Captivate
EDUCATION

Biology

Question and Answer Book

Practice examination 1 – 2027

Student name _____

Teacher _____

- Reading time is 15 minutes
- Writing time is 2 hours 30 minutes

Materials supplied

- Question and Answer Book
- Multiple-Choice Answer Sheet

Instructions

- Follow the instructions on your Multiple-Choice Answer Sheet.
- At the end of the examination, place your Multiple-Choice Answer Sheet inside the front cover of this book.

Students are not permitted to bring mobile phones and/or any unauthorised electronic devices into the examination room.

Contents

Section A (40 questions, 40 marks)

Section B (10 questions, 80 marks)

Practice material in the layout of the 2025 VCAA paper – generated 2027. Not a VCAA examination.

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Section A – Multiple-choice questions

Instructions

- Answer **all** questions in pencil on your Multiple-Choice Answer Sheet.
- Choose the response that is correct or that best answers the question.
- A correct answer scores 1; an incorrect answer scores 0.
- Marks will not be deducted for incorrect answers.
- No marks will be given if more than one answer is completed for any question.
- Unless otherwise indicated, the diagrams in this book are not drawn to scale.

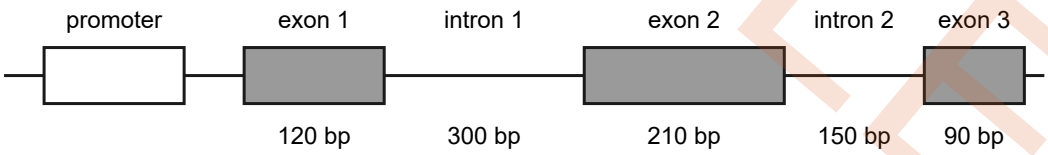
Question 1

Which option correctly identifies the sugar in a DNA nucleotide and a base that is found in RNA but **not** in DNA?

	Sugar in a DNA nucleotide	Base found only in RNA
A.	deoxyribose	uracil
B.	ribose	uracil
C.	deoxyribose	thymine
D.	ribose	thymine

Use the following information to answer Questions 2–4.

The diagram below shows the structure of a eukaryotic gene that codes for a digestive enzyme. The length of each exon and intron is given in base pairs (bp).



Question 2

Transcription of this gene begins at the start of exon 1 and ends at the end of exon 3. Before RNA processing, the number of nucleotides in the pre-mRNA would be

A. 420

B. 450

C. 870

D. 1740

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Question 3

The promoter of this gene is

A. the site where a repressor protein binds to block transcription.

B. the site where RNA polymerase binds to begin transcription.

C. a sequence that is removed from the pre-mRNA together with the introns.

D. the codon at which translation of the mRNA begins.

Question 4

Part of the **template** strand of DNA within exon 1 has the sequence 3′ TAC GGA CTT 5′.

The mRNA transcribed from this sequence is

A. 5′ UAC GGA CUU 3′

B. 5′ ATG CCT GAA 3′

C. 3′ AUG CCU GAA 5′

D. 5′ AUG CCU GAA 3′

Question 5

In the bacterium *Escherichia coli*, when the concentration of tryptophan in the cell is high,

A. tryptophan binds to the repressor protein, which then binds to the operator of the *trp* operon.

B. tryptophan binds to the repressor protein, which then binds to the promoter of the *trp* operon.

C. the repressor protein detaches from the operator and the structural genes are transcribed.

D. RNA polymerase binds to tryptophan and transcribes the structural genes more rapidly.

Use the following information to answer Questions 6–9.

Chytridiomycosis is a disease of frogs caused by the fungus *Batrachochytrium dendrobatidis*. To test for the fungus, scientists rub a swab over a frog's skin and use the polymerase chain reaction (PCR) to amplify a section of *B. dendrobatidis* DNA that may be present on the swab. The three steps in one PCR cycle are shown in the table below.

Step	Temperature (°C)	Time (s)
1	95	30
2	55	30
3	72	60

Question 6

During Step 2,

A. the hydrogen bonds between the two strands of DNA are broken.

B. primers bind to complementary sequences on the single strands of DNA.

C. *Taq* polymerase adds nucleotides to the end of each primer.

D. DNA ligase joins the newly made fragments of DNA together.

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Question 7

Taq polymerase is used in PCR, rather than a DNA polymerase from a frog or a human, because *Taq* polymerase

A. cuts DNA at specific recognition sites.

B. works most rapidly at 37 °C.

C. does not require primers to begin synthesising DNA.

D. is not denatured at the high temperature used in Step 1.

Question 8

A swab carried one double-stranded molecule of the target DNA. After four complete PCR cycles, the number of double-stranded copies of the target DNA would be

A. 4

B. 8

C. 16

D. 32

Question 9

The scientists swabbed frogs at 20 ponds and recorded the water temperature at each pond. They then examined whether ponds with warmer water had a lower percentage of infected frogs. No conditions at the ponds were changed by the scientists.

The scientific investigation methodology used was a

A. correlational study.

B. controlled experiment.

C. literature review.

D. simulation.

Question 10

Rainbow papaya (*Carica papaya*) contains a gene from the papaya ringspot virus. The gene makes the plant resistant to infection by this virus.

Rainbow papaya is best described as

A. genetically modified but not transgenic, because a virus is not a cellular organism.

B. neither genetically modified nor transgenic, because the gene occurs naturally in the virus.

C. a product of selective breeding, because resistant plants were chosen as parents.

D. transgenic, because its genome contains a gene from a different species.

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Marking scheme – teacher copy

Practice examination 1 – 2027

Not for distribution to students.

Section	Questions	Marks available	Marks awarded
Section A	40	40	
Section B	10	80	
Total		**120**	

Section A

Question	Key	Question	Why
1	**A**	Which option correctly identifies the sugar in a DNA nucleotide and a base that is found in RNA but **not** in DNA?	DNA nucleotides contain the sugar deoxyribose; RNA nucleotides contain ribose. Uracil is found in RNA in place of thymine, so thymine (options C and D) is incorrect.
2	**C**	Transcription of this gene begins at the start of exon 1 and ends at the end of exon 3. Before RNA processing, the number of nucleotides in the pre-mRNA would be	The pre-mRNA includes both exons and introns: 120 + 300 + 210 + 150 + 90 = 870 nucleotides. Option A (420) is the length of the exons only, which is the coding length of the mRNA after the introns are removed. The promoter is not transcribed.
3	**B**	The promoter of this gene is	RNA polymerase binds to the promoter to begin transcription. Option A describes an operator. Option C is incorrect as the promoter is not part of the pre-mRNA. Option D describes a start codon, which is part of the mRNA.

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4	**D**	Part of the **template** strand of DNA within exon 1 has the sequence 3′ TAC GGA CTT 5′. The mRNA transcribed from this sequence is	mRNA is complementary to the template strand, is antiparallel to it and contains uracil in place of thymine. Option A has the same sequence as the template strand. Option B contains thymine, so it is DNA. Option C has the correct bases but the 5′ and 3′ ends are reversed.
5	**A**	In the bacterium *Escherichia coli*, when the concentration of tryptophan in the cell is high,	When tryptophan is abundant it binds to the repressor protein, which changes shape and binds to the operator, blocking RNA polymerase. Option B is incorrect as the repressor binds to the operator, not the promoter. Option C describes what happens when tryptophan levels are low.
6	**B**	During Step 2,	At about 55 °C the primers anneal to complementary sequences. Option A describes Step 1 (denaturation) and option C describes Step 3 (extension). Option D is incorrect as DNA ligase is not used in PCR.
7	**D**	*Taq* polymerase is used in PCR, rather than a DNA polymerase from a frog or a human, because *Taq* polymerase	*Taq* polymerase comes from a bacterium that lives in hot springs and is not denatured at 95 °C, so it does not need to be replaced after every cycle. Option A describes an endonuclease. Option C is incorrect as all DNA polymerases require a primer.
8	**C**	A swab carried one double-stranded molecule of the target DNA. After four complete PCR cycles, the number of double-stranded copies of the target DNA would be	The number of copies doubles in each cycle: 1 becomes 2, 4, 8 and then 16 after four cycles.

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9	**A**	The scientists swabbed frogs at 20 ponds and recorded the water temperature at each pond. They then examined whether ponds with warmer water had a lower percentage of infected frogs. No conditions at the ponds were changed by the scientists. The scientific investigation methodology used was a	The scientists recorded two variables without manipulating either and looked for an association between them, which is a correlational study. Option B is incorrect because no independent variable was changed and no variables were controlled.
10	**D**	Rainbow papaya (*Carica papaya*) contains a gene from the papaya ringspot virus. The gene makes the plant resistant to infection by this virus. Rainbow papaya is best described as	A transgenic organism contains genetic material from a different species. All transgenic organisms are genetically modified, so options A and B are incorrect. Option C is incorrect as the gene was inserted using gene technology and could not be obtained by breeding papaya plants.
11	**C**	Which option correctly identifies Stage 2 and its location?	Stage 2 receives pyruvate and produces 2 ATP and carbon dioxide (X): it is the Krebs cycle, which occurs in the mitochondrial matrix. Option B is incorrect as the cristae are the location of the electron transport chain (Stage 3).
12	**A**	Molecule Z is	Z is an input to the electron transport chain, where water is an output: oxygen is the final electron acceptor. Option B is incorrect as glycolysis does not require oxygen. Option C describes X, which is an output of Stage 2. Option D describes the light-dependent stage of photosynthesis.

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