

**Advanced GCE**

**HUMAN BIOLOGY**

Unit F224: Energy, Reproduction and Populations

**Specimen Paper**

Candidates answer on the question paper.

Time: 1 hour 15 minutes

Additional Materials:

Ruler (cm/ mm)  
Scientific calculator

## F224 QP

Candidate Name

Centre Number

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Candidate Number

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### INSTRUCTIONS TO CANDIDATES

- Write your name, Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED.

### INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
-  Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use a scientific calculator.
- You are advised to show all the steps in any calculations.
- The total number of marks for this paper is **60**.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
<b>1</b>	<b>13</b>	
<b>2</b>	<b>13</b>	
<b>3</b>	<b>17</b>	
<b>4</b>	<b>8</b>	
<b>5</b>	<b>9</b>	
<b>TOTAL</b>	<b>60</b>	

This document consists of **11** printed pages and **1** blank page.

Answer **all** the questions.

1 The growing concern over the increase in obesity has made adequate exercise an important issue.

(a) Explain the term *aerobic exercise*.

.....

.....

.....

.....

.....

.....

[2]

(b) Fig 1.1 shows the effect of a short period of exercise on blood pressure.

With reference to Fig 1.1, describe the effects of exercise on the cardiovascular system which would result in the changes to blood pressure shown in Figure 1.1. .

.....

.....

.....

.....

.....

.....

[4]

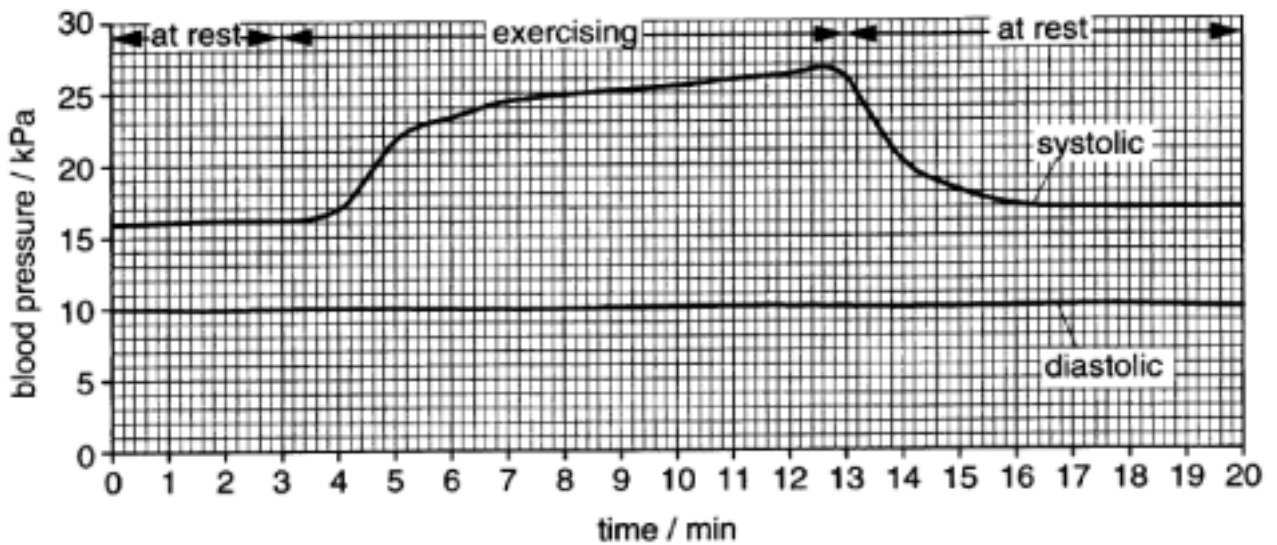
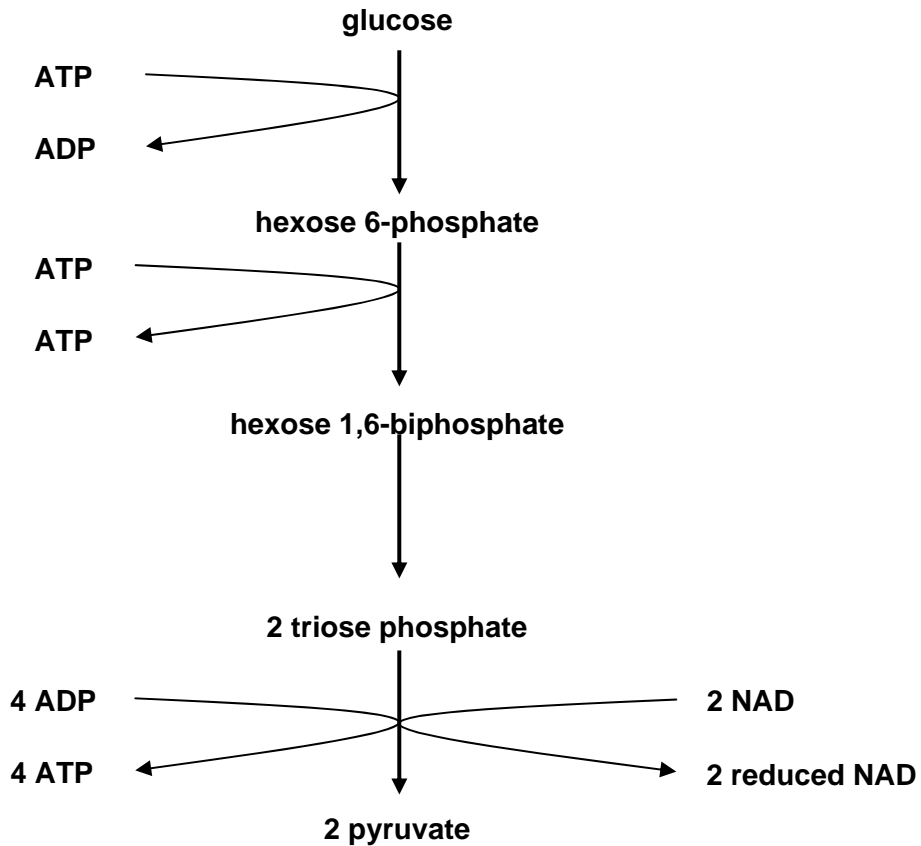


Fig 1.1

(c) Fig. 1.1 shows a metabolic pathway that occurs in muscle tissue.



**Fig. 1.1**

(i) Name the metabolic pathway shown in Fig. 1.1.

 *In your answer, you should use the appropriate technical term, spelled correctly.*

..... [1]

(ii) Calculate the theoretical net yield of ATP when one molecule of glucose is metabolised by this pathway.

..... [1]

(iii) Outline what happens to the pyruvate formed in this pathway in the absence of oxygen

..... [1]

(d) Fig. 1.2 is a photomicrograph of a sarcomere from a skeletal muscle fibre.

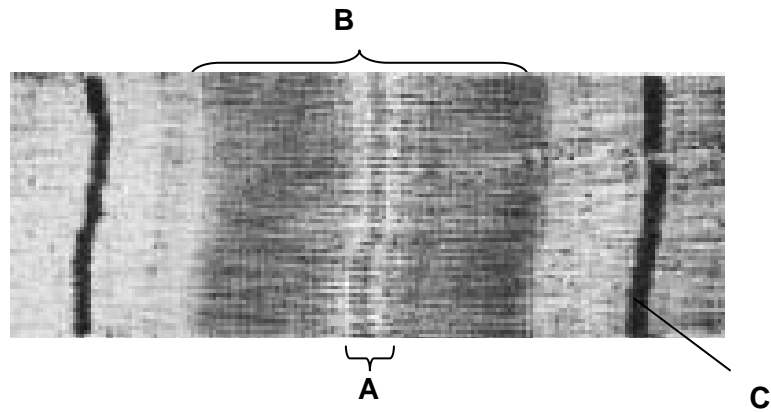


Fig. 1.2

(i) Name **A** to **C** in Fig. 1.2.

**A** .....

**B** .....

**C** ..... [3]

(ii) The sarcomere shown in Fig. 1.2 is in a relaxed state.

State **one** feature that gives evidence to support this.

..... [1]

[Total: 13]

2 Haemoglobin is a pigment which can combine with oxygen and is found in red blood cells.

Fig. 2.1 shows the oxygen dissociation curve for adult haemoglobin.

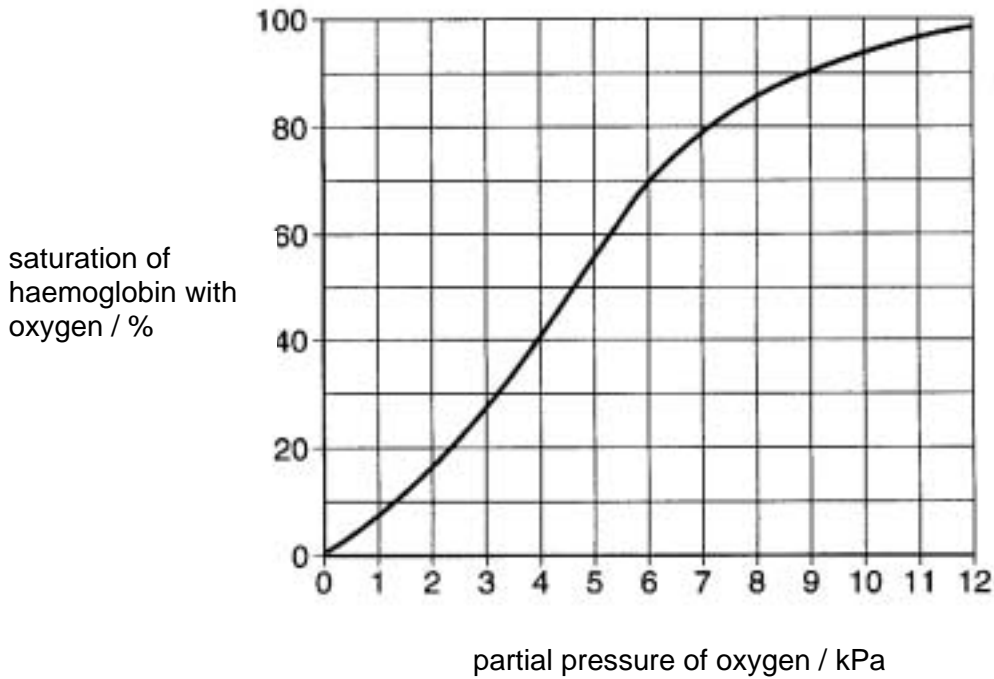


Fig 2.1

(a) Using Fig. 2.1, calculate the difference in % saturation of haemoglobin with oxygen between oxygen partial pressures of 11 k Pa and 2 k Pa.

..... [2]

(b) (i) On Fig. 2.1, sketch a curve to show the effect of an increase in carbon dioxide concentration on the dissociation of oxy-haemoglobin. [1]

(ii) Describe how an increase in carbon dioxide concentration causes this effect.

.....  
 .....  
 .....  
 .....  
 .....  
 ..... [3]

(iii) Comment on the significance of this effect in leg muscles during exercise.

.....  
 .....  
 .....  
 ..... [2]

[Turn Over

(c) Sickle cell anaemia is a disease caused by a gene mutation which affects the structure of haemoglobin.

(i) Describe how a gene mutation can cause a change in the structure of haemoglobin.

.....  
.....  
.....  
.....  
.....  
..... [3]

(ii) Describe how the changed haemoglobin can affect the role of the red blood cells.

.....  
.....  
.....  
..... [2]

[Total: 13]

3 The early detection of pregnancy is important so that routine antenatal tests may be conducted to monitor the health of the mother and the foetus.

As the zygote implants, human chorionic gonadotrophin (hCG) is secreted by the developing cells of the zygote.

(i) Describe how the secretion of hCG may be detected, **using monoclonal antibodies**, in a pregnancy test.

.....  
.....  
.....  
.....  
..... [5]

(ii) Suggest why monoclonal antibodies are particularly suited to detect the presence of HCG.

.....  
.....  
.....  
..... [2]

**(iii)** Describe the role of hCG in maintaining a pregnancy.

.....  
.....  
.....  
..... [2]

**(b)** Describe the role of prolactin

**(i)** during pregnancy;

.....  
.....  
.....  
..... [2]

**(ii)** following the birth of the baby.

.....  
.....  
.....  
..... [2]

**(c)** Prolactin also inhibits the release of FSH and LH.

Comment on the possible effects of prolactin on menstruation and fertility

.....  
.....  
.....  
.....  
.....  
..... [4]

**[Total: 17]**

**[Turn Over**

4 Fig. 4.1 shows some of the events during the first stage of protein synthesis.

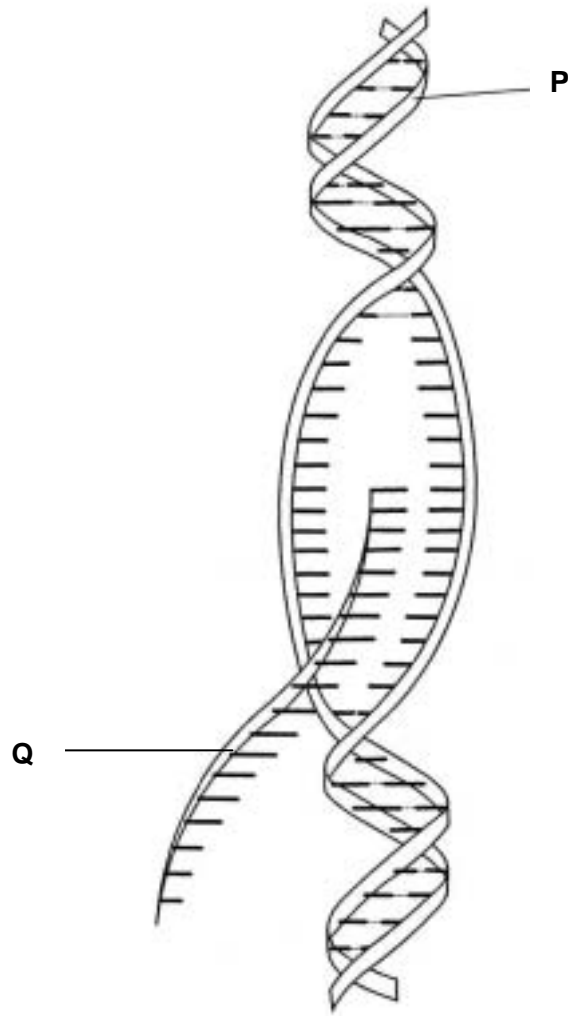


Fig. 4.1

(a) (i) Name the molecules labelled **P** and **Q** on Fig. 4.1.

**P** .....

**Q** ..... [2]

(ii) Name this stage of protein synthesis.

*In your answer, you should use the appropriate technical term, spelled correctly.*

..... [1]



**(b) (i)** Describe what is happening during this stage of protein synthesis.

.....  
.....  
.....  
.....  
.....  
.....  
..... [4]

**(ii)** Describe what happens next to the molecule labelled **Q**.

.....  
..... [1]

**[Total: 8]**

5 Human activity has a considerable impact on the environment.

(a) Explain the term *succession*.

.....  
.....  
.....  
..... [2]

(b) Fig. 5.1 shows a primary succession in a temperate climate.

X represents an example of deflected succession.

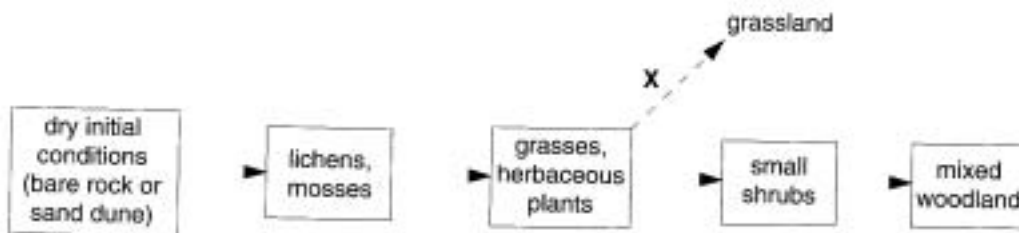


Fig. 5.1

Suggest how the deflected succession X could be caused.

.....  
.....  
.....  
..... [2]

(ii) Explain how biomass changes during primary succession.

.....  
..... [1]

(c) A farmer intends to change from keeping turkeys free-range, in fields, to keeping them inside large sheds.

Explain how this change will affect the sustainability of production.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
..... [4]

[Total: 9]

Paper Total [60]

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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Advanced GCE**

**HUMAN BIOLOGY**

**F224**

Unit F224: Energy, Reproduction and Populations

**Specimen Mark Scheme**

The maximum mark for this paper is **60**.

Question Number	Answer	Max Mark
1(a)	<p><i>(is exercise that)</i>  improves cardiovascular function ;  improves function of respiratory system ;  increases heart / breathing rate, for a minimum of 20 minutes ;  ref. to use of red muscle fibres ;  uses oxygen / aerobic respiration (of muscles) ;  80% of maximum heart rate ;  AVP ; eg named example</p>	[2 max]
(b)	<p>increase in systolic blood pressure ;  data quote from graph to support; 2x and 2 y values  (due to) increase cardiac output;  (due to ) increase in heart rate;  (due to) increase in stroke volume;  more complete emptying of ventricles ;</p> <p><u>(no change in diastolic pressure due to) elastic fibres in artery walls;synoptic mark</u>  <u>arterioles dilate / vasodilation, in muscle / skin ;</u>  <u>arterioles constrict / vasoconstriction, in gut ;</u>  <u>ref smooth muscle;</u></p> <p>ref. to adrenaline ;  AVP ;</p>	[4 max]
(c)(i)	<p>glycolysis / glycolytic pathway ;  <i>QWC correct spelling of glycolysis or glycolytic</i></p>	[1]
(ii)	2 ;	[1]
(iii)	<p>reduced to lactate;  acts as hydrogen acceptor;</p>	1 max
(d)(i)	<p><b>A</b> H zone / band ;  <b>B</b> A band / myosin ;  <b>C</b> Z line / disc ;</p>	[3]
(ii)	<p>H zone very narrow/narrower;  candidates to make a value statement – <b>R</b> narrow unqualified</p>	[1]
	<b>Total</b>	<b>[13]</b>

Question Number	Answer	Max Mark
<b>2(a)</b>	80% ;; 97 – 17 ; <i>correct answer = 2</i> <i>wrong answer, but correct working = 1 max</i>	<b>[2 max]</b>
<b>(b)(i)</b>	curve to right and lower ;	<b>[1]</b>
<b>(ii)</b>	increase in carbon dioxide levels cause increase in H <sup>+</sup> ; (due to) action of carbonic anhydrase ; H <sup>+</sup> binds to Hb ; Hb acts as a buffer ; HHb / haemoglobinic acid formed ; lowers affinity of Hb for oxygen / causes release of oxygen ; Bohr, effect / shift ;	<b>[3 max]</b>
<b>(iii)</b>	(respiring) muscles produce more carbon dioxide ; (because) rate of respiration increases during exercise / demand for oxygen increases ; more oxygen is released ; because of higher partial pressure of carbon dioxide ; Bohr, effect / shift ;	<i>if not awarded in (ii)</i> <b>[2 max]</b>
<b>(c)(i)</b>	substitution ; changed sequence of three bases / triplets / codons/ primary structure ; different amino acid / valine ; hydrophobic (R group) ; causes polypeptide chain to fold up differently ; ref tertiary structure changes	<b>[3 max]</b>
<b>(ii)</b>	sickle – shaped / distorted shape ; Hb less soluble at low ppO <sub>2</sub> of oxygen / forms long chains / polymers ; decreased surface area ; less oxygen carried ; cells less flexible ; block blood capillaries ;	<b>[2 max]</b>
	<b>Total</b>	<b>[13]</b>

Question Number	Answer	Max Mark
<p><b>(3)(a)(i)</b></p> <p><b>(ii)</b></p> <p><b>(iii)</b></p> <p><b>(b)(i)</b></p> <p><b>(ii)</b></p> <p><b>(c)</b></p>	<p>urine sample added to test kit ; if present hCG present , attaches to monoclonal antibodies ; <i>Look for link</i></p> <p>monoclonal antibodies with attached hCG carried up test ; to bind with line of immobile antibodies ; coloured line produced ; any uncombined monoclonal antibodies continue to move ; attach to second line of immobilised antibodies ; to form second coloured line to show the test is working ; AVP ;eg detail of how coloured line is produced <i>Look for labelled diagrams illustrating the above.</i></p> <p>specific / only bind to hCG molecules ; can detect very small amounts of hCG ;</p> <p>maintains corpus luteum ; maintains progesterone production ;</p> <p><i>mark (i) and (ii) together</i></p> <p>stimulates growth of, mammary glands / breasts ; ref. to glandular / alveolar cells ; inhibited by, oestrogen / progesterone</p> <p>increased by suckling ; (which) controls milk production / lactation ; increases as oestrogen / progesterone levels fall ; AVP ; eg promotes bonding</p> <p>(prolactin) follicle not stimulated; oestrogen levels do not rise; (resulting in) absence / delay of menstruation; (as) endometrium does not proliferate/ AW; less chance of ovulating; R NO OVULATION lower fertility ;</p> <p>AVP ;</p>	<p><b>[5 max]</b></p> <p><b>[2]</b></p> <p><b>[2]</b></p> <p><b>[2]</b></p> <p><b>[2]</b></p> <p><b>[2]</b></p> <p><b>4 max</b></p>
	<b>Total</b>	<b>[17]</b>



Question Number	Answer	Max Mark
<p><b>4(a)(i)</b></p> <p><b>P</b> DNA ; <b>Q</b> mRNA ;</p> <p><b>(ii)</b> transcription ;</p> <p><b>(b)(i)</b> DNA unzipping / breaking of H bonds / action of helicase ; DNA sense strand acts as a template ; RNA nucleotides move to template ; complementary base-pairing / described ; RNA polymerase action ; polynucleotide formed ; condensation reaction / described ;</p> <p><b>(ii)</b> moves out of nucleus into cytoplasm ; associate with ribosomes ;</p>		<p>[2]</p> <p>[1]</p> <p>[4 max]</p> <p>[1]</p>
<p><b>5(a)</b></p>	<p>starts with uncolonised area ; ref, pioneer species ; series of recognizable stages or seres ; progresses to final equilibrium stage / climax ;</p>	<p>[2 max]</p>
<p><b>(b)(i)</b></p>	<p>grazing ; burning ; mowing ; exposure to wind ; deforestation ; resulting in grass able to continue to row ;</p>	<p>[2 max]</p>
<p><b>(ii)</b></p>	<p>increases ;</p>	<p>[1]</p>
<p><b>(c)</b></p>	<p>change from extensive farming to intensive farming; non-renewable ; resources used to construct housing ; removal of waste ; high energy demand ; not recycled / fields not fertilised ; environmental control within sheds ; increased use of processed foods ; AVP ;</p>	<p>[4 max]</p>
	<b>Total</b>	<p>[9]</p>
	<b>Paper Total</b>	<p>[60]</p>

**Assessment Objectives Grid (includes QWC)**

<b>Question</b>	<b>AO1</b>	<b>AO2</b>	<b>AO3</b>	<b>Total</b>
<b>1(a)</b>	1	1		2
<b>1(b)</b>	2	2		4
<b>1(c)(i)</b>	1			2
<b>1(c)(ii)</b>		1		1
<b>1(c)(iii)</b>	1			1
<b>1(d)(i)</b>		3		3
<b>1(d)(ii)</b>		1		1
<b>2(a)</b>			2	2
<b>2(b)(i)</b>			1	1
<b>2(b)(ii)</b>	3			3
<b>2(b)(iii)</b>		2		2
<b>2(c)(i)</b>	3			3
<b>2(c)(ii)</b>	2			2
<b>3(a)(i)</b>	5			5
<b>3(a)(ii)</b>		2		2
<b>3(a)(iii)</b>	2			2
<b>3(b)(i)</b>	2			2
<b>3(b)(ii)</b>	2			2
<b>3(c)</b>		4		4
<b>4(a)(i)</b>		2		2
<b>4(a)(ii)</b>	1			1
<b>4(b)(i)</b>	2	2		4
<b>4(b)(ii)</b>		1		1
<b>5(a)</b>	2			2
<b>5(b)(i)</b>		2		2
<b>5(b)(ii)</b>		1		1
<b>5(c)</b>		4		4
<b>Totals</b>	<b>29</b>	<b>28</b>	<b>3</b>	<b>60</b>