 15-1** shows some of the steps involved in genetic engineering.

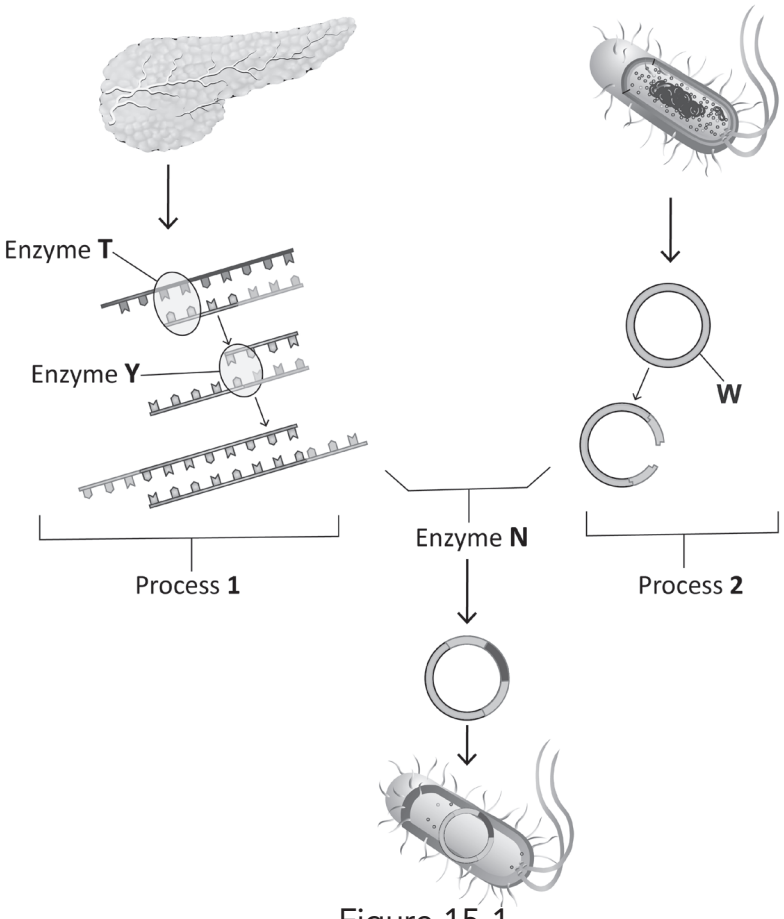


Figure 15-1

a. Describe how scientists use structure **W** to confirm the gene expression of the desired gene.

_____

_____

_____ [2]

b. Explain why the same restriction enzyme is used in both processes **1** and **2**.

_____

_____ [1]

c. Describe the function of enzymes **T**, **Y** in process **1** and enzyme **N** as shown in **Figure 15-1**.

- Enzymes T: _____

_____

- Enzyme Y: _____

_____

- Enzyme N: _____

_____ [3]

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16) The following statements describe some advantages of recombinant human genes:

1- Strictly available through blood donation.

2- Produced in genetically modified human donors.

3- Reduce the risk of immune reactions or disease transmission.

Which of the following is a shared advantage of recombinant human insulin, factor VIII, and ADA?

(Shade the shape (⬭) corresponding to the correct answer).

⬭ 2 only ⬭ 3 only

⬭ 1 and 2 ⬭ 1 and 3 [1]

17) Outline **two** advantages of using genetic screening in the treatment of breast cancer.

– _____

_____

– _____

_____ [2]

18) **Figure 18-1** shows a schematic drawing of part of the glomerulus and Bowman's capsule in the nephron.

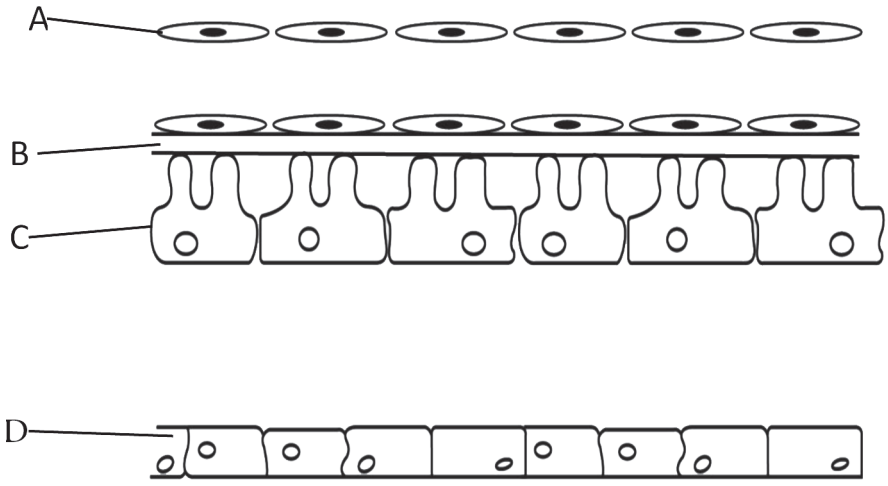


Figure 18-1

Which structure forms the main filtration barrier that prevents large plasma proteins from passing into the filtrate?

(Shade the shape (⬭) corresponding to the correct answer).

⬭ A ⬭ B

⬭ C ⬭ D [1]

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19) Describe the role of microvilli and co-transporter proteins on the proximal convoluted tubule (PCT) cells in the formation of urine.

- Microvilli (brush borders): _____

_____

- Co-transporter proteins: _____

_____ [2]

20) Two students with the same body mass and under the same weather conditions were investigated as follows:

- **Student A** consumed **2.5 L of fluids** during the day.
- **Student B** consumed **1.0 L of fluids** during the day.

Despite the difference, both students were found to have a similar blood water potential.

Explain the mechanism that enabled **student B** to have a similar blood water potential.

_____

_____

_____

_____

_____

_____

_____

_____ [4]

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21) **Figure 21-1** shows the concentration of blood glucose during 12 hours of fasting for an individual who inherited a mutation in the GNAS gene which affects the activation of the G-protein in the liver.

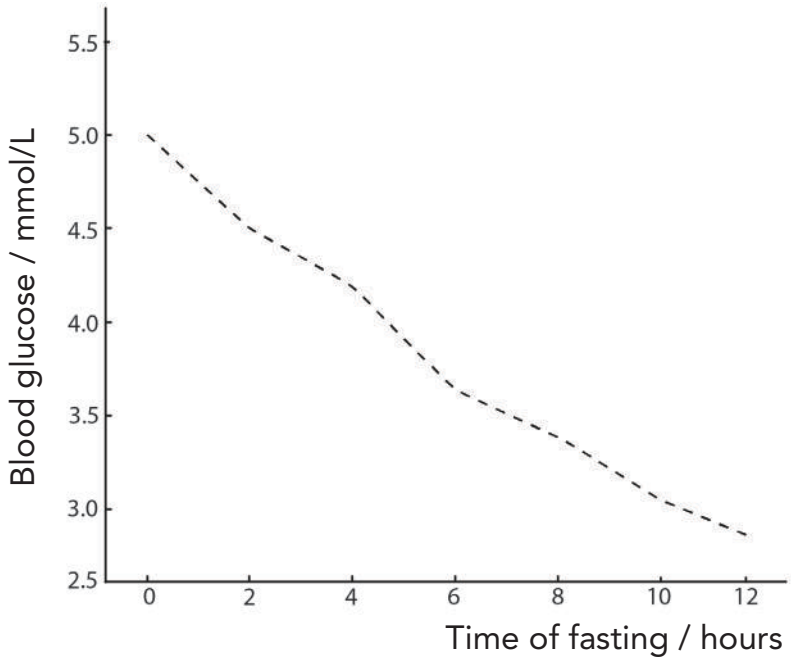


Figure 21- 1

a. Explain the glucose level shown in **Figure 21-1** using the principle of cell signaling.

_____

_____

_____

_____ [2]

b. Explain how glucagon is not affected by GNAS gene mutation.

_____

_____ [1]

c. Name the enzyme that converts oxygen and glucose to gluconic acid and hydrogen peroxide in test strips.

_____ [1]

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22) **Figure 22-1** shows the membrane of two guard cells.

Note: Arrows indicate the movement of potassium ions (K^+).

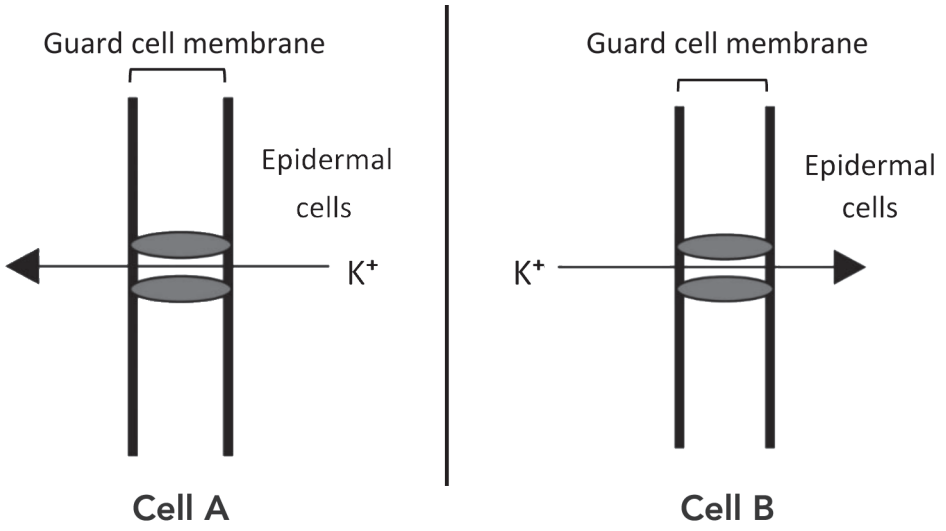


Figure 22- 1

a. Describe the movement of water in cell **A**.

_____ [1]

b. Which of the following describes the CO_2 concentration and the soil humidity of the plant that cell **B** is taken from?

(Shade the shape (⬭) corresponding to the correct answer).

	CO_2 concentration	Soil humidity
⬭	Low	Dry
⬭	High	Moist
⬭	High	Dry
⬭	Low	Moist

[1]

c. Describe the importance of breaking down starch to malate ions during the opening of the stomata.

_____

_____ [1]

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23) A student is suddenly startled when a dog barks loudly. Within seconds, his heart rate increases. A few minutes later, he still feels nervous and shaky.
Which statement explains why the student experienced both an immediate and a prolonged response?

(Shade the shape (⬭) corresponding to the correct answer).

	Immediate response	Prolonged response
⬭	Endocrine system	Nervous system
⬭	Nervous system	Nervous system
⬭	Nervous system	Endocrine system
⬭	Endocrine system	Endocrine system

[1]

24) **Figure 24-1** shows the changes in the permeability of a section of axon membrane to ions **A** and **B** which are involved in producing an action potential.

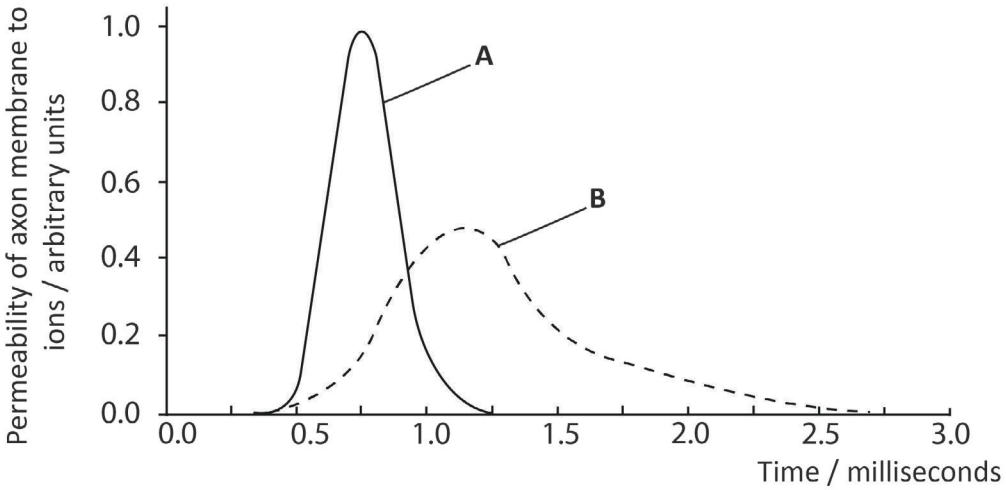


Figure 24 - 1

Explain how the movements of these ions are involved in producing the action potential with reference to the voltage-gated channels, and the names of ions **A** and **B.**

[4]

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25) **Figure 25-1** shows the transmission of nerve impulses at a cholinergic synapse.

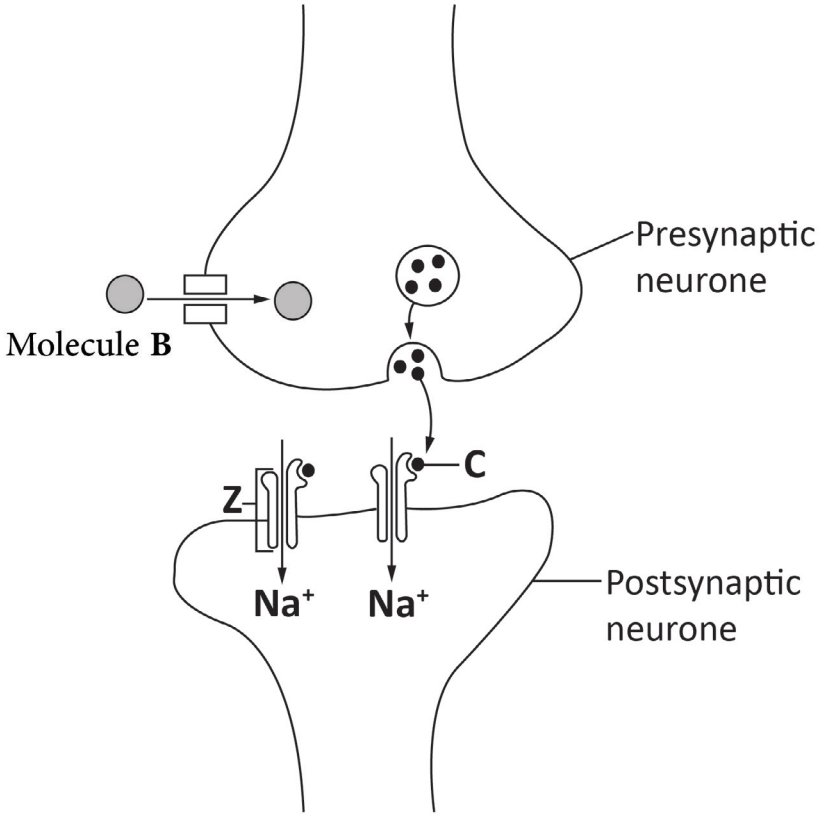


Figure 25- 1

a. Name molecule **B**.

_____ [1]

b. Explain how the amount of substance **C** is maintained in the presynaptic neurone.

_____

_____ [1]

c. Predict the effect on the postsynaptic neurone if substance **C** remains attached to structure **Z**.

_____

_____ [1]

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26) **Figure 26-1** shows part of a myofibril and the arrangement of proteins involved in the sliding filament model of muscular contraction.

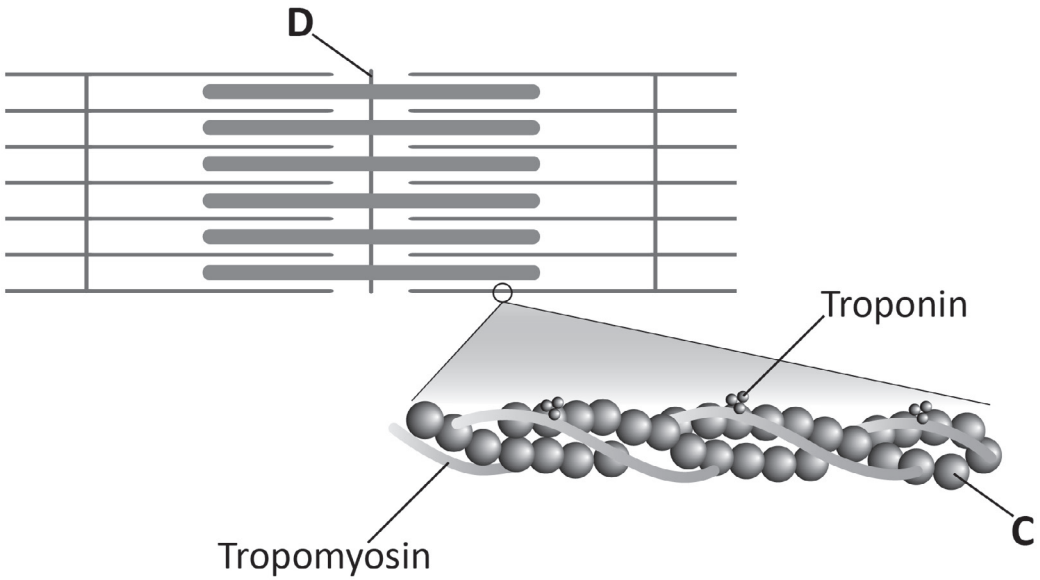


Figure 26- 1

a. Name protein **C** and structure **D**.

- Protein C: _____

- Structure D: _____ [2]

b. Which of the following statements describe the role of tropomyosin in muscle contraction? (Shade the shape (⬭) corresponding to the correct answer).

⬭ Provides ATP for the myosin head to detach from actin.

⬭ Covers actin binding sites when the muscle is relaxed.

⬭ Hydrolysis ATP to allow the power stroke.

⬭ Binds calcium ions to initiate contraction. [1]

c. A myofibril is exposed to a non-hydrolysable ATP analogue while the concentration of Ca^{2+} is high.

Describe how this would affect muscle contraction.

_____

_____

_____ [1]

[End of Examination]

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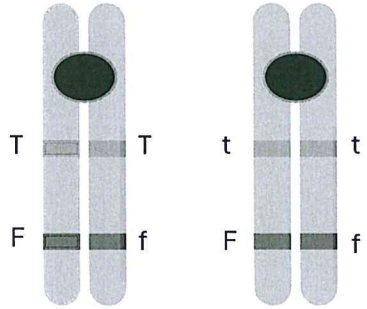
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Note: Marking scheme in (10) sheets. Total marks: 70

Item		Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
						Cambr	**Hodd**		
1		ATP consists of three phosphate groups. **(1 mark)** and Adenosine group **OR** Adenine and ribose. **(1 mark)**	2		1	145	122	1.1.1	AO1
2	a	Adenine | Cytosine	1			151	128	1.1.2	AO2
	b	phosphodiester bond. **(1 mark)** Links the phosphate group of one nucleotide to the 3' carbon of the sugar in the next nucleotide. **OR** forms the sugar-phosphate backbone, providing structural integrity. **(1 mark)**	2			145	123	1.1.1	AO1
3		Exons are joined to form a mature mRNA.	1			152	132-133	1.4.3	AO1
4	a	Because the mutation in gene A is a deletion mutation **(1 mark)**, which causes a frame-shift mutation. **OR** causes an incorrect reading of the sequence of the triplets in the genetic code due to the shift in the reading frame. **(1 mark)**	2			155	138	1.5.2	AO2
	b	Tyr-Phe-Asp	1			155	131	1.5.1	AO2

Item		Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
						Cambr	**Hodd**		
5		All hybrids / Half hybrids, half light	1			150	126	1.2.1	AO2
6	**a**	- RNA polymerase binds to the beginning of the gene to be copied and starts unwinding/unzipping the DNA of the gene **OR** breaking the hydrogen bonds between the base pairs of the two strands **OR** forming two separated strands of DNA. **(1 mark)** - RNA polymerase moves along the length of the gene **OR** copies one strand of DNA (the template / coding/ transcribed strand) and joins free nucleotides to the growing mRNA strand by complementary base pairing. **(1 mark)** - RNA polymerase forms a complete mRNA copy of the template strand and releases the mRNA molecule once it is fully formed. Then, leaves the DNA after transcription is complete. **(1 mark)**	3	Accept: mRNA is modified before it leaves the nucleus. (1 mark)	1	151-152	131-132	1.4.1	AO2
	b	Translation will not occur because mRNA cannot leave the nucleus.	1			152	134	1.4.1	AO2

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Item		Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
						Cambr	Hodd		
7	a	Prophase I	1		2	431	346	2.1.4	AO2
	b	Haploid Because it contains one complete set of chromosomes. **OR** meiosis/ reduction division produces haploid cell. **OR** it has half of the number of chromosomes.	1			429	344	2.1.1	AO2
	c	Reformation of the nuclear envelope.	1			431	346	2.1.4	AO2
8			1			434	345, 349	2.2.1	AO2
9		- Each son inherits the mother's affected X^h and the father's Y. Genotype of sons = X^hY → all sons have hemophilia. **(1 mark)** - Each daughter inherits the mother's affected X^h and the father's normal X^H. Genotype of daughters = X^HX^h → daughters are carriers, but do not show hemophilia. **(1 mark)**	2	- Accept: X- linked disease (1mark) - Accept answer in form of genetic diagram.	2	440-441	357-358	2.4.2	AO1

وزارة التربية والتعليم
والإختبارات والإدارة العامة للامتحانات
قطاع الامتحانات العامة

<table>
<tr><th colspan="2" rowspan="2">Item</th><th rowspan="2">Answer</th><th rowspan="2">Mark</th><th rowspan="2">Additional Information</th><th rowspan="2">Unit</th><th colspan="2">Page</th><th rowspan="2">Learning Outcome</th><th rowspan="2">Assessment Objective</th></tr>
<tr><th>Cambr</th><th>Hodd</th></tr>
<tr><td rowspan="2">10</td><td>a</td><td>
parental phenotypes Agouti coat Albino

parental genotypes AaBb aabb

Parental gametes (AB) (aB) (Ab) (ab) (ab) (1mark)

offspring genotypes and phenotypes
<table>
<tr><td></td><td>(AB)</td><td>(Ab)</td><td>(aB)</td><td>(ab)</td></tr>
<tr><td>(ab)</td><td>AaBb Agouti</td><td>Aabb Albino</td><td>aaBb Black coat</td><td>aabb Albino</td></tr>
<tr><td></td><td>(1 mark)</td><td>(1 mark)</td><td>(1 mark)</td><td>(1 mark)</td></tr>
</table>
</td><td>5</td><td>Both genotypes and phenotypes of the offspring should be correct.</td><td>2</td><td>448</td><td>363</td><td>2.4.3</td><td>AO2</td></tr>
<tr><td>b</td><td>A genetic cross in which an organism showing the dominant characteristic is crossed with a homozygous recessive organism; the phenotypes of the offspring can indicate whether the original organism is homozygous or heterozygous.</td><td>1</td><td></td><td>2</td><td>439</td><td>354</td><td>2.4.1</td><td>AO1</td></tr>
</table>

Item		Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
						Cambr	Hodd		
11		Proteins that bind to DNA.	1			455	375	2.6.3	AO1
12	a	Tyrosinase	1			452	369	2.5.1	AO1
	b	***Any two of the following:*** - The production of melanin/ (C) requires a pathway in which the amino acid tyrosine is converted into melanin/ (C) by a series of enzyme-controlled steps. - A key enzyme is tyrosinase/ (B), which is coded for by the TYR gene. - The enzyme/ (B) is either not produced or is non-functional. - Cannot be converted into dopaquinone and subsequently into melanin. - No melanin/ (C) is produced.	2			451-452	369	2.5.1	AO2

Item		Answer	Mark	Additional Information		Page		Learning Outcome	Assessment Objective
						Cambr	Hodd		
13	a	Promoter. **(1 mark)** It ensures that the inserted gene is turned on/activated and produces the right amount of the desired protein in the right cell. **(1 mark)**	2			552	464	3.2.2	AO2
	b	C Because the modified gene allows the GM salmon to grow faster in a shorter period of time.	1			572	482	3.5.1	AO1
14	a	Adds nucleotides. | Taq polymerase.	1			555-556	461	3.3.1	AO2
	b	Primers will not be able to bind to the base sequences of DNA.	1		3	556	461	3.3.1	AO2
15	a	A marker is inserted into structure W/ plasmid. **(1 mark)** The desired gene is identified when coded for florescent product or is coloured. **(1 mark)**	2			551	466-467	3.2.3	AO2
	b	To produce Complementary/ matching sticky ends	1			547	462	3.1.2	AO1
	c	- Enzyme T: produces cDNA/ strand from mRNA strand. **(1 mark)** - Enzyme Y: Synthesizes new strand of DNA/ / nucleic acid/ adds nucleotides. **(1 mark)** - Enzyme N: joins/catalyses the formation of phosphodiester C-O/phosphodiester bond (backbone) **OR** joins the gene to the plasmid. **(1 mark)**	3			550	459	3.2.1	AO2
16		3 only.	1			564	466	3.4.1	AO1

سلطنة عمان
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دائرة الامتحانات وزارة التربية والتعليم
قسم الامتحانات العامة

Item	Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
					Cambr	Hodd		
17	***Any two of the following:*** - Preventative treatment can be offered for people at risk of developing diseases such as breast cancer that can be identified before they develop symptoms. - They can also be offered advice about changes in lifestyle to reduce the risk of developing the condition. - Decrease the amount of money/Saves money/Reduces the healthcare treatment cost that would otherwise be spent in long-term treatment for the condition. - Improve medicine and make it cheaper. - Improve treatment of genetic disease.	2		3	568-569	479-481	3.4.2	AO1

Item		Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
						Cambr	Hodd		
18		B	1		4	355	304	4.1.8	AO1
19		- Microvilli (brush borders): Increases the surface area for reabsorption of substances such as glucose, amino acids, and ions into the blood. **(1 mark)** - Co transporter proteins: Efficiently reabsorb diverse essential solutes and ions from the filtrate using sodium-driven transport / bring in glucose and amino acid at the same time. **(1 mark)**	2			357	305-306	4.1.8	AO1
20		- Student B secreted more ADH. **(1 mark)** - ADH increased the water permeability of the collecting duct **OR** Aquaporins (water channels) are inserted into the membrane. **(1 mark)** - More water is reabsorbed into the blood by osmosis. **(1 mark)** - In student B, the volume of urine decreased and became more concentrated. **(1 mark)**	4			362	310	4.2.1	AO2
21	a	Because G protein activation is affected this would impair the activation of adenylyl cyclase and the release of the secondary messenger (cAMP). **(1 mark)** The breakdown of glycogen to glucose is decreased causing the glucose level in the blood to drop. **(1 mark)**	2			366-367	297	4.3.2	Ao2
	b	Production of glucagon is unaffected because it is produced in pancreatic α-cells and the mutation only affects G proteins in the liver.	1			364	296	4.3.1	Ao2
	c	Glucose oxidase	1			368	299	4.3.3	AO1
22	a	Water enters the guard cells	1			373-374	313-314	4.4.3	AO2

Item		Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
						Cambr	Hodd		
22	b	High | Dry	1			372	312	4.4.2	AO2
	c	Helps to maintain the electrical balance **OR** decreases the water potential inside the cell to allow the water to enter the cell.	1	Accept: Increase solute concentration inside the cell.		374	313-314	4.4.3	AO1



Item		Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
						Cambr	Hodd		
23		Nervous system | Endocrine system	1		5	388	318-319	5.1.1	AO1
24		Ion A: sodium. **(1 mark)** Ion B: potassium. **(1 mark)** Sodium voltage-gated channels open causing sodium ions/ ion A to diffuse into axon (Depolarisation). **(1 mark)** Sodium voltage-gated channels close, potassium voltage-gated channels open causing potassium/B to leave (repolarisation). **(1 mark)**	4			393-399	323-324	5.2.4	AO2
25	a	Calcium ion / Ca^{+2}	1			404	327-328	5.2.7	AO2
	b	Choline is absorbed by the presynaptic neuron and recycled into ACh.	1			404	327-328	5.2.7	AO2
	c	The postsynaptic neuron would permanently stay depolarized	1			404	327-328	5.2.7	AO2
26	a	- Protein C: Actin. **(1 mark)** - Structure D: M line. **(1 mark)**	2			407-409	331	5.3.1	AO1
	b	Covers actin binding sites when the muscle is relaxed.	1			410	332	5.3.2	AO1
	c	Without ATP hydrolysis the myosin head can't return back to its original position. Therefore, no power strokes/cross-bridge cycling occurs.	1			411	334	5.3.2	AO2

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وزارة التربية والتعليم
وكالة الاختبارات وإدارة الامتحانات
قسم الامتحانات العامة

وزارة التعليم

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

الفصل الدراسي الأول - الدور الثاني

للعام الدراسي ١٤٤٨/١٤٤٧ هـ - ٢٠٢٥ / ٢٠٢٦ م

تنبيه:
- المادة: الأحياء.
- الأسئلة في (١٧) 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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1) **Figure 1-1** shows a nucleic acid.

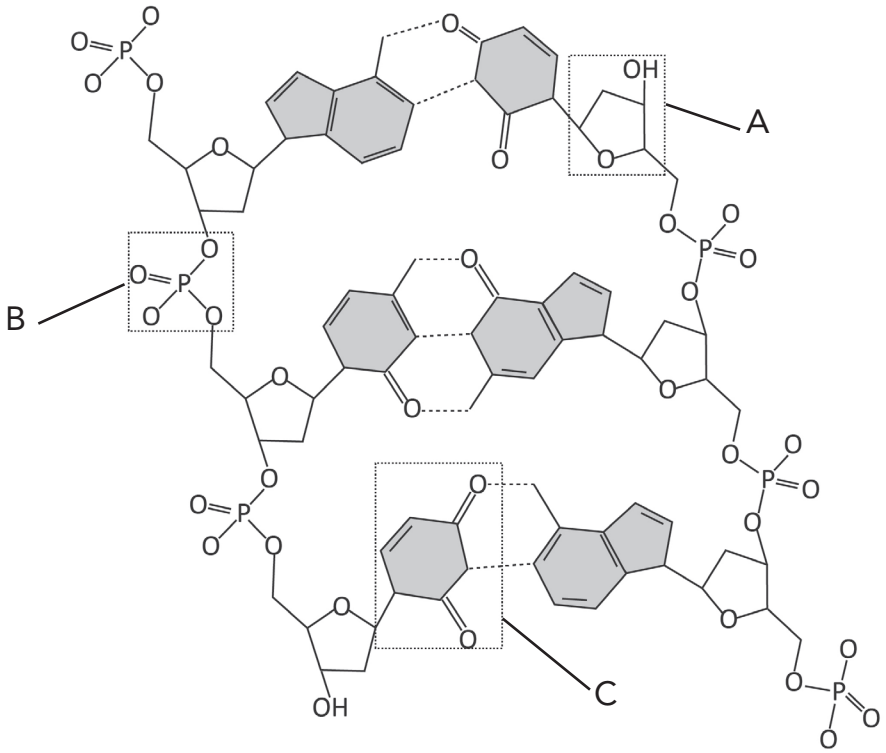


Figure 1-1

a. Identify the following:

- Structure **A**: _____
- Structure **C**: _____
- The importance of structure **B**: _____

_____ [3]

b. State **two** features of the nucleic acid as shown in **Figure 1-1**.

- _____

_____

- _____

_____ [2]

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2) **Figure 2-1** shows section **A** and section **B** of a DNA molecule.

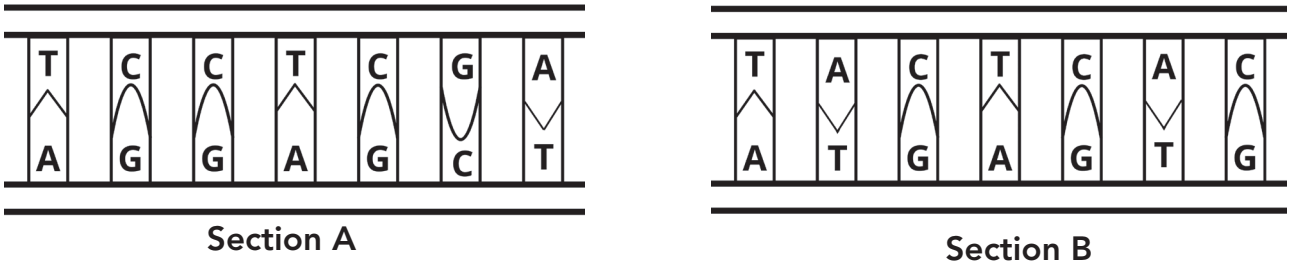


Figure 2-1

Which of the following explains the section that is more stable according to the number of bonds?
(Shade the shape (▭) corresponding to the correct answer).

- ▭ Section B because it contains more cytosine
- ▭ Section A because it contains more adenine.
- ▭ Section A because it contains more guanine.
- ▭ Section B because it contains more thymine. [1]

3) **Figure 3-1** shows a process occurring in the nucleus.

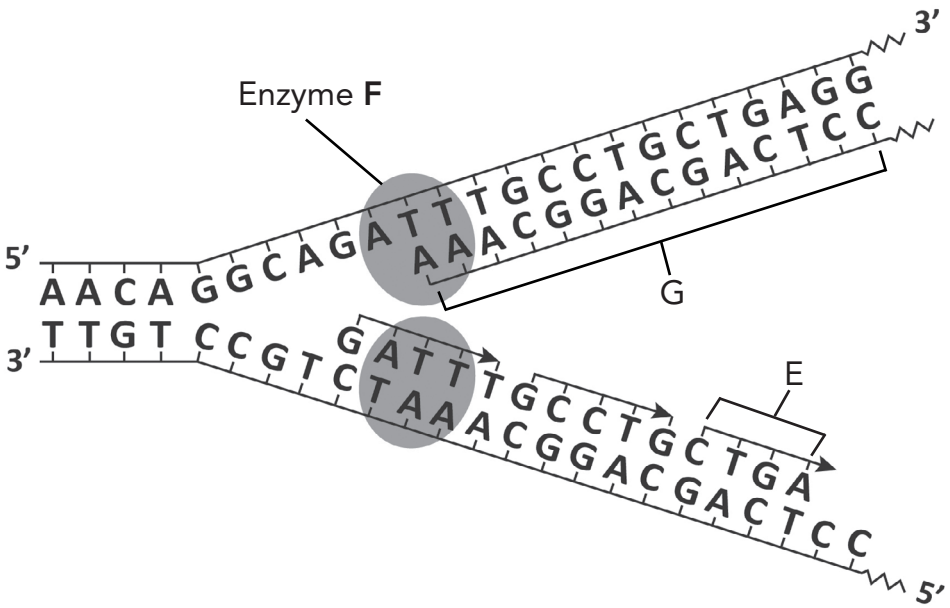


Figure 3 - 1

Describe how enzyme **F** forms strands **G** and **E** with reference to its name.

_____

_____

_____

_____ [3]

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4) **Figure 4-1** shows two processes of protein synthesis.

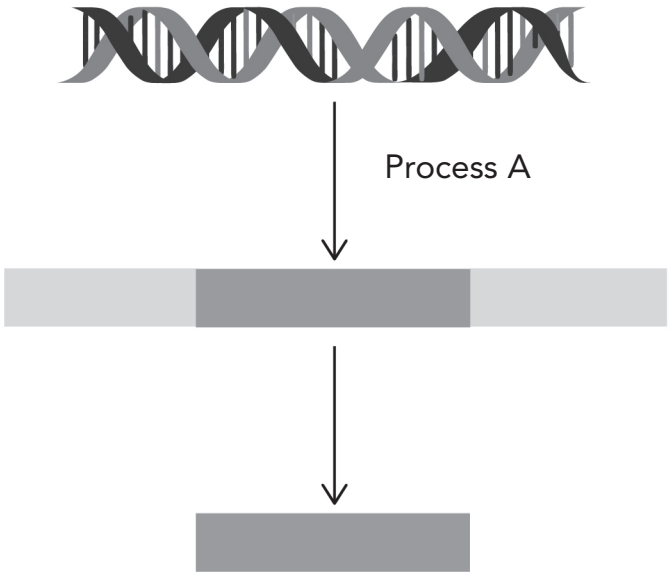


Figure 4-1

Which of the following describes process **A** and fragment **C**?

(Shade the shape (▭) corresponding to the correct answer).

	Process A	Fragment C
▭	Modification	Intron
▭	Modification	Exon
▭	Transcription	Exon
▭	Transcription	Intron

[1]

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5) **Figure 5-1** shows the process of translation.

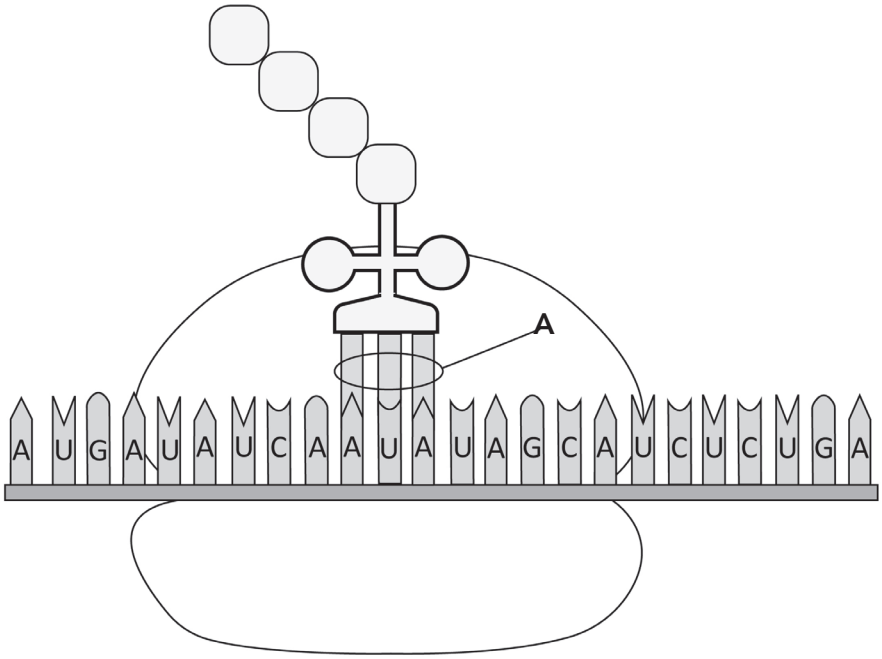


Figure 5-1

a. Which of the following represents the triplet bases labelled **A**?
(Shade the shape (⬭) corresponding to the correct answer).

⬭ ATA. ⬭ TAT.

⬭ AUA. ⬭ UAU. [1]

b. State the role of the anticodon.

_____

_____ [1]

c. Using the **Codons Table** provided, write the amino acid chain sequence that is produced after the translation process is finished in **Figure 5-1**.

_____

_____ [2]

Codons	Amino acid
ACA	Thr
AUA	Ile
AUG	Met
CUA	Leu
CAU	His
CUC	Leu
GUA	Val
GAG	Glu
UCA	Ser

Codons Table

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6) **Figure 6-1** shows one stage of meiosis.

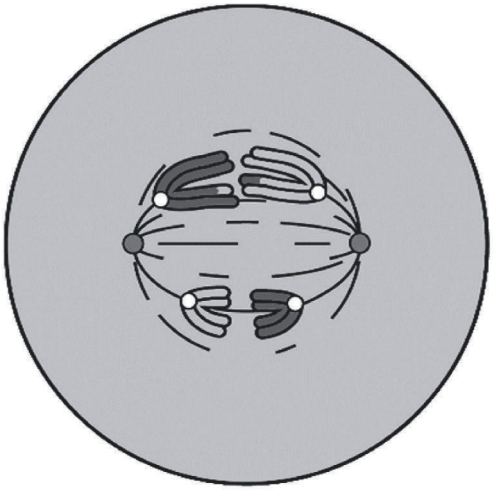


Figure 6-1

Describe the **behaviour** of the chromosome and the spindle fibers in **Figure 6-1**.

- Chromosome: _____

_____

- Spindle fibers: _____

_____ [2]

7) State **two** main reasons for the variation in genetic content among individuals.

– _____

– _____ [2]

8) Which of the following identifies the gene affected by a mutation that causes a defect in the development of neurons?

(Shade the shape (⬭) corresponding to the correct answer).

⬭ *HBB*. ⬭ *HTT*.

⬭ *F8*. ⬭ *TYR*. [1]

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9) A researcher designs an experiment to determine the order of genes in the lac operon. They selectively blocked RNA polymerase before it transcribed each gene in the operon and then determined whether the protein was produced or not.

KEY	
Produced	+
Not Produced	-

Table 9-1 shows the effects of blocking RNA polymerase before the transcription of the sequential genes.

Gene blocked	Permease	Beta-galactosidase	Transacetylase
Gene A	-	-	-
Gene B	-	+	-
Gene C	+	+	-

Table 9-1

a. Predict the correct sequence of proteins produced by the lac operon.

_____ [1]

b. Identify the type of enzyme produced by gene **B**.

_____ [1]

10) Which of the following parental genotypes can produce offspring with blood **group O**? (Shade the shape (⬭) corresponding to the correct answer).

⬭ $|^{A}|^{A} \times |^{B}|^{B}$ ⬭ $|^{A}|^{i} \times |^{B}|^{B}$

⬭ $|^{A}|^{A} \times |^{B}|^{i}$ ⬭ $|^{A}|^{i} \times |^{B}|^{i}$ [1]

11) **Figure 11-1** shows the body colour of two mice in a cross experiment.



Figure 11-1

Which of the following represents the parent's genotypes if the offspring was 1:1 Black to Albino? (Shade the shape (⬭) corresponding to the correct answer).

⬭ BB × bb ⬭ Bb × bb

⬭ Bb × Bb ⬭ bb × bb [1]

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12) A normal man marries a woman who carries both genes for hemophilia A (h) and red-green color blindness (f) on the same chromosome as shown in **Figure 12-1**.

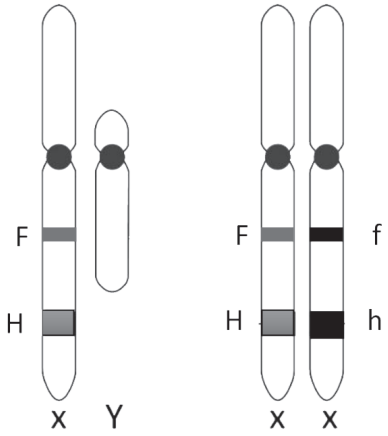


Figure 12-1

a. Identify the male gametes.

_____ [1]

b. Identify the children's phenotypes (affected/ unaffected):

- Male: _____
- Female: _____ [2]

13) In a sunflower plant, two genes affect the flower colour (R/r) and stem height (T/t) found on the **same chromosome**. A homozygous plant with red petals (R) and tall stems (T) was crossed with a plant with yellow petals (r) and short stems (t).

All F_1 plants had red petals and tall stems.

Draw a genetic diagram to show the result of crossing an F_1 with a homozygous recessive plant, if no crossing over occurs.

_____

_____

_____

_____

_____

_____

_____

_____

_____ [4]

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14) **Figure 14-1** shows a step used in genetic engineering.

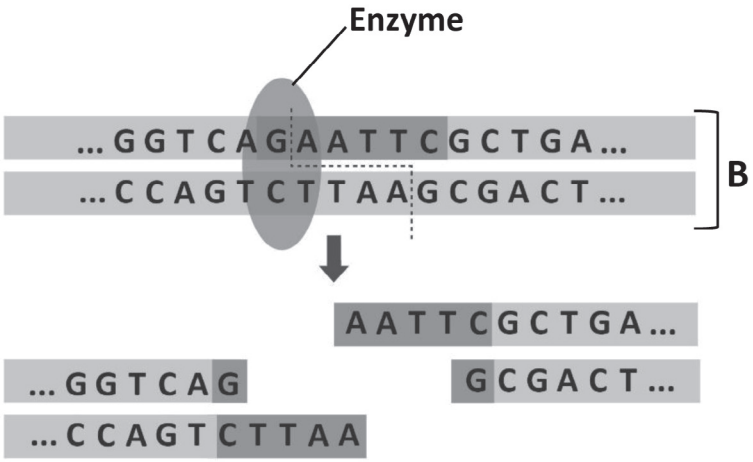


Figure 14-1

a. State **two** ways in which molecule **B** can be obtained.

– _____

_____

– _____

_____ [2]

b. Explain how the human insulin gene can be inserted into plasmid.

_____

_____

_____

_____

_____

_____ [2]

15) Which of the following enzymes is responsible for forming a phosphodiester bond in recombinant DNA (rDNA).

(Shade the shape (⬭) corresponding to the correct answer).

⬭ DNA Ligase.
⬭ DNA polymerase.
⬭ Taq polymerase.
⬭ Reverse transcriptase. [1]

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16) Gel electrophoresis is used to analyse **three** DNA samples collected from three suspects to identify the criminal.

The result is shown in **Figure 16-1**

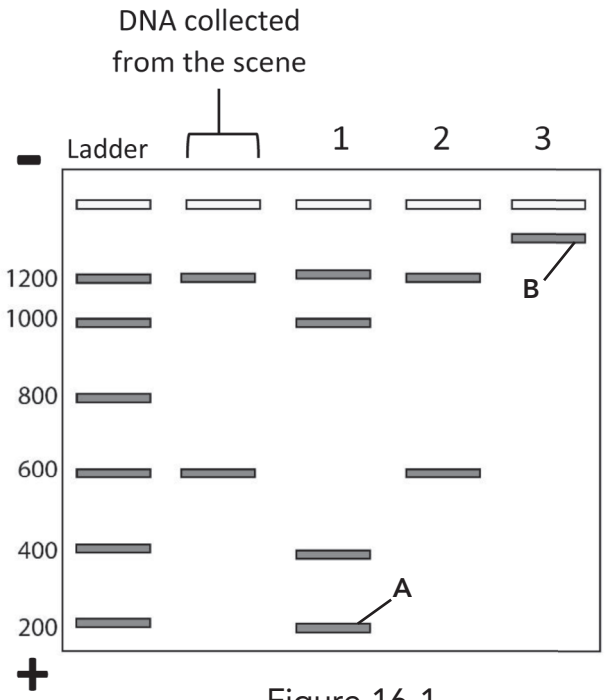


Figure 16-1

a. Explain the sample in **Figure 16-1** that identifies the criminal with reference to the sample's number.

_____

_____

_____ [2]

b. Explain why the DNA fragments **A** and **B** moved to different distances.

- Fragment A: _____
- Fragment B: _____ [2]

c. Predict the effect on the DNA samples if the negative and positive electrodes were switched.

_____

_____ [1]

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17) **Figure 17-1** shows the three stages of PCR.

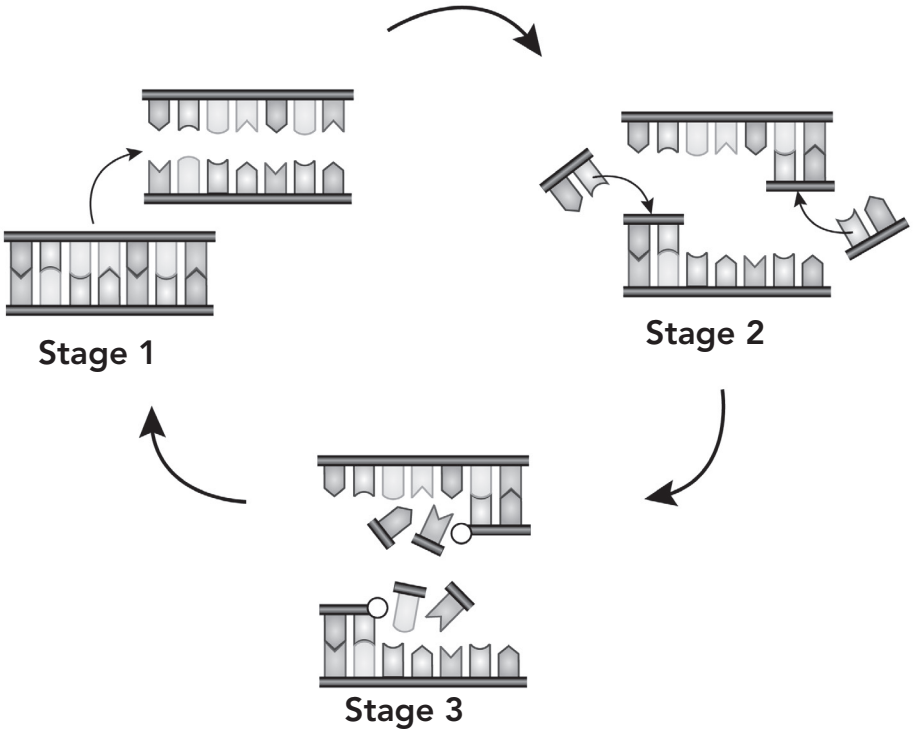


Figure 17-1

a. Explain the change in temperature in **stage 2** with reference to its importance.

_____

_____ [2]

b. Which of the following is an aim and a controlling factor for a **stage 3** in PCR? (Shade the shape (⬭) corresponding to the correct answer).

	Aim of stage	Controlling factor
⬭	Adds nucleotides	Low temperature
⬭	Separates DNA strands	Taq polymerase
⬭	Adds nucleotides	Taq polymerase
⬭	Separates DNA strands	Low temperature

[1]

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Do not write in this space

18) Explain how herbicide-resistant crops can help solve the global demand for food.

_____

_____

_____ [1]

19) **Table 19-1** shows two substances **Y** and **Z** of blood plasma that enter the glomerulus in a healthy person.

Key:

Unchanged: *The substance is present and its concentration is the same as in blood plasma.*

Absent: *The substance is not found at all*

Substance of blood plasma entering glomerulus	Substance in newly formed glomerular filtrate	Substance in urine
Y	Unchanged	Absent
Z	Absent	Absent

Table 19-1

a. Name the process by which glomerular filtrate is formed.

_____ [1]

b. Which of the components, **Y** or **Z**, represents glucose?
(Shade the shape (⬭) corresponding to the correct answer).

⬭ Y ⬭ Z

Explain your answer.

_____

_____

_____ [1]

c. Give **two** explanations why the structure of Bowman's capsule stops large proteins from passing into the filtrate.

– _____

_____

– _____

_____ [2]

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Do not write in this space

20) **Figure 20-1** represents a section of the nephron where the glomerular filtrate is formed.

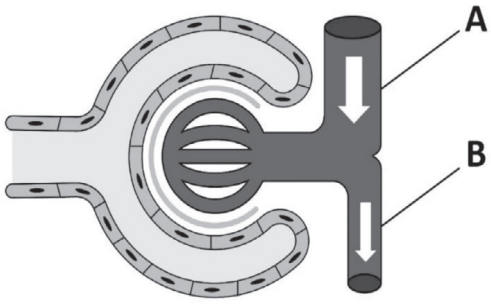


Figure 20-1

Predict the effect if the diameters of arteriole **A** and arteriole **B** were the same.

_____

_____

_____ [1]

21) A patient with a head injury develops ***central diabetes insipidus (DI)***, which had an impact on his posterior pituitary gland.

Figure 21-1 shows the results of the volume of urine (L/day) of the patient before and after injury.

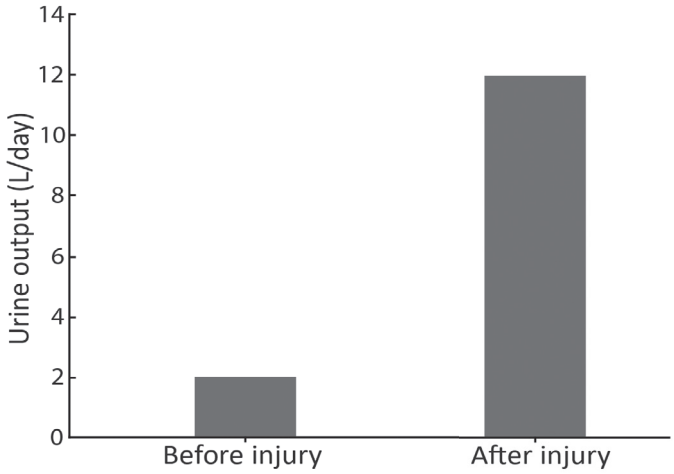


Figure 21-1

Explain the impact of central diabetes insipidus (DI) on this patient's posterior pituitary gland and urine output.

_____

_____

_____ [2]

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Do not write in this space

22) **Figure 22-1** shows two structures of the nephron.

Which of the following identifies the functions of structures **1** and **2**?

(Shade the shape (⬭) corresponding to the correct answer).

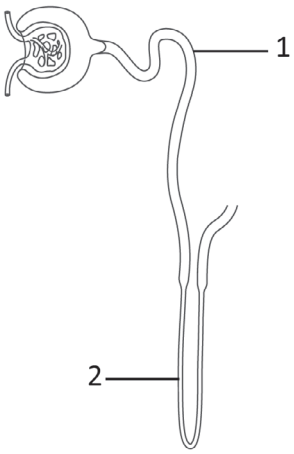


Figure 22-1

	Creates a high concentration of ions in the medulla	Contains lots of co-transporter proteins	Contains Microvilli (Brush borders)
⬭	1	2	1
⬭	2	2	1
⬭	1	1	2
⬭	2	1	1

[1]

23) A student measured the glycogen content of the liver (as a percentage of liver wet weight) over four days. The results are shown in **Table 23-1**.

Note: In a healthy human glycogen ranges from 4-8% of liver wet weight.

Day	Liver glycogen (% of liver wet weight)
1	5.5%
2	2.9%
3	0.9%
4	8.7%

Table 23-1

a. Which of the following describes the body's response in days **3** and **4** as shown in **Table 23-1**? (Shade the shape (⬭) corresponding to the correct answer).

	Day 3	Day 4
⬭	Insulin increase	Glucagon increase
⬭	Glucagon increase	Glucagon decrease
⬭	Glucagon increase	Insulin decrease
⬭	Insulin increase	Insulin decrease

[1]

b. Identify the type of feedback involved in the regulation of blood glucose level.

_____ [1]

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24) **Figure 24-1** shows the movement and direction of water (H_2O) between two leaf cells.

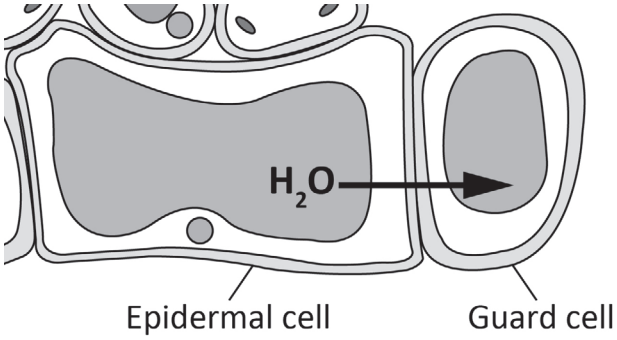


Figure 24-1

Explain change on the stomatal aperture in **Figure 24-1**, with reference to the movement of **K^+**, **malate ions** and **water potential**.

_____

_____

_____

_____

_____

_____

_____ [4]

25) **Table 25-1** shows the membrane potential of an axon at rest and during different phases of an action potential.

a. Identify the state of the sodium ions (Na^+) channels (open or closed) at depolarisation and repolarisation phases in **Table 25-1.** [1]

Phase of axon	Membrane potential / mV	Voltage-gated Na^+ channel proteins in axon membrane	Voltage-gated K^+ channel proteins in axon membrane
Resting	–70	Closed	Closed
Depolarisation starting	–50	_____	Closed
Repolarisation	–20	_____	Open

Table 25-1

b. Explain how the action potential only moves in one direction along an axon.

_____

_____ [1]

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26) **Figure 26-1** shows two neurone cells labelled **W** and **Z**.

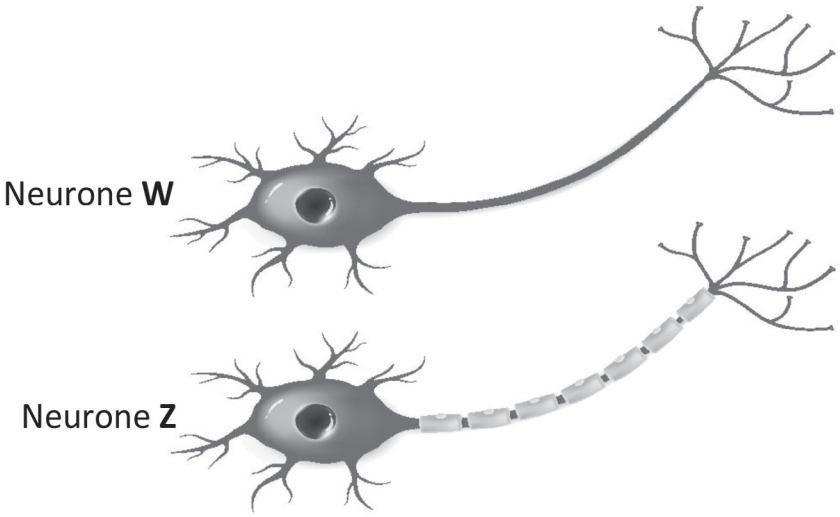


Figure 26-1

a. Explain how **Neurone Z** reduces the ATP cost of maintaining resting potentials compared to **Neurone W**.

_____

_____

_____ [2]

b. Which of the following statements describes a motor neuron?
(Shade the shape (⬭) corresponding to the correct answer).

- ⬭ The axon lies within the central nervous system.
- ⬭ The cell body lies within the central nervous system.
- ⬭ Transmits impulses from the central nervous system to a receptor.
- ⬭ Transmits impulses from a receptor to the central nervous system. [1]

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27) **Figure 27-1** shows a sarcomere under condition **A** and condition **B**.

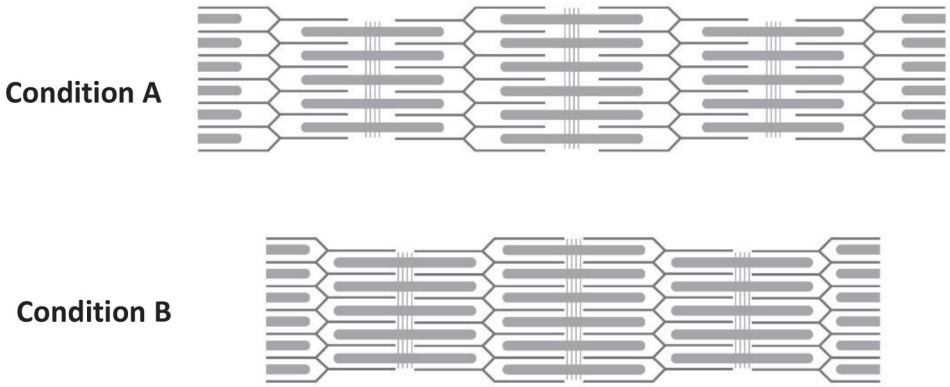


Figure 27-1

a. Which of the following describes the change in the sarcomere from condition **A** to condition **B**?

(Shade the shape (⬭) corresponding to the correct answer).

⬭ Light band decreases. ⬭ Light band increases.

⬭ Thin filaments shorten. ⬭ Thick filaments shorten. [1]

b. Name the proteins that make up the thick filaments in a sarcomere.

_____ [1]

c. Sprinters often experience muscle cramps.
Explain why this happens using the sliding filament model.

_____

_____

_____

_____ [1]

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28) **Figure 28-1** shows an example of chemical communication in plants.

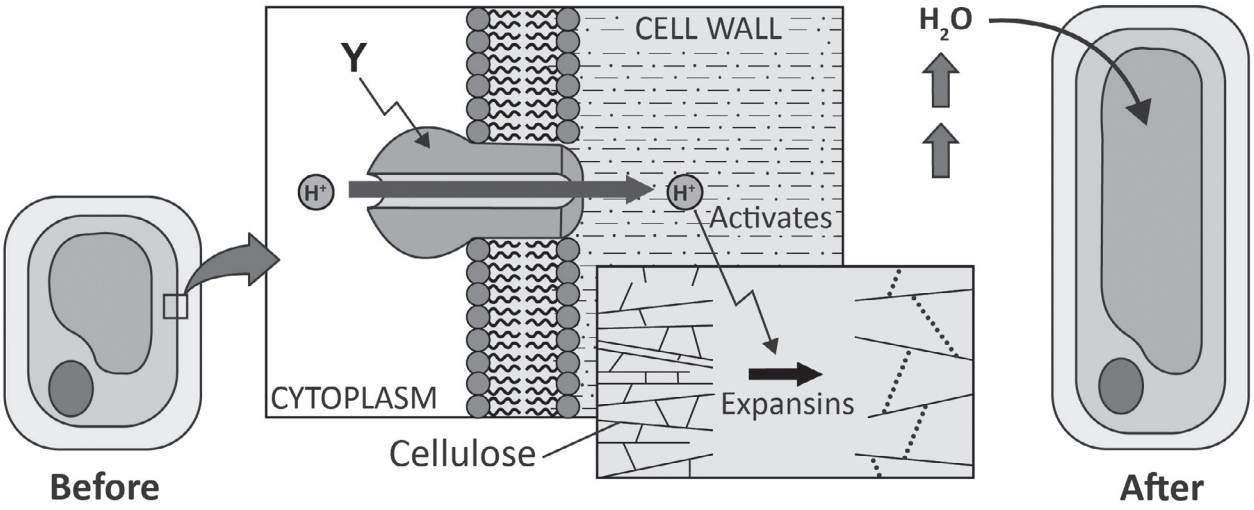


Figure 28-1

Explain the regulatory role of this chemical in plants including the name of the chemical labelled **Y**.

[4]

[End of Examination]

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Marking Guide of
General Education Diploma
Bilingual Private Schools
First Semester – Second Session
2025/2026

The marking guide is in (9) pages. Subject: Biology Total marks: (70)

Item		Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
						Cambr	**Hodd**		
1	a	- Structure A: Deoxyribose/ sugar. **(1 mark)** - Structure C: Thymine **OR** nitrogen base **OR** pyrimidines **(1 mark)** - Links the phosphate group of one nucleotide to the 3' carbon of the sugar in the next nucleotide **OR** forms the sugar-phosphate backbone, providing structural integrity. **(1 mark)**	3		1	145-148	122	1.1.3	AO2
	b	***Any two of the following:*** - It is made of two polynucleotide chains. Each chain is a right-handed helix. - The two chains coil around each other to form a double helix. - The chains run in opposite directions- they are said to be antiparallel. - Each chain has a sugar-phosphate backbone with bases projecting at right angle. - The bases in one chain are attracted to the bases of the other chain by hydrogen bonding between the bases. - Because of the way they fit together, like a jigsaw piece, A-T, G-C (complementary base pairing). - In all DNA molecules, the nucleotides contain deoxyribose.	2			147-148	123	1.1.3	AO1
2		Section A because it contains more guanine.	1			148	123	1.1.3	AO1

3		-DNA polymerase. **(1 mark)** - Strand G/ the leading strand is copied in the same direction of DNA polymerase/ 5' to 3' direction/unwinding direction. **(1 mark)** - Strand E/ the lagging strand is copied in the opposite direction to the unwinding. **(1 mark)**	3		149	125-126	1.2.1	AO2
4		Transcription | Exon	1		151-152	135-136	1.4.3	AO1
5	**a**	UAU	1		153-154	133-134	1.4.1	AO2
	b	The anticodon is complementary to the codon of messenger RNA that codes for the specific amino acid. **OR** align with RNA codons by complementary base pairing which brings amino acids side by side.	1		153	135-136	1.4.1	AO1
	C	Met-Ile-Ser-Ile	2	Do not accept the STOP codon as amino acid. Two marks for four correct amino acids written in the right order. One mark if: - (2-3) amino acids written in the right order. - amino acids written after the STOP codon.	131	152-153	1.4.1	AO2

Item		Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
						Cambr	**Hodd**		
6		- Whole chromosomes move towards opposite ends of the spindle, centromeres first, pulled by microtubules and remain intact **or** homologous chromosome separated and whole chromosomes are pulled towards opposite poles of the spindle, centromere first. **(1 mark)** - The spindle fibers pull on centromeres/ shorten. **(1 mark)**	2			430-432	345-347	2.1.4	AO1
7		***Any two of the following:*** - Crossing over. - Independent assortment. - Random fertilization.	2	Accept answers in the form of an explanation.	2	430-436	348-349	2.2.1 2.2.2	AO1
8		*HTT*	1			452	371	2.5.1	AO1
9	**a**	Beta-galactosidase, permease, transacetylase.	1			453-455	375-359	2.6.2	AO2
	b	Inducible enzyme.	1			455	375	2.6.2	AO2
10		$I^AI^i \times I^BI^i$	1			437	356	2.4.2	AO2
11		Bb × bb	1			439	353-354	2.4.4	AO2
12	**a**	X^{FH} Y **or** (X^{FH}) (Y)	1			440-441	357-359	2.4.2	AO2
	b	Male: 1 affected, 1 unaffected. **(1 mark)** Female: all unaffected. **(1 mark)**	2			440-441	357-359	2.4.2	AO2

Item	Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
					Cambr	Hodd		
13	*parental phenotypes* red petals, tall stems × yellow petals, short stems *parental genotypes* (RT) (rt) (rt) (rt) **(1 mark)** *parental gametes* RT rt rt **(1 mark)** *offspring* *genotypes and phenotypes* (RT) (rt) red petals, tall stems **(1 mark)** (rt) (rt) yellow petals, short stems **(1 mark)**	4		2	447-448	362-365	2.4.3	AO2

Item		Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
						Cambr	Hodd		
14	a	***Any two of the following:*** - Extracted from the DNA of a donor organism. - Synthesized from mRNA of a donor organism. - Synthesized chemically from nucleotides.	2		3	544	460/ 466	3.1.3	AO2
	b	- A plasmid/ bacterial DNA and human gene (insulin) is cut using restriction enzymes. These enzymes produce complementary/ sticky ends. **(1 mark)** - The gene (insulin) is inserted into the plasmid using DNA ligase. **(1 mark)**	2			548	462	3.2.1	AO1
15		DNA Ligase.	1			548	462	3.1.1	AO1
16	a	Sample 2 **(1 mark)** Because the number of fragments and its possessions matches/ the same as the DNA collected from the crime scene. **(1 mark)**	2			557	468-469	3.3.2	AO2
	b	- Fragment A: small/light fragment of DNA. - Fragment B: large/heavy fragment of DNA.	2			557	469	3.3.2	AO2
	c	***Any one of the following:*** - It will move backward to the newly positive electrodes. - Goes back and out of the gel. - DNA exits the gel at the top - No separation will occur.	1			557-578	468	3.3.2	AO1
17	a	Cool to 40 °C **OR** 60 °C / lower the temperature / decrease the temperature **(1 mark)** to allow the primer to attach/ stick/ anneal to each strand. **(1 mark)**	2			555-556	461	3.3.1	AO2
	b	Adds nucleotides | Taq polymerase	1			556	461	3.3.1	AO2

Item	Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
					Cambr	**Hodd**		
18	Genetically modified crops will survive the application of specific herbicides which would normally kill them.	1		3	570	483	3.5.1	AO1

Item		Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
						Cambr	**Hodd**		
19	**a**	Ultrafiltration.	1		4	354-355	304	4.1.6	AO1
	b	Y Because glucose is reabsorbed during selective reabsorption in PCT.	1			356-359	304-305	4.1.6	AO2
	c	***Any two of the following:*** **-** The **capillary endothelium** has fenestrations (pores) that allow plasma fluid to pass through but not blood cells. - The **basement membrane** acts as a selective filter, preventing large plasma proteins from passing through. - The **podocyte layer** with filtration slits provides an additional barrier, ensuring only water and small solutes enter the Bowman's capsule.	2			356-357	305-306	4.1.8	AO1
20		The **hydrostatic pressure in the glomerulus would fall.** This would reduce or even prevent **ultrafiltration.**	1			356	304	4.1.6	AO2
21		Central diabetes insipidus impaired the **posterior pituitary gland's ability to secrete ADH**. **(1 mark)** leading to a very high urine output. **(1 mark)**	2			360-362	308-311	4.2.1	AO2
22		2 | 1 | 1	1			354-358	302-307	4.1.8	AO1
23	a	Glucagon increase | Glucagon decrease	1			364-367	295-297	4.3.2	AO2
	b	Negative feedback.	1			365	296	4.3.1	AO1

Item	Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
					Cambr	Hodd		
24	Potassium ions (k^+) are pumped/ actively transported into the guard cell vacuole. **(1 mark)** Malate ions enter the guard cell vacuole. **(1 mark)** Thus, water potential becomes more negative/ low in the vacuole. **(1 mark)** Water (H_2O) will move down a water potential gradient into the guard cell vacuole leading the stomata to increase/ open. **(1 mark)**	4			373-374	314	4.4.3	AO2

وزارة التعليم
المديرية العامة للتقويم التربوي
دائرة إدارة الامتحانات والاختبارات

Item		Answer	Mark	Additional Information	Unit	Page		Learning Outcome	Assessment Objective
						Cambr	Hodd		
25	a	<table><tr><th>Phase of axon</th><th>Voltage-gated Na^+ channel proteins in axon membrane</th></tr><tr><td>Depolarisation starting</td><td>Open</td></tr><tr><td>Repolarisation</td><td>Closed</td></tr></table>	1			399	323	5.2.4	AO1
	b	Voltage-gated Na^+ channels are inactivated/ closed during the refractory period **OR** following the passing of action potential, the neurone fiber is not excitable	1			397	325	5.2.4	AO1
26	a	In neurone Z depolarisation only occurs at the nodes of Ranvier **(1 mark)**, so fewer Na^+ and K^+ ions cross the membrane. Therefore, less activity of the Na^+/K^+ pump is required to restore ion gradients, reducing ATP usage. **(1 mark)**	2			393/ 398-399	323/ 326	5.2.4 5.2.5	AO2
	b	The cell body lies within the central nervous system.	1			390	319	5.2.1	AO1
27	a	Light band decreases.	1			410-411	331	5.3.1	AO2
	b	Myosin.	1			407	331	5.3.1	AO1
	c	Without ATP, myosin heads stay attached to actin, so muscles remain cramped.	1			410-411	332-334	5.3.1	AO2
28		The name of the chemical is Auxin. **(1 mark)** Auxin/ Y regulates plant cell enlargement. **(1 mark)** Auxin/ Y stimulates proton (H^+) pumps in the plasma membrane. **(1 mark)** Protons (H^+) are pumped into the cell wall, activating expansion proteins by reducing the pH number. **(1 mark)**	4			410-411	332-334	5.3.1	AO2