

MARKER CODE

Pacific
Community
Communauté
du Pacifique

Student Personal Identification Number

South Pacific Form Seven Certificate

BIOLOGY

2019

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>	
Strand 1: Animal Behaviour Demonstrate an understanding of biological concepts and processes by 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
Strand 2: Gene Expression Describe, explain and discuss biological concepts and processes relating to gene expression.	8	2	3	1	25% 62 min
Strand 3: Biotechnology Applications Describe, explain and discuss biotechnology applications and the human needs and demands for the applications.	4	3	-	-	10% 21 min
Strand 4: Processes and Patterns of Evolution Describe, explain and discuss processes and patterns of evolution.	5	1	3	1	20% 52 min
TOTAL	19	9	7	3	70% 180 min

Check that this booklet contains pages 2–18 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*

1.1 1.1a	<p>The advantage for a coconut crab to occupy a very specific ecological niche is that it will encounter less inter-specific competition.</p> <p>Define the phrase ecological niche.</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			
Unistructural												
1												
0												
NR												
1.1b	<p>The diagram below shows a coconut crab on a coconut tree trunk.</p>  <p>Source: https://www.pickeringpost.com/</p> <p>Describe the ecological niche of a coconut crab.</p> <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	
Multistructural												
2												
1												
0												
NR												
1.2	<p>The behaviour that an organism develops as a result of experience is said to be learnt behaviour.</p> <p>Using an example, describe one feature of learnt behaviour.</p> <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	
Multistructural												
2												
1												
0												
NR												

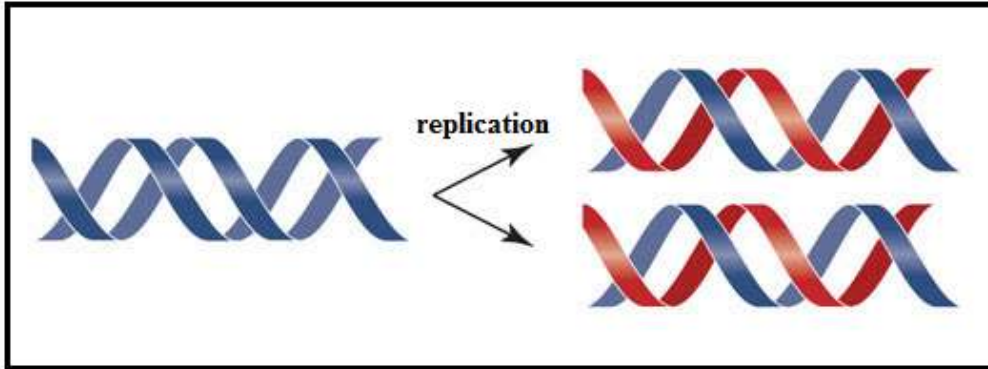
<p>1.3</p> <p>1.3a</p>	<p>Use the information below to answer questions 1.3a and 1.3b.</p> <p>A certain Species X has relatively stable populations and tends to produce relatively low numbers of offspring. Females have long gestation periods lasting several months and individual offspring tend to grow to quite a large size.</p> <p>Identify whether Species X is an example of <i>r</i>- or <i>k</i>-selected species.</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					
Unistructural														
1														
0														
NR														
<p>1.3b</p>	<p>Explain how the reproductive behaviour of Species X influences its survival.</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1"> <tr> <th colspan="2">Relational</th> </tr> <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> </table>	Relational		3		2		1		0		NR	
Relational														
3														
2														
1														
0														
NR														
<p>1.4</p>	<p>The graph below shows the relationship between prey and predator populations.</p> <div data-bbox="424 1149 1056 1597" data-label="Figure"> </div> <p>Source: https://www.researchgate.net/</p> <p>With reference to the graph, state two features of the prey and predator relationship.</p> <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			
Multistructural														
2														
1														
0														
NR														

STRAND 2: GENE EXPRESSION

Assessor's use only

2.1 Use the information given below to answer questions 2.1a–2.1c.

The diagram below demonstrates the **semi-conservative nature of DNA replication**.



Source: <https://articlesprove.info/>

2.1a Define the term **semi-conservative replication**.

Unistructural	
1	
0	
NR	

2.1b Describe the structure and replication of DNA in terms of Okazaki fragments, and leading and lagging strands.

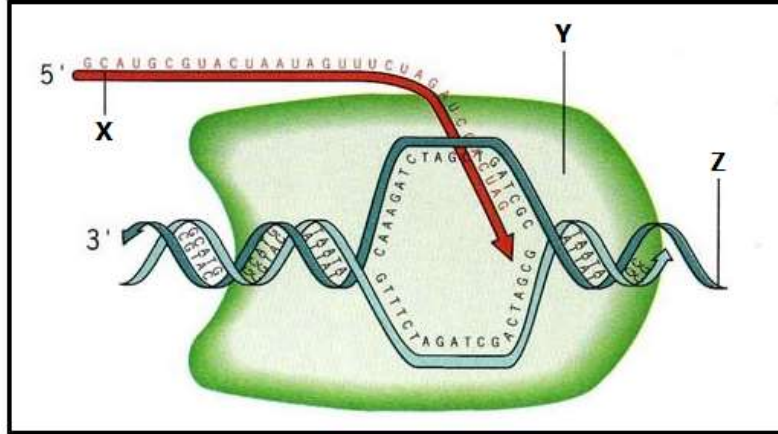
Multistructural	
2	
1	
0	
NR	

2.1c DNA replication is a highly accurate process, but mistakes can occasionally occur. Explain how DNA replication problems occur.

Relational	
3	
2	
1	
0	
NR	

2.2 Use the information given below and your own knowledge to answer the questions that follow.

The diagram below summarises one stage in the process of **protein synthesis**.



2.2a Define **protein synthesis**.

Unistructural

1

0

NR

2.2b Identify the letter that represents the mRNA strand in the diagram above.

Unistructural

1

0

NR

2.2c State **one** function of mRNA.

Unistructural

1

0

NR

2.3 The genetic code defines a mapping between tri-nucleotide sequences called codons and amino acids; every triplet of nucleotides in a nucleic acid sequence specifies a single amino acid.

		Second Base					
		A		G			
First Base	U	UAU	Tyr	UGU	Cys	Third Base	U
		UAC	Tyr	UGC	Cys		C
		UAA	STOP	UGA	STOP		A
		UAG	STOP	UGG	Trp		G
	C	CAU	His	CGU	Arg		U
		CAC	His	CGC	Arg		C
		CAA	Gln	CGA	Arg		A
		CAG	Gln	CGG	Arg		G

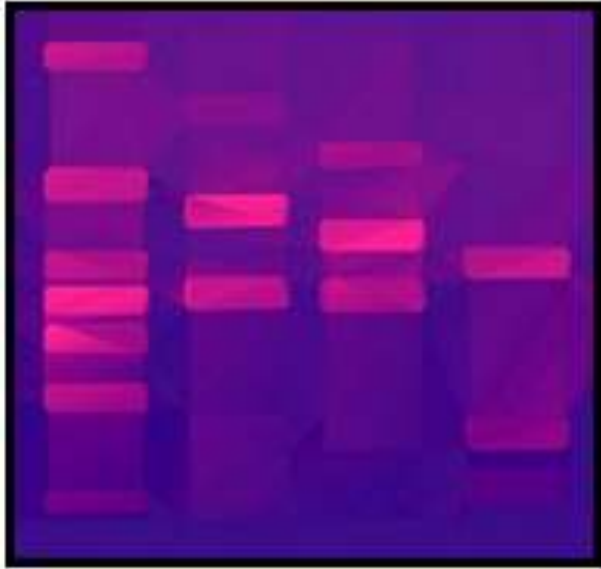
Source: <http://www.doe.mass.edu/>

	<p>Using an example from the diagram, describe the use of the genetic code (codon dictionary) to identify an amino acid of your choice.</p> <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			
Multistructural														
2														
1														
0														
NR														
<p>2.4</p> <p>2.4a</p>	<p>Mutations cause genetic variation and some have a positive effect on the affected organism.</p> <p>Define mutation.</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					
Unistructural														
1														
0														
NR														
<p>2.4b</p>	<p>Differentiate between chromosomal mutation and gene mutation.</p> <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	
Relational														
3														
2														
1														
0														
NR														
<p>2.5</p> <p>2.5a</p>	<p>Haemophilia, a sex-linked condition, is a mostly inherited genetic disorder that impairs the body's ability to make blood clots that are needed to stop bleeding.</p> <p>State one feature of sex-linked conditions like haemophilia.</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					
Unistructural														
1														
0														
NR														

STRAND 3: BIOTECHNOLOGY APPLICATIONS

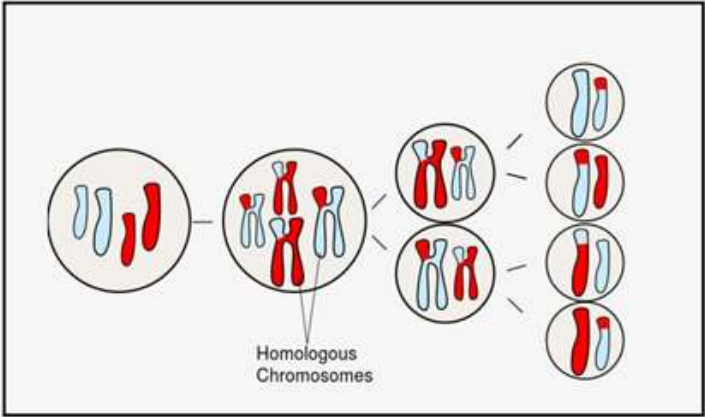
Assessor's use only

<p>3.1</p> <p>3.1a</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Biolistics has proven to be a versatile method of genetic modification assisted by the use of a gene gun. It is the generally preferred method used to engineer crops that are resistant to disease and pesticides, such as <i>Bt</i> maize.</p> </div> <p>Define the term gene gun.</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: 20px;"></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			
Unistructural												
1												
0												
NR												
<p>3.1b</p>	<p>One known genetically modified cereal is <i>Bt</i> maize, which is genetically engineered to express agriculturally desirable traits, including resistance to pests and herbicides.</p> <p>Describe how the gene gun method is used to accomplish transgenesis of <i>Bt</i> maize.</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="background-color: #cccccc;">Multistructural</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">2</td> <td style="width: 20px;"></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> </tbody> </table>	Multistructural		2		1		0		NR	
Multistructural												
2												
1												
0												
NR												
<p>3.2</p> <p>3.2a</p>	<p>Forensic scientists working in a crime scene used a technique called gel electrophoresis to separate DNA fragments. These fragments were then used to recreate DNA profiles.</p> <p>Define gel electrophoresis.</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: 20px;"></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			
Unistructural												
1												
0												
NR												
<p>3.2b</p>	<p>State one feature of gel electrophoresis.</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: 20px;"></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			
Unistructural												
1												
0												
NR												

<p>3.2c</p>	<p>Describe the formation of DNA profiles using the technique of gel electrophoresis.</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	
Multistructural												
2												
1												
0												
NR												
<p>3.2d</p>	<p>DNA profiling is a forensic technique in criminal investigations, which compares criminal suspects' profiles to DNA evidence so as to assess their involvement in a crime.</p> <p>The diagram below shows a typical DNA profile.</p> <div style="text-align: center;">  </div> <p style="text-align: center;">Source: https://dnatestingchoice.com/</p> <p>State one feature of DNA profiling.</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			
Unistructural												
1												
0												
NR												
<p>3.2e</p>	<p>The feature of DNA that makes it appropriate for identifying suspects and victims in investigations is its uniqueness.</p> <p>Describe the uniqueness 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	
Multistructural												
2												
1												
0												
NR												

STRAND 4: PROCESSES AND PATTERNS OF EVOLUTION

Assessor's use only

<p>4.1</p>	<p>The diagram below shows a cell division process.</p>  <p style="text-align: center;">Source : https://www.pngkit.com/</p>	<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					
Unistructural														
1														
0														
NR														
<p>4.1a</p>	<p>Identify the type of cell division process shown in the above diagram.</p> <hr/> <hr/>	<table border="1"> <tr> <th colspan="2">Relational</th> </tr> <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> </table>	Relational		3		2		1		0		NR	
Relational														
3														
2														
1														
0														
NR														
<p>4.1b</p>	<p>With reference to the diagram, explain how this type of division affects genetic variation.</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					
Unistructural														
1														
0														
NR														
<p>4.2</p>	<p>A form of dwarfism, the Ellis-van Creveld Syndrome, is common among members of the Amish Community. The reason given for its common occurrence among the Amish is the Founder Effect.</p>	<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			
Multistructural														
2														
1														
0														
NR														
<p>4.2a</p>	<p>Define the term Founder Effect.</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					
Unistructural														
1														
0														
NR														
<p>4.2b</p>	<p>Describe a feature of the Founder Effect as a special case of genetic drift.</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			
Multistructural														
2														
1														
0														
NR														


4.3a **Instant speciation** can occur within a single generation as a result of polyploidy. Animals are much less likely to tolerate changes in ploidy, thus it is more common in plants.

State a feature of **instant (polyploidy) speciation**.

Unistructural	
1	
0	
NR	

4.3b Speciation can also occur due to reproductive isolation. The mechanisms of reproductive isolation prevent members of different species from producing offspring. One such mechanism is **geographical isolation**.

The diagram below shows two species of owl, and the geographical locations of populations along the west coast of the United States.



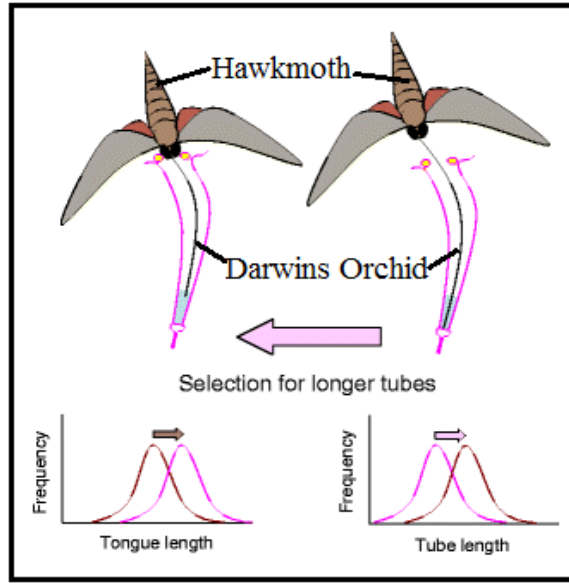
Source: <https://evolution.berkeley.edu/>

The two populations once belonged to the same species, but are now classed into different sub-species, and soon may become different species.

Explain why geographical isolation leads to reproductive isolation and speciation.

Relational	
3	
2	
1	
0	
NR	

4.4 The diagram below shows **co-evolution** between Darwin's Orchid (*Angraecum sesquipedale*) and its pollinator, the Hawkmoth.



Source: <https://link.springer.com/>

4.4a Define **co-evolution**.

Unistructural	
1	
0	
NR	

4.4b Species have also evolved in two other ways – through **divergent evolution** and **convergent evolution**.

Compare and contrast between these two types of evolution.

Relational	
3	
2	
1	
0	
NR	

4.5a Define **sexual selection**.

Unistructural	
1	
0	
NR	

