

MARKER CODE

Pacific  
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Student Personal Identification Number

# South Pacific Form Seven Certificate

## BIOLOGY

### 2017

### QUESTION and ANSWER BOOKLET

**Time allowed:** Three hours

*(An extra 10 minutes is allowed for reading this paper.)*

#### **INSTRUCTIONS**

Write your **Student Personal Identification Number (SPIN)** in the space provided on the top right hand corner of this page.

Answer **ALL QUESTIONS**. Write your answers in the spaces provided in this booklet.

If you need more space for answers, ask the Supervisor for extra paper. Write your SPIN on all extra sheets used and clearly number the questions. Attach the extra sheets at the appropriate places in this booklet.

Major Learning Outcomes (Achievement Standards)	Skill Level & Number of Questions				Weight/ Time
	Level 1 <i>Uni- structural</i>	Level 2 <i>Multi- structural</i>	Level 3 <i>Relational</i>	Level 4 <i>Extended Abstract</i>	
<b>Strand 1: Animal Behaviour</b> Demonstrate understanding of biological concepts and processes relating animal behaviour to biotic and abiotic environmental factors and how the behaviour contributes to the organism's survival	2	3	1	1	15% 45min
<b>Strand 2: Gene Expression</b> Describe, explain and discuss biological concepts and processes relating to gene expression	8	2	3	1	25% 62 min
<b>Strand 3: Biotechnology Applications</b> Describe, explain and discuss biotechnology applications and the human needs and demands for the applications	4	3	-	-	10% 21 min
<b>Strand 4: Processes and Patterns of Evolution</b> Describe, explain and discuss processes and patterns of evolution	5	1	3	1	20% 52 min
<b>TOTAL</b>	<b>19</b>	<b>9</b>	<b>7</b>	<b>3</b>	<b>70% 180 min</b>

Check that this booklet contains pages 2-19 in the correct order and that none of these pages is blank.

**HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION**

**STRAND 1: ANIMAL BEHAVIOUR**

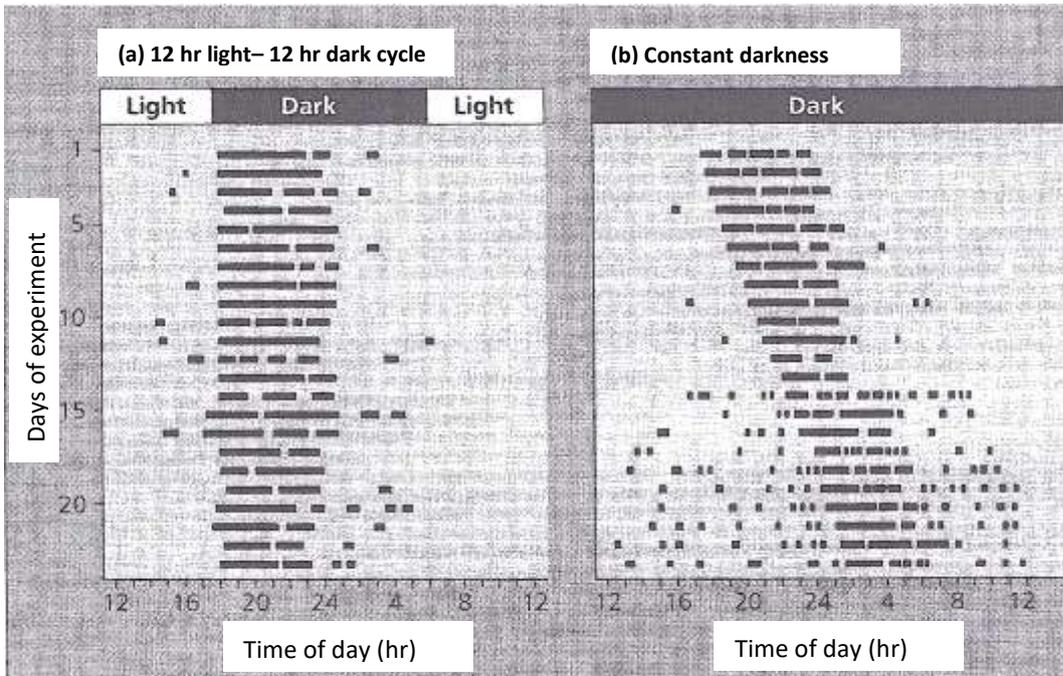
*Assessor's use only*

<p>1.1a</p>	<p>In North America, monarch butterflies carry out one of the longest insect migrations. The butterflies spend the summer in Canada and the northern states of America, then migrate 4000km south to spend winter in Mexico. The migratory behaviour of the monarch butterfly can be described as innate. It is not a learned behaviour.</p> <p>Define the term <b>innate behaviour</b>.</p> <p>Innate Behaviour</p> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1"> <tr> <th colspan="2">Unistructural</th> </tr> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td></td> </tr> <tr> <td>NR</td> <td></td> </tr> </table>	Unistructural		1		0		NR			
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<p>1.1b</p>	<p>Name and describe a change in an environmental cue that could trigger the monarch's migration.</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1"> <tr> <th colspan="2">Multistructural</th> </tr> <tr> <td>2</td> <td></td> </tr> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td></td> </tr> <tr> <td>NR</td> <td></td> </tr> </table>	Multistructural		2		1		0		NR	
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- 1.3 For the cockroach (*Blatta orientalis*), activity normally begins with the onset of darkness and ends at dawn, which suggests that light is an important external cue for the cockroaches. Researchers tested this by monitoring the activity of captive cockroaches for 23 days under two sets of conditions: (a) a regular cycle of 12 hours of light and 12 hours of darkness and (b) constant darkness. The cockroaches were given free access to an exercise wheel and a rest cage. A recorder automatically noted when the wheel was rotating and when it was still. The results collected over 23 days are shown for both sets of conditions below.



Use the actograms to calculate the natural or free running period of the cockroach. Show your working.

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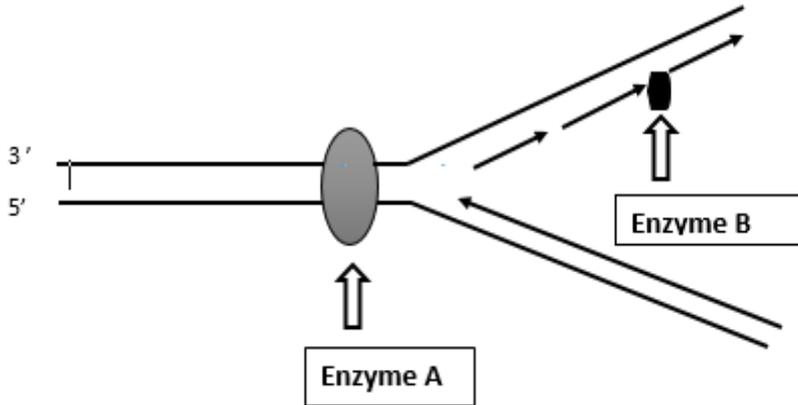
<p>1.4a</p>	<p>Spider monkeys are social animals living in groups of up to 30 animals. These large groups may split into smaller sub groups (e.g. between 2 to 8 animals) during the day when foraging but come together again at night. Each group occupies a territory which males mark using scent glands.</p> <p>Define the term <b>territory</b>.</p> <p>Territory</p> <hr/> <hr/>	<table border="1"> <thead> <tr> <th colspan="2">Unistructural</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td></td> </tr> <tr> <td>NR</td> <td></td> </tr> </tbody> </table>	Unistructural		1		0		NR							
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<p>1.4b</p>	<p>Give <b>one</b> advantage and <b>one</b> disadvantage of living in a group.</p> <table border="1"> <thead> <tr> <th>Advantage</th> <th>Disadvantage</th> </tr> </thead> <tbody> <tr> <td style="height: 100px;"></td> <td></td> </tr> </tbody> </table>	Advantage	Disadvantage			<table border="1"> <thead> <tr> <th colspan="2">Multistructural</th> </tr> </thead> <tbody> <tr> <td>2</td> <td></td> </tr> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td></td> </tr> <tr> <td>NR</td> <td></td> </tr> </tbody> </table>	Multistructural		2		1		0		NR	
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<p>1.5</p>	<p>Two marine animals reproduce in different ways. Oysters release millions of eggs into the surrounding water, which may be fertilized by the sperm of other oysters in the area.</p> <div style="display: flex; justify-content: space-around;">   </div> <p>A female whale is likely to give birth to a single calf once every one to six years. The offspring will be raised by the mother until it is able to hunt and survive on its own. Some female whales will form groups with other females and their children for protection.</p> <p>Discuss how the different reproductive behaviours work together to influence the survival of the two species. In your answer you should focus on:</p> <ul style="list-style-type: none"> <li>• Identifying the different reproductive strategies</li> <li>• The risks and benefits to each species due to these strategies</li> <li>• Reasons why the reproductive outcomes are equally successful</li> </ul>															



## STRAND 2: GENE EXPRESSION

*Assessor's use only*

- 2.1a The diagram shows the process of DNA replication, which has been greatly simplified.



Name enzyme A and enzyme B.

Enzyme A: \_\_\_\_\_

Enzyme B: \_\_\_\_\_

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- 2.1b DNA replicates by semi-conservative replication.

Define **semi-conservative replication**.

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- 2.2a The process of protein synthesis is fundamental to the understanding of how a cell can control its activities.

Define **protein synthesis**.

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2.3a

The diagram shows the base sequence on a sense strand from a length of DNA and three possible types of gene mutation.

**Normal DNA:**                 ACTGAGTA

**Mutation 1:**                ACTGGAGCTA

**Mutation 2 :**               ACTAGCTA

**Mutation 3:**               ACTTAGCTA

Define the term **mutation**.

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2.3b

Name and describe the type of mutation shown in either **1** or **3**.

Mutation 1:

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OR

Mutation 3:

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2.3c

Explain the causes of gene mutations.

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Relational	
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2.4

Human haemoglobin is made up of four protein molecules (globin chains) that are connected together. It is formed from two polypeptides;  $\alpha$ - globin and  $\beta$ -globin. The sixth amino acid in the  $\beta$ -globin is normally glutamic acid. The first part of the DNA template sequence for amino acids one and two of the normal  $\beta$ - globin chain is shown in the table below.

Triplet	1	2
DNA	CAC	GTG
mRNA		
Amino acid		

Complete the table above to show the corresponding mRNA sequence for this section of DNA. Use the codon table to find the amino acid sequence this section of DNA codes for and complete the table by adding the amino acids. (only three letters are required)

		Second Letter					
		U	C	A	G		
1st letter	U	UUU   Phe UUC   UUA   Leu UUG	UCU   UCC   Ser UCA   UCG	UAU   Tyr UAC   UAA   Stop UAG   Stop	UGU   Cys UGC   UGA   Stop UGG   Trp	U C A G	
	C	CUU   CUC   Leu CUA   CUG	CCU   CCC   Pro CCA   CCG	CAU   His CAC   CAA   Gln CAG	CGU   CGC   Arg CGA   CGG	U C A G	
	A	AUU   AUC   Ile AUA   AUG   Met	ACU   ACC   Thr ACA   ACG	AAU   Asn AAC   AAA   Lys AAG	AGU   Ser AGC   AGA   Arg AGG	U C A G	
	G	GUU   GUC   Val GUA   GUG	GCU   GCC   Ala GCA   GCG	GAU   Asp GAC   GAA   Glu GAG	GGU   GGC   Gly GGA   GGG	U C A G	

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2.5

Read the passage below and use it to answer the questions that follow.

A **sex-linked gene** controls fur colour coat in cats. The alleles for black coat (**B**) and ginger coat (**G**) are **co-dominant**. Some female cats have ginger and black patches of fur. They are described as tortoiseshell. Male cats are rarely tortoiseshell.

2.5a

Define the term **co-dominant**.

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2.5b

Identify the sentence from the passage that describes and supports an observable feature about coat colour inheritance showing co-dominance.

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2.6 Labradors are a breed of dogs. They can be black, golden or brown in colour. They are never white. These genes are on separate chromosomes. One gene determines the colour black which is dominant (allele **B**) or recessive brown allele (allele **b**) The other gene determines whether this colour will be expressed. If the dominant allele (**E**) is present at this locus, then the colour (black or brown) will be expressed. If the dominant allele is not present at this locus (genotype = **ee**) then these colours cannot be expressed and the dog will have a golden coat.



*Assessor's use only*

2.6a Identify this type of gene interaction.

\_\_\_\_\_

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2.6b When two Labradors are bred, it is possible to have all three colours (golden, black, brown) amongst the puppies. Discuss how two Labradors known to be heterozygous with black phenotypes could produce a litter of puppies with black, brown and golden variations in coat colour. In your answer you will need to:

- determine the genotypes of the parents;
- complete the Punnett square;
- analyse the results to show the theoretical phenotypic ratio.

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Extended Abstract	
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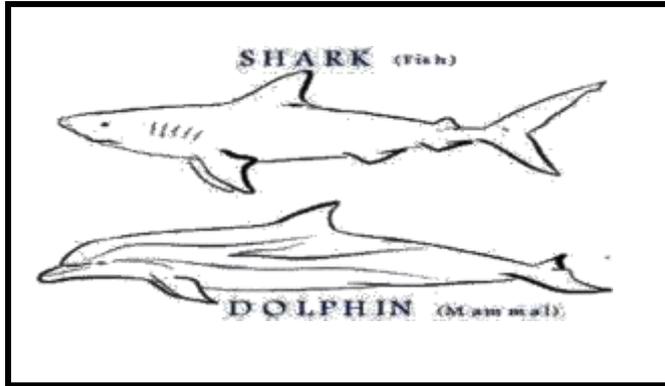


<p>3.3</p> <p>3.3a</p>	<p>PCR is a technique which allows many copies of DNA to be made from small samples and therefore provides enough material to be tested.</p> <p>What do the letters <b>PCR</b> stand for?</p> <hr/>	<table border="1"> <tr> <th colspan="2">Unistructural</th> </tr> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td></td> </tr> <tr> <td>NR</td> <td></td> </tr> </table>	Unistructural		1		0		NR			
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<p>3.3b</p>	<p>In this process, the DNA helix is separated into single strands. How is this achieved?</p> <hr/> <hr/> <hr/>	<table border="1"> <tr> <th colspan="2">Unistructural</th> </tr> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td></td> </tr> <tr> <td>NR</td> <td></td> </tr> </table>	Unistructural		1		0		NR			
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<p>3.4a</p>	<p>Define <b>DNA profiling</b>.</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1"> <tr> <th colspan="2">Unistructural</th> </tr> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td></td> </tr> <tr> <td>NR</td> <td></td> </tr> </table>	Unistructural		1		0		NR			
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<p>3.4b</p>	<p>A forensic scientist collected a sample of DNA from a crime scene. Describe the main techniques of how the scientist could produce a DNA profile from the collected sample.</p> <hr/>	<table border="1"> <tr> <th colspan="2">Multistructural</th> </tr> <tr> <td>2</td> <td></td> </tr> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td></td> </tr> <tr> <td>NR</td> <td></td> </tr> </table>	Multistructural		2		1		0		NR	
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**Strand 4. Processes and Patterns of Evolution**

*Assessor's use only*

4.1 The pictures below show two different animals; a shark and a dolphin. They display convergent evolution.



4.1a Define **convergent evolution**.

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4.1b Describe how convergent evolution has occurred with sharks and dolphins.

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