

MARKER CODE



Student Personal Identification Number

South Pacific Form Seven Certificate

BIOLOGY 2022

QUESTION and ANSWER BOOKLET

Time allowed: Three hours

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

INSTRUCTIONS

1. Write your **Student Personal Identification Number (SPIN)** in the space provided on the top right-hand corner of this page.
2. Answer **ALL QUESTIONS**. Write your answers in the spaces provided in this booklet.
3. 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>	
Strand 1: Animal Behaviour Demonstrate an 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.	3	2	1	0	10% 30min
Strand 2: Gene Expression Describe, explain and discuss biological concepts and processes relating to gene expression.	7	3	1	1	20% 60 min
Strand 3: Biotechnology Applications Describe, explain and discuss biotechnology applications and the human needs and demands for the applications.	0	1	1	0	5% 15 min
Strand 4: Processes and Patterns of Evolution Describe, explain and discuss processes and patterns of evolution.	9	2	1	1	20% 60 min
Strand 5: Environmental Issues Demonstrate an understanding of biological concepts and processes relating to contemporary environmental issues.	0	1	1	0	5% 15 min
TOTAL	19	9	5	2	60% 180 min

Check that this booklet contains pages 2–17 in the correct order and that none of these pages are blank.

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

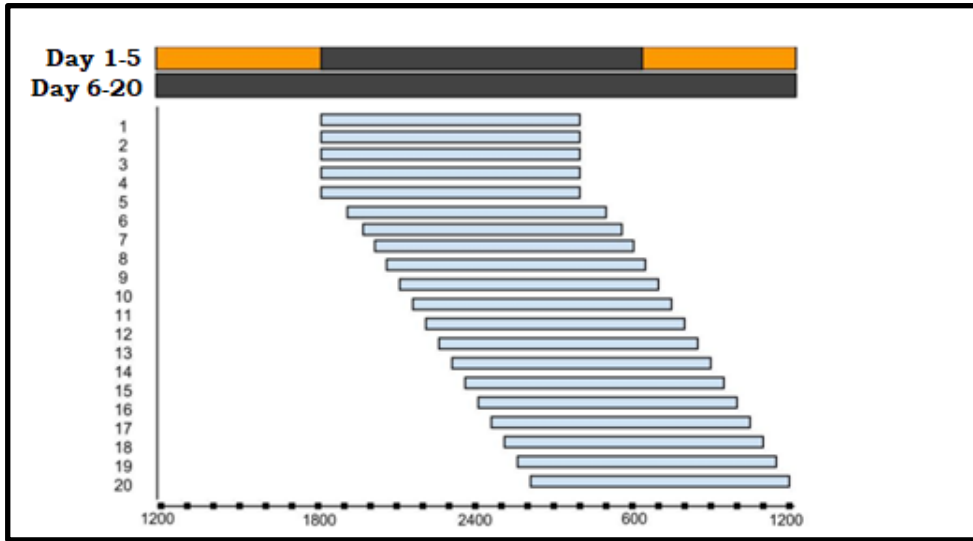
STRAND 1: ANIMAL BEHAVIOUR

Assessor's use only

<p>1.1a</p>	<p>The picture given below shows a pair of wood ducks.</p> <div style="text-align: center;">  </div> <p style="text-align: center;">Source: https://www.sciencedirect.com/</p> <p>It is believed the male remains in this monogamous mating relationship because his chances of future reproduction are better than if he leaves.</p> <p>Define monogamous mating.</p> <hr/> <hr/>	<table border="1" style="width: 100%;"> <tr> <th colspan="2">Unistructural</th> </tr> <tr> <td style="text-align: center;">1</td> <td style="width: 50px;"></td> </tr> <tr> <td style="text-align: center;">0</td> <td></td> </tr> <tr> <td style="text-align: center;">NR</td> <td></td> </tr> </table>	Unistructural		1		0		NR			
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<p>1.1b</p>	<p>Birds, like the wood ducks in question 1.1 above, are typical k-strategists.</p> <p>List two features of k-strategists.</p> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1" style="width: 100%;"> <tr> <th colspan="2">Multistructural</th> </tr> <tr> <td style="text-align: center;">2</td> <td style="width: 50px;"></td> </tr> <tr> <td style="text-align: center;">1</td> <td></td> </tr> <tr> <td style="text-align: center;">0</td> <td></td> </tr> <tr> <td style="text-align: center;">NR</td> <td></td> </tr> </table>	Multistructural		2		1		0		NR	
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<p>1.2</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p><i>Orthokinesis refers to the increased or decreased speed of movement of an organism in response to a stimulus. Woodlice, for example, change their speed of movement when exposed to high or low temperatures.</i></p> <p style="text-align: center;">Source: https://courses.lumenlearning.com/boundless-biology/</p> </div> <p>Describe the adaptive value of orthokinesis to the woodlice.</p> <hr/> <hr/> <hr/> <hr/>	<table border="1" style="width: 100%;"> <tr> <th colspan="2">Multistructural</th> </tr> <tr> <td style="text-align: center;">2</td> <td style="width: 50px;"></td> </tr> <tr> <td style="text-align: center;">1</td> <td></td> </tr> <tr> <td style="text-align: center;">0</td> <td></td> </tr> <tr> <td style="text-align: center;">NR</td> <td></td> </tr> </table>	Multistructural		2		1		0		NR	
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1.3a

The graph below shows the activity of a cockroach under laboratory conditions, initially given a cycle of 12 hours light and 12 hours darkness. Light was removed after Day 5, leaving the cockroach in complete darkness.



Source: <https://docs.google.com/presentation/>

What is the graph shown above called?

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1.3b

With reference to the graph in question 1.3a, explain the activity of the cockroach using the terms: **free running**, **shift phase** and **zeitgeber**.

Relational

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1.4	<p>Read the following information and answer the question that follows.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p><i>Fiji's Ministry of Environment, under its Fiji Ridge to Reef (R2R) project, is now working towards eradicating African Tulip (an invasive species) that is aggressively outgrowing native tree species and threatening traditional agriculture and biodiversity conservation in the Waidina and Labasa catchments, while rapidly increasing in the Ba and Tuva catchments.</i></p> <p>Source: https://pasifika.news/2022/03/african-tulip-a-major-threat-to-biodiversity-in-fiji/</p> </div> <p>Identify the type of relationship between species in the above context.</p> <hr/> <hr/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="background-color: #cccccc;">Unistructural</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="width: 50px;"></td> </tr> <tr> <td style="text-align: center;">0</td> <td></td> </tr> <tr> <td style="text-align: center;">NR</td> <td></td> </tr> </tbody> </table>	Unistructural		1		0		NR	
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STRAND 2: GENE EXPRESSION

Assessor's use only

<p>2.1a</p>	<p>In living organisms, the genome is found in the chromosomes. Define genome.</p> <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>2.1b</p>	<p>The diagram below shows a 'flat' section of the DNA molecule.</p> <div data-bbox="459 568 1059 842" data-label="Diagram"> </div> <p>Source: www.http://quizlet.com</p> <p>Describe the structure of DNA.</p> <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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<p>2.2a</p>	<p>Codons are found along the mRNA molecule. Define codon.</p> <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>2.2b</p>	<p>The mRNA molecule is formed from the DNA inside the nucleus. State the function of the mRNA molecule.</p> <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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2.3 The diagram below shows a section of the genetic code.

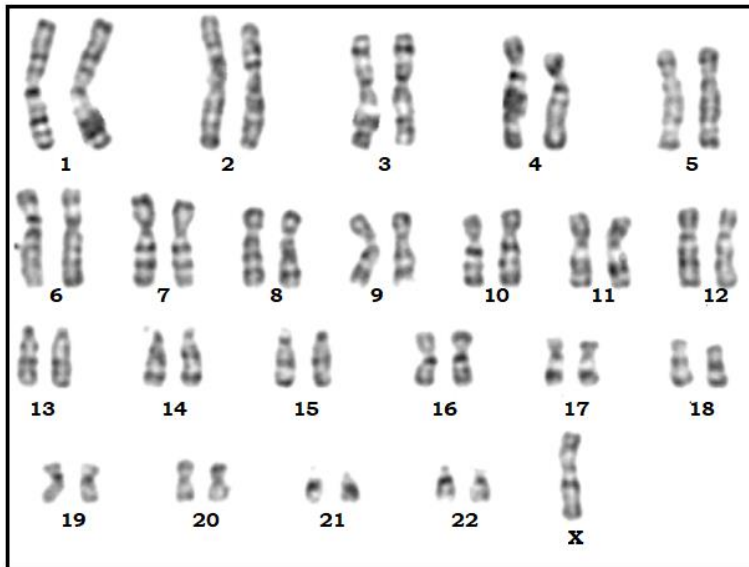
		U	C	A	G	
A	AUU	Ile	ACU	AAU	AGU	U
	AUC		ACC	AAC	AGC	
	AUA	Met	ACA	AAA	AGA	A
	AUG		ACG	AAG	AGG	Stop
G	GUU	Val	GCU	GAU	GGU	U
	GUC		GCC	GAC	GGC	
	GUA	Ala	GCA	GAA	GGA	A
	GUG		GCG	GAG	GGG	Stop

Adapted from: https://www.mun.ca/biology/scarr/MtDNA_code.html

Describe the use of the genetic code to identify a STOP codon.

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Use the diagram below that shows a karyotype of an individual to answer questions 2.4a and 2.4b.



Source: <https://www.researchgate.net/figure/>

2.4a Identify the condition that the individual with the above karyotype suffers from.

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2.4b With reference to the karyotype, describe one common **physical characteristic** of this individual.

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2.5 The Salmonidae fish and the cotton *Gossypium hirsutum* are tetraploids. Define the term **tetraploid**.

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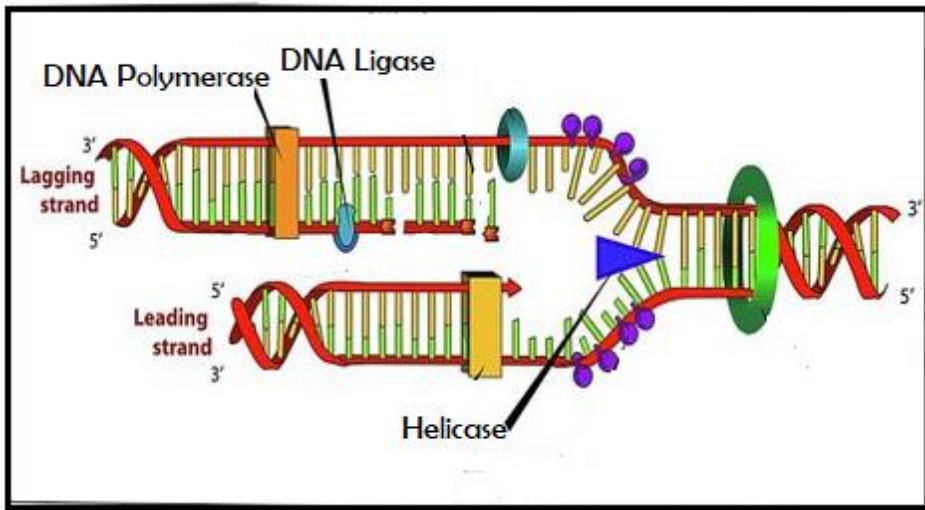
The diagram below shows a type of gene interaction called epistasis. Use the diagram to answer questions 2.6a and 2.6b.

Source: <https://courses.lumenlearning.com/>

2.6a Define the term **epistasis**.

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The diagram below shows the process of DNA replication, which is said to be **semi-conservative**. Use the diagram to answer questions 2.7a and 2.7b.



Source: <https://fineartamerica.com/featured/>

2.7a Define **semi-conservative replication**.

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2.7b Three enzymes are shown in the diagram above – **DNA polymerase, DNA ligase** and **helicase**. These enzymes play significant roles in the DNA replication process.

Explain the relationship between the roles of the three enzymes during the replication process.

Relational	
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STRAND 3: BIOTECHNOLOGY APPLICATIONS

Assessor's use only

3.1	<p>Scientists have long taken advantage of bacterial plasmids as tools for transferring, manipulating and making copies of genes.</p> <p>Source: https://www.nature.com/scitable/definition/plasmid-plasmids-28/</p> <p>List the first two steps of using bacterial plasmids to produce multiple copies of the desired gene.</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<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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3.2	<p>Explain one positive impact of the use of transgenesis on the gene pool for a population.</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1"><thead><tr><th colspan="2">Relational</th></tr></thead><tbody><tr><td>3</td><td></td></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></tbody></table>	Relational		3		2		1		0		NR	
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STRAND 4: PROCESSES AND PATTERNS OF EVOLUTION

Assessor's use only

<p>4.1</p>	<p>Define the phrase crossing over when applied to genetic materials.</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>4.2</p>	<p>There are basically two known types of cell division – meiosis and mitosis.</p> <p>State one feature of meiosis.</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>4.3a</p>	<p>Mutation is a cause of genetic variation.</p> <p>Describe how the process of mutation leads to the formation of new alleles.</p> <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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<p>4.3b</p>	<p>Most mutations are generally not harmful. Some, however, can be harmful and may cause significant disruptions in a population.</p> <p>Discuss the negative impact of mutation on a population, using a specific example.</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>											

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4.4a	<p>Charles Darwin first proposed the process of natural selection and to date remains the key element of his theory of evolution.</p> <p>Define natural selection.</p> <hr/> <hr/> <hr/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="text-align: center;">Unistructural</th> </tr> <tr><td style="text-align: center;">1</td><td></td></tr> <tr><td style="text-align: center;">0</td><td></td></tr> <tr><td style="text-align: center;">NR</td><td></td></tr> </table>	Unistructural		1		0		NR							
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4.4b	<p>Outline two key points of the theory of natural selection as proposed by Darwin.</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="text-align: center;">Multistructural</th> </tr> <tr><td style="text-align: center;">2</td><td></td></tr> <tr><td style="text-align: center;">1</td><td></td></tr> <tr><td style="text-align: center;">0</td><td></td></tr> <tr><td style="text-align: center;">NR</td><td></td></tr> </table>	Multistructural		2		1		0		NR					
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4.6 **Allele frequencies** are important measures of genetic variation within a population.

Define the phrase **allele frequency**.

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4.7 Study the diagram given below.

Source: <https://slideplayer.com/>

With reference to the above diagram, write a definition for **genetic drift**.

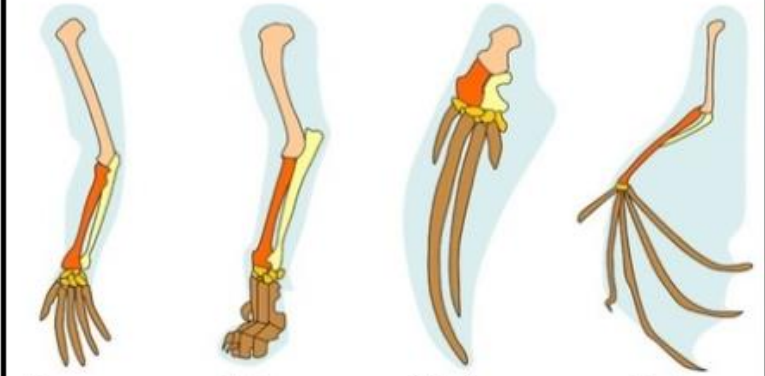
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4.8a *'The hybrid embryos of sheep and goats often fail to develop into mature individuals, dying in the early developmental stages before birth.'*

Source: <https://www.britannica.com/>

Identify the reproductive isolating mechanism described above.

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4.8b	<p>Define the phrase hybrid breakdown.</p> <hr/> <hr/> <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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4.9	<p>Study the diagram below showing pentadactyl limbs of several animals.</p> <div data-bbox="365 577 1139 1079" style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Homologous structures</p>  <p>Human Cat Whale Bat</p> </div> <p>Source: http://group4cladistics.weebly.com/</p> <p>State one feature of the above structures.</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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STRAND 5: ENVIRONMENTAL ISSUES

Assessor's use only

<p>5.1a</p>	<p>Climate change is a major environmental issue, much discussed in local and global platforms.</p> <p>List two features of climate change.</p> <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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<p>5.1b</p>	<p>The effects of climate change have caused devastation for many coastal communities.</p> <p>Some adaptations to help mitigate these devastations include building a sea wall, relocation, improving drainage systems, and building better protected wells.</p> <p>Explain why relocation would be the best adaptive strategy.</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>											

