



Trial Examination 2023

## **HSC Year 12 Biology**

**Solutions and Marking Guidelines**



Answer and explanation	Syllabus content, outcomes and targeted performance bands
<p><b>Question 6</b>      <b>A</b></p> <p><b>A</b> is correct. The genotype of the homozygous round pea is RR and the genotype of the homozygous wrinkled pea is rr. Therefore, the offspring (<math>F_1</math> generation) are all heterozygous (Rr) round peas.</p> <p><b>B, C and D</b> are incorrect. These options do not represent the cross between the two peas.</p>	<p>Mod 5 Genetic Variation BIO12–6, 12–12      Bands 4–5</p>
<p><b>Question 7</b>      <b>D</b></p> <p><b>D</b> is correct. Recombinant DNA technology involves the exchange of genetic material between different organisms.</p> <p><b>A</b> is incorrect. Transplanting usually refers to the exchange of organs, not genetic material, between organisms.</p> <p><b>B</b> is incorrect. Mutation refers to a sudden change in genetic material.</p> <p><b>C</b> is incorrect. Conservation management refers to sustaining the existence of specific species or sustaining biodiversity in general.</p>	<p>Mod 6 Genetic Technologies BIO12–13      Bands 3–4</p>
<p><b>Question 8</b>      <b>D</b></p> <p><b>D</b> is correct. Mutations in coding DNA often result in phenotypic changes because it codes for proteins; non-coding DNA does not directly code for proteins.</p> <p><b>A</b> is incorrect. Coding DNA makes up approximately 1.55% of human DNA and non-coding DNA makes up approximately 98.5% of human DNA.</p> <p><b>B</b> is incorrect. Coding DNA does code for proteins, but non-coding DNA is not important to the structure, function and regulation of a cell.</p> <p><b>C</b> is incorrect. Mutations in coding DNA do not change the sequences of amino acids; while mutations can be inherited from a parent, not all mutations in non-coding DNA occur in this method.</p>	<p>Mod 6 Mutation BIO12–12      Bands 5–6</p>
<p><b>Question 9</b>      <b>C</b></p> <p><b>C</b> is correct. Bulls with good genetics are very expensive, so artificial insemination is a cost-effective alternative for farmers to access the desired genetics.</p> <p><b>A</b> is incorrect. Artificial insemination is a complex process that requires specialised skills to complete.</p> <p><b>B</b> is incorrect. The success rate of artificial insemination is 65% or less.</p> <p><b>D</b> is incorrect. The optimal time to carry out artificial insemination is 6–24 hours after a cow's standing heat (the estrous cycle) has been observed and before ovulation.</p>	<p>Mod 6 Genetic Technologies BIO12–13      Bands 2–3</p>



Answer and explanation	Syllabus content, outcomes and targeted performance bands
<p><b>Question 15</b>      <b>D</b></p> <p><b>D</b> is correct. In the fully vaccinated group, 0.1 individuals died. In the not fully vaccinated group, 1.1 individuals died, which is approximately 10 times higher than the death rate for the fully vaccinated group.</p> <p><b>A</b> and <b>C</b> are incorrect. There is no information provided about the specific number of individuals participating in the study as the data is presented as a proportion of 100 000 individuals in the population.</p> <p><b>B</b> is incorrect. 0.1 individuals in the fully vaccinated group died.</p>	<p>Mod 7 Prevention, Treatment and Control BIO12–5, 12–14                      Bands 4–5</p>
<p><b>Question 16</b>      <b>A</b></p> <p><b>A</b> is correct. The opening and closing of stomates can alter the rate of transpiration; that is, they control the loss of water, which contributes to maintaining water balance.</p> <p><b>B</b> is incorrect. Hormonal control is not relevant to water balance in plants.</p> <p><b>C</b> is incorrect. Perspiration does not take place in plants.</p> <p><b>D</b> is incorrect. Photosynthesis uses water but does not directly maintain water balance.</p>	<p>Mod 8 Homeostasis BIO12–15                              Bands 2–3</p>
<p><b>Question 17</b>      <b>B</b></p> <p><b>B</b> is correct. Of the diseases shown in the table, coronary heart disease has the greatest number of deaths overall (17 700).</p> <p><b>A</b> is incorrect. The data is likely to be more accurate if it was collected from a wide range of sources.</p> <p><b>C</b> is incorrect. Even though the data is a few years old, it is still useful when making predictions about future health concerns in a population.</p> <p><b>D</b> is incorrect. The mortality rates of men and women are compared because the conclusions that are reached with one group might not be representative of the results and experiences of the other group.</p>	<p>Mod 8 Causes and Effects BIO12–5, 12–12, 12–15              Bands 3–4</p>
<p><b>Question 18</b>      <b>C</b></p> <p><b>C</b> is correct. Epidemiology determines the causes of and who is affected by disease.</p> <p><b>A</b> is incorrect. Epidemiology is not concerned with developing cures for diseases.</p> <p><b>B</b> is incorrect. Epidemiology investigates both infectious and non-infectious disease.</p> <p><b>D</b> is incorrect. Statistics are a significant aspect of epidemiology.</p>	<p>Mod 8 Epidemiology BIO12–14, 12–15                      Bands 2–3</p>

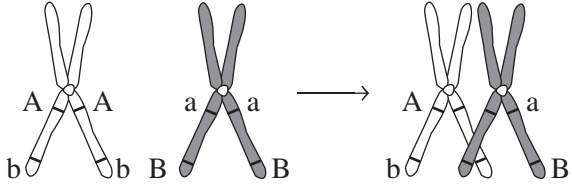
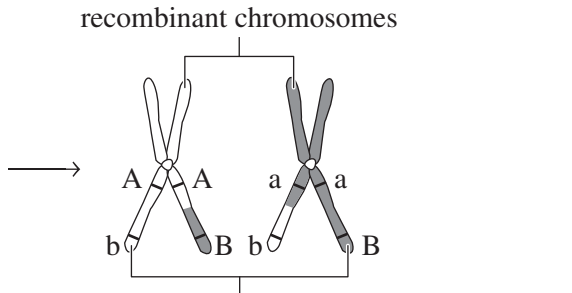
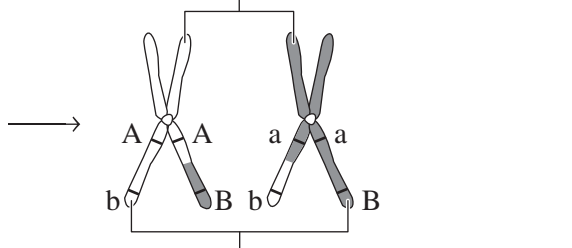
Answer and explanation	Syllabus content, outcomes and targeted performance bands
<p><b>Question 19</b>      <b>C</b></p> <p><b>C</b> is correct. The values for radon concentration and relative risk rise together on the graph, which indicates that they are correlated.</p> <p><b>A</b> is incorrect. The graph indicates that even if no radon is present in an individual's surroundings, they are still at some risk of developing lung cancer.</p> <p><b>B</b> is incorrect. The graph gives no information about lung cancer in smokers.</p> <p><b>D</b> is incorrect. The graph gives no information about changes in radon concentration over time.</p>	<p>Mod 8 Causes and Effects BIO12–6, 12–15                      Bands 4–5</p>
<p><b>Question 20</b>      <b>B</b></p> <p>The data is non-continuous (discrete) and thus should be represented in the appropriate non-continuous form; that is, a bar or column graph or a pie chart. There are six data groups that must be represented, which are the vineyards that show signs of each of the five listed pathogens and the vineyards that show no sign of pathogens. Graph <b>B</b> is the only graph that represents all six data groups from the study in a non-continuous form.</p>	<p>Mod 7 Responses to Pathogens BIO12–5                                      Bands 5–6</p>

**SECTION II**

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide				
<b>Question 21</b>					
(a)					
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; padding: 5px;"><i>Similarities</i></th> <th style="text-align: center; padding: 5px;"><i>Differences</i></th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;"> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>• DNA and RNA are both large biological polymers.</li> <li>• DNA and RNA both consist of sugar, nitrogenous bases, and a phosphate backbone.</li> <li>• DNA and RNA are both helical.</li> <li>• DNA and RNA are both molecules where guanine and cytosine pair with each other (are complementary).</li> </ul> </td> <td style="padding: 5px;"> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>• DNA uses the bases adenine, thymine, guanine and cytosine, whereas RNA uses the bases adenine, uracil, guanine and cytosine.</li> <li>• DNA has the sugar deoxyribose, whereas RNA has the sugar ribose.</li> </ul> </td> </tr> </tbody> </table>	<i>Similarities</i>	<i>Differences</i>	<p><i>For example:</i></p> <ul style="list-style-type: none"> <li>• DNA and RNA are both large biological polymers.</li> <li>• DNA and RNA both consist of sugar, nitrogenous bases, and a phosphate backbone.</li> <li>• DNA and RNA are both helical.</li> <li>• DNA and RNA are both molecules where guanine and cytosine pair with each other (are complementary).</li> </ul>	<p><i>For example:</i></p> <ul style="list-style-type: none"> <li>• DNA uses the bases adenine, thymine, guanine and cytosine, whereas RNA uses the bases adenine, uracil, guanine and cytosine.</li> <li>• DNA has the sugar deoxyribose, whereas RNA has the sugar ribose.</li> </ul>	<p>Mod 5 DNA and Polypeptide Synthesis BIO12–12 Bands 3–4</p> <ul style="list-style-type: none"> <li>• Draws an appropriate table.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides at least TWO similarities between the structure of RNA and DNA.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides at least TWO differences between the structure of RNA and DNA . . . . . 4</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Draws an appropriate table.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides at least TWO similarities between the structure of RNA and DNA.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides ONE difference between the structure of RNA and DNA.</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>• Draws an appropriate table.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides ONE similarity between the structure of RNA and DNA.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides at least TWO differences between the structure of RNA and DNA . . . . . 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Draws an appropriate table.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides ONE similarity between the structure of RNA and DNA.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides ONE difference between the structure of RNA and DNA . . . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Provides some relevant information . . . . . 1</li> </ul>
<i>Similarities</i>	<i>Differences</i>				
<p><i>For example:</i></p> <ul style="list-style-type: none"> <li>• DNA and RNA are both large biological polymers.</li> <li>• DNA and RNA both consist of sugar, nitrogenous bases, and a phosphate backbone.</li> <li>• DNA and RNA are both helical.</li> <li>• DNA and RNA are both molecules where guanine and cytosine pair with each other (are complementary).</li> </ul>	<p><i>For example:</i></p> <ul style="list-style-type: none"> <li>• DNA uses the bases adenine, thymine, guanine and cytosine, whereas RNA uses the bases adenine, uracil, guanine and cytosine.</li> <li>• DNA has the sugar deoxyribose, whereas RNA has the sugar ribose.</li> </ul>				

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
<p>(b) <i>Any one of:</i></p> <ul style="list-style-type: none"> <li>• mRNA is used as a template to make proteins.</li> <li>• mRNA transcribes the genetic code from DNA into a form that can be read and used to make proteins.</li> <li>• mRNA carries genetic information from the nucleus to the cytoplasm of a cell.</li> </ul>	<p>Mod 5 DNA and Polypeptide Synthesis BIO12–12 Bands 2–3</p> <ul style="list-style-type: none"> <li>• Identifies ONE role of mRNA. . . . . 1</li> </ul>
<p>(c) <i>Any one of:</i></p> <ul style="list-style-type: none"> <li>• tRNA matches amino acids with the relevant mRNA to help make proteins.</li> <li>• tRNA transfers amino acids to the ribosome that corresponds to each three-nucleotide codon of rRNA.</li> </ul>	<p>Mod 5 DNA and Polypeptide Synthesis BIO12–12 Bands 2–3</p> <ul style="list-style-type: none"> <li>• Identifies ONE role of tRNA. . . . . 1</li> </ul>
<b>Question 22</b>	
<p>(a) chromosomes</p>	<p>Mod 5 Genetic Variation BIO12–12, 12–13 Bands 1–2</p> <ul style="list-style-type: none"> <li>• Names the structures . . . . . 1</li> </ul>



Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
<p>(b) During stage 1, homologous chromosomes line up. These chromosomes contain the same genes in the same order along their chromosomal arms (one from each parent), line up.</p> <p>During stage 2, the chromosomes cross over. This is when the exchange of DNA between paired homologous chromosomes occurs.</p> <p>During stage 3, new combinations of alleles are formed in the gametes (ovum or sperm).</p> <div style="text-align: center;"> <p>alignment of chromosomes</p>  <p>crossover of chromosomes</p>  <p>recombinant chromosomes</p>  <p>non-recombinant chromosomes</p> </div> <p><i>Note: Responses may also refer to sister and non-sister chromatids. Responses do not require a diagram to obtain full marks.</i></p>	<p>Mod 5 Genetic Variation BIO12–12, 12–13 Bands 4–5</p> <ul style="list-style-type: none"> <li>• Outlines what occurs in all THREE stages ..... 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Outlines what occurs in TWO stages ..... 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Provides some relevant information ..... 1</li> </ul>
<p>(c) Meiosis increases genetic variation in the offspring produced.</p>	<p>Mod 5 Genetic Variation BIO12–13 Bands 1–2</p> <ul style="list-style-type: none"> <li>• Identifies the effect of meiosis on genetic variation in offspring ..... 1</li> </ul>
<b>Question 23</b>	
<p>(a) Autosomal refers to a gene that is located on a numbered chromosome, not a sex chromosome. Hence, males and females are affected in the same ratio.</p> <p>Recessive refers to an allele (a variety of genetic code) that does not create the corresponding phenotype (physical characteristic) if a dominant allele is present.</p>	<p>Mod 5 Genetic Variation Mod 5 Inheritance Patterns in a Population BIO12–12, 12–13 Bands 3–4</p> <ul style="list-style-type: none"> <li>• Outlines the meaning of autosomal AND recessive ..... 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Outline the meaning of autosomal OR recessive. .... 1</li> </ul>

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
<p>(b) <i>Any two of the following individuals:</i></p> <ul style="list-style-type: none"> <li>• row I, individual 1</li> <li>• row I, individual 2</li> <li>• row II, individual 3</li> <li>• row II, individual 4</li> </ul> <p>Using C to represent the dominant gene and c to represent the recessive gene, heterozygous individuals (Cc) have an unaffected phenotype and may show no symptoms despite being carriers of the affected gene. They may produce heterozygous offspring (Cc), unaffected homozygous offspring (CC) or affected homozygous offspring (cc).</p> <p>Affected homozygous individuals (cc) will only produce affected homozygous children (cc). Unaffected homozygous parents (CC) will only produce unaffected homozygous offspring (CC).</p> <p>If unaffected individuals have not had children with a known phenotype, their unaffected genotype cannot be ascertained from this data.</p> <p>Therefore, only individuals 1 and 2 from row I and individuals 3 and 4 from row II can be heterozygous for the genotype responsible for cystic fibrosis.</p>	<p>Mod 5 Genetic Variation BIO12–6, 12–12                      Bands 5–6</p> <ul style="list-style-type: none"> <li>• Identifies TWO individuals that are heterozygous for the cystic fibrosis genotype.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides a detailed explanation that refers to inheritance patterns . . . . . 5–6</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Identifies TWO individuals that are heterozygous for the cystic fibrosis genotype.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides an explanation that refers to inheritance patterns . . . . . 4</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Identifies TWO individuals that are heterozygous for the cystic fibrosis genotype.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides an explanation. . . . . 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Identifies ONE individual that is heterozygous for the cystic fibrosis genotype.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides an explanation. . . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Provides some relevant information . . . . . 1</li> </ul>
<p>(c) Antibiotics are used to kill the bacteria that causes damage to the lungs of individuals with cystic fibrosis.</p>	<p>Mod 7 Prevention, Treatment and Control BIO12–14                      Bands 1–2</p> <ul style="list-style-type: none"> <li>• Provides the correct reason . . . . . 1</li> </ul>
<b>Question 24</b>	
<p>(a) <i>Any two of:</i></p> <ul style="list-style-type: none"> <li>• electromagnetic radiation (UV, X-rays, extreme heat)</li> <li>• chemicals (tobacco products, nitrosamines)</li> <li>• naturally occurring mutagens (some viruses, bacteria and fungi)</li> </ul> <p><i>Note: Response does not require examples to obtain full marks.</i></p>	<p>Mod 6 Mutation BIO12–13                      Bands 1–2</p> <ul style="list-style-type: none"> <li>• Identifies TWO mutagens . . . . . 1</li> </ul>

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
<p>(b) The type of mutation shown in the diagram is a point mutation.</p> <p>A point mutation changes a single nucleotide base and therefore shows up at a single point in a DNA sequence.</p>	<p>Mod 6 Mutation BIO12–13 Bands 4–5</p> <ul style="list-style-type: none"> <li>Identifies the type of mutation.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Provides an explanation. . . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Identifies the type of mutation.</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>Provides some relevant information . . . . . 1</li> </ul>
<p>(c) Mutation 1 will alter all subsequent amino acids because it inserts a nucleotide at a specific point in the DNA or RNA sequence. This puts all subsequent nucleotide sequences out of their previous order. Hence, different codons and, consequently, different amino acids will form.</p>	<p>Mod 6 Mutation BIO12-6, 12-13 Bands 3–4</p> <ul style="list-style-type: none"> <li>Explains why mutation 1 will alter all subsequent amino acids . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Provides some relevant information . . . . . 1</li> </ul>

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
<p><b>Question 25</b></p> <p><i>For example:</i></p> <p>Natural and artificial pollination are processes where the male sex cells in plants (pollen) are taken to the female sex cells (ova) to fertilise them. The resulting zygote grows into a seed that, under the correct conditions, can then develop into a new plant.</p> <p>Natural pollination occurs when either wind or insects carry pollen from one plant to another. These are random processes and can produce offspring with a wide variety of genotypes and phenotypes. This may result in crops having undesirable characteristics, as there is a higher chance of crops being pollinated by plants outside of the farm.</p> <p>Artificial pollination involves intervention by humans. Research is being conducted to automate the process, but most of the work is carried out by hand. Farmers collect pollen from a flower using a paintbrush or cotton swab and take it to another plant. This is labour intensive, but it allows greater control over the genes of the subsequent seeds.</p> <p>Artificial pollination is carried out on a much smaller scale than natural pollination, but it allows farmers to maintain the genetic line of the plant and thus produce crops with desired characteristics.</p>	<p>Mod 6 Genetic Technologies BIO12–12, 12–13 Bands 5–6</p> <ul style="list-style-type: none"> <li>• Compares the processes and effects of natural and artificial pollination.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Describes the process of natural pollination.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Describes the process of artificial pollination.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Describes the effects of natural pollination.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Describes the effects of artificial pollination . . . . . 5</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Any FOUR of the above points . . . . 4</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Any THREE of the above points . . . 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Any TWO of the above points. . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Provides some relevant information . . . . . 1</li> </ul>

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
<p><b>Question 26</b></p> <p><i>For example:</i></p> <p>Biotechnology refers to the use of living organisms for industrial purposes or the development of processes and products used in society. Biotechnology is not new; humans have manipulated the biological processes of microorganisms to produce food, such as bread and cheese, for over 6000 years. In recent years, however, biotechnology has advanced significantly. Modern biotechnology can cause changes at the cellular level; for example, recombinant DNA technology can produce transgenic organisms and genetically modified organisms (GMOs).</p> <p>Social implications are the effects that biotechnology can have on people. A social benefit is that GMOs can result in increased food and fibre production and more consistent and predictable crop yields. This increases profits for farmers, and feeds and clothes larger populations more affordably. Another social benefit is the creation of genetically modified varieties of rice that contain high levels of vitamin A, which helps to reduce global vitamin deficiencies.</p> <p>Ethical uses of biotechnology are those that are moral and match the values of society. Many GMOs, such as genetically modified crop plants, are used in agriculture. For example, canola, soybean, corn and sugar beet crops, among others, have been modified to be resistant to glyphosate, a very efficient herbicide, by having a glyphosate-resistant gene inserted into their DNA.</p> <p>An example of a transgenic organism is Bt cotton, which has had a gene that codes for <i>Bacillus thuringiensis</i> added to its DNA. This gene enables the plant to produce its own pesticide so that caterpillars die when they eat parts of the plant.</p> <p>Biotechnology also has social and ethical limitations. Recombinant DNA technology has proved to be controversial. Many people distrust GMOs, as they believe they are unnatural or contaminated and are uncertain about the health consequences. As access to seeds for GMOs is controlled by large corporations, many people may be unaware that the food they eat contains GMOs.</p> <p>An ethical issue of biotechnology includes the possibility GMOs entering the wild. This could lead to weeds becoming resistant to pesticides and other unforeseen changes to plants and ecosystems.</p> <p><i>Note: This response is more detailed than a student would be expected to write. The term GMO and transgenic organism are often used interchangeably as both types of organisms have an artificially modified genome. However, a transgenic organism is a GMO containing a DNA sequence or gene from a different species. Thus, all transgenic organisms are GMOs, but not all GMOs are transgenic organisms.</i></p>	<p>Mod 6 Biotechnology Mod 6 Genetic Technologies BIO12–7, 12–13                      Bands 5–6</p> <ul style="list-style-type: none"> <li>• Describes biotechnology in detail.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Analyses in detail the social implications of biotechnology.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Analyses in detail the ethical uses of biotechnology.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Refers to examples. . . . . 6–7</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Describes biotechnology.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Analyses the social implications of biotechnology.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Analyses the ethical uses of biotechnology.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Refers to examples. . . . . 4–5</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Identifies a biotechnology.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Describes the social implications of biotechnology.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Describes the ethical uses of biotechnology.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Refers to an example . . . . . 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Any TWO of the above points. . . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Provides some relevant information . . . . . 1</li> </ul>

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
<p><b>Question 27</b></p> <p>The student’s report confuses some aspects of gene flow and genetic drift. Both terms involve changes of the genotypes and phenotypes present in a population. However, gene flow occurs when individuals move out of the population, whereas genetic drift occurs within a specific population.</p> <p>The student is correct in stating that genetic drift can occur as a result of random events and is a change in allele frequency in a population. However, the transfer of alleles or gametes from one population to another is gene flow, not an alternative definition of genetic drift.</p> <p>The diagram and descriptions of phenotypes are accurate and relevant to the understanding of genetic drift, as they show how a chance event can change the gene pool and result in the abundance of phenotypes.</p> <p>The report correctly states that genetic drift can occur in both small and large populations and identifies that small populations are more significantly affected. The report demonstrates an awareness that genetic drift is only one factor affecting gene pools.</p> <p>The student’s report provides some relevant information and correctly identifies that genetic drift may result in the loss of alleles from a population, thus decreasing the size of the gene pool. However, there is confusion between genetic drift and gene flow; therefore, the student’s evaluation of the effect of genetic drift on the gene pool of a population is not entirely accurate.</p> <p>(continues on next page)</p>	<p>Mod 6 Mutation BIO12–5, 12–13 Bands 5–6</p> <ul style="list-style-type: none"> <li>Assesses the accuracy of the student’s report.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Refers to at least TWO examples of correct information in the report.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Refers to at least TWO examples of incorrect information in the report.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Provides an appropriate assessment statement . . . . . 5</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Assesses the accuracy of the student’s report.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Refers to at least TWO examples of correct information in the report.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Refers to ONE example of incorrect information in the report.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Provides an appropriate assessment statement.</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>Assesses the accuracy of the student’s report.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Refers to ONE example of correct information in the report.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Refers to at least TWO examples of incorrect information in the report.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Provides an appropriate assessment statement . . . . . 4</li> </ul>

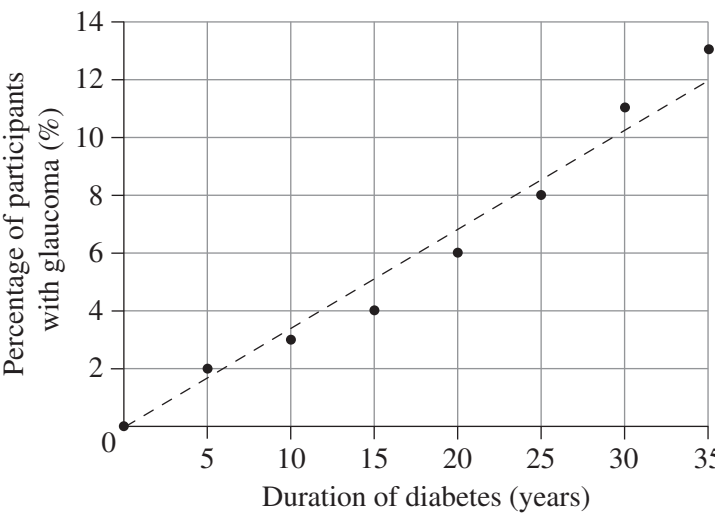
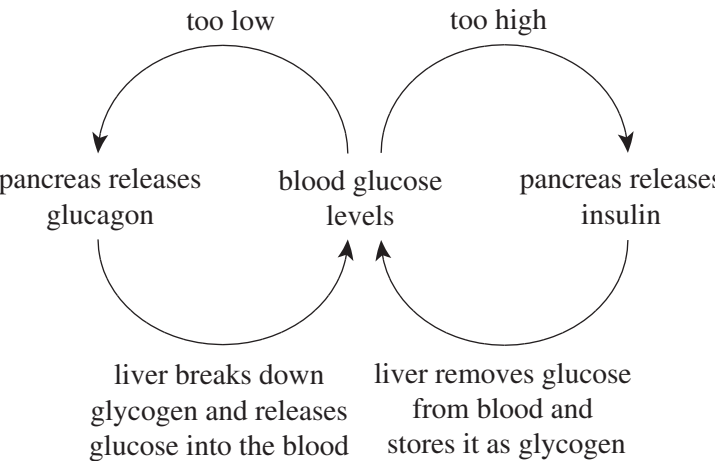
Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
(continued)	<ul style="list-style-type: none"> <li>• Assesses the accuracy of the student’s report.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Refers to ONE example of correct information in the report.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Refers to ONE example of incorrect information in the report.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides an appropriate assessment statement . . . . . 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Refers to ONE example of correct OR incorrect information in the report.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides an appropriate assessment statement . . . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Provides some relevant information . . . . . 1</li> </ul>

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
<p><b>Question 28</b></p> <p><i>For example:</i></p> <p>Public health campaigns are designed to raise public awareness about a specific disease. They are often used by governments to help minimise the spread of infectious diseases. They can involve legal and physical intervention by federal and state authorities.</p> <p>An example of a public health campaign includes the federal and state response to COVID-19. Throughout the COVID-19 pandemic, governments released campaigns informing individuals about the dangers of the disease and necessary precautions. Advice on masks, hand washing and social distancing has been made available through a range of media sources, including websites, television interviews with health officials and press conferences held by politicians. By raising public awareness about COVID-19, the public health campaign enables the public to make informed decisions about how to prevent the spread of the disease.</p> <p>Intervention strategies used in the COVID-19 public health campaign include the vaccination mandates and cleaning policies for businesses. These measures have been made compulsory in areas where people are at a high risk of contracting COVID-19, such as aged care facilities. These interventions aim to minimise the spread of infectious disease through good hygiene and vaccination.</p>	<p>Mod 7 Prevention, Treatment and Control BIO12–14 Bands 5–6</p> <ul style="list-style-type: none"> <li>• Describes public health campaigns.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Explains in detail how public health campaigns can minimise the spread of infectious diseases.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Refers to examples of specific strategies . . . . . 5</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Describes public health campaigns.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Explains how public health campaigns can minimise the spread of infectious diseases.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Refers to examples of specific strategies. . . . . 4</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Describes public health campaigns.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Describes how public health campaigns can minimise the spread of infectious diseases.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Refers to examples of specific strategies . . . . . 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Any TWO of the above points. . . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Provides some relevant information . . . . . 1</li> </ul>
<p><b>Question 29</b></p> <p>(a) The doctor may have believed that Hua’s illness was a viral infection. Antibiotics are ineffective against viruses.</p> <p><b>OR</b></p> <p>Overuse of antibiotics has led to antibiotic resistance in bacteria and has made many antibiotics less effective. Thus, the doctor may be reluctant to prescribe them for mild symptoms because they may not work and also may contribute further to antibiotic resistance.</p>	<p>Mod 7 Prevention, Treatment and Control BIO12–14 Bands 1–2</p> <ul style="list-style-type: none"> <li>• Outlines ONE reason. . . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Provides some relevant information . . . . . 1</li> </ul>



Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
<p>(b) The purpose of the investigation is to observe the effectiveness of particular antibiotics in inhibiting the growth of a specific bacterium. Bacteria will grow on the nutrient agar unless something inhibits it. The less growth of bacteria around a particular disc, the greater the effectiveness of the antibiotic.</p> <p>The diagram shows that antibiotic X is the most effective in this investigation because it has the largest zone of inhibition. The second-most effective is antibiotic Z. Antibiotic Y may be ineffective against the bacteria.</p>	<p>Mod 7 Prevention, Treatment and Control BIO12–6, 12–14 Bands 5–6</p> <ul style="list-style-type: none"> <li>• Outlines in detail the purpose of the investigation.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides a relevant and detailed conclusion that refers to the diagram . . . . . 4</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Outlines the purpose of the investigation.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides a relevant conclusion that refers to the diagram . . . . . 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Any ONE of the above points . . . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Provides some relevant information . . . . . 1</li> </ul>
<p><b>Question 30</b></p> <p><i>For example:</i></p> <p>Foot-and-mouth disease (FMD) has no cure. If the disease enters Australia, methods of preventing its spread, such as destroying infecting animals, would be very expensive and disruptive to the livestock industry. Therefore, it is necessary to prevent the disease from entering Australia.</p> <p>Quarantine separates and restricts the movement of people and animals who may have been exposed to an infectious disease such as FMD. This allows authorities to observe whether the disease has been contracted and thus prevent potentially infected individuals from spreading the disease. Therefore, if a individual arrives in Australia carrying FMD, the implementation of a quarantine period prevents the individual from entering the general population until they are no longer infected with the disease.</p>	<p>Mod 7 Prevention, Treatment and Control BIO12–14 Bands 4–5</p> <ul style="list-style-type: none"> <li>• Outlines in detail why quarantine may be used to prevent the spread of FMD . . . . . 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Outlines why quarantine may be used to prevent the spread of FMD . . . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Provides some relevant information . . . . . 1</li> </ul>
<p><b>Question 31</b></p> <p>(a) A pathogen is a microorganism that can cause disease.</p>	<p>Mod 7 Responses to Pathogens BIO12–14 Bands 1–2</p> <ul style="list-style-type: none"> <li>• Defines pathogen . . . . . 1</li> </ul>

Sample answer		Syllabus content, outcomes, targeted performance bands and marking guide
(b)		Mod 7 Responses to Pathogens BIO12-4, 12-6, 12-15      Bands 4-5
<i>Physical changes</i>	<i>Chemical changes</i>	
<p><i>Any two of:</i></p> <ul style="list-style-type: none"> <li>• Phagocytosis: Specialist cells called phagocytes seek out and consume pathogens.</li> <li>• Mucus and cilia: Mucus in the respiratory tract dissolves pathogens and cilia expel it from the airways.</li> <li>• Sneezing and coughing: Sneezing and coughing helps to remove foreign bodies from the respiratory tract.</li> <li>• Fever: Fever increases body temperature to kill pathogens.</li> <li>• Spleen: The spleen filters blood to remove microbes.</li> </ul>	<p><i>Any two of:</i></p> <ul style="list-style-type: none"> <li>• Inflammation: The body recognises and acts against pathogens by, for example, increasing levels of plasma and leukocytes at the affected part of the body.</li> <li>• Antibodies: Antibodies recognise and bind foreign objects in the body to neutralise them.</li> <li>• B cells: B cells release antibodies, which bind antigens and prevent them from harming the body, and secrete cytokines, which attract other immune cells.</li> <li>• T cells: There are many types of T cells, including killer T cells, which kill virus-infected cells.</li> <li>• Thymus: The thymus filters and monitors blood content. It produces white blood cells called T cells.</li> </ul>	<ul style="list-style-type: none"> <li>• Draws an appropriate table.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Identifies TWO physical changes.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Describes TWO physical changes.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Identifies TWO chemical changes.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Describes TWO chemical changes . . . . . 4</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Any FOUR of the above points . . . . 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Any THREE of the above points . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Provides some relevant information . . . . . 1</li> </ul>

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide																		
<p><b>Question 32</b></p>																			
<p>(a)</p>  <table border="1" data-bbox="183 369 901 884"> <caption>Data points from the scatter plot</caption> <thead> <tr> <th>Duration of diabetes (years)</th> <th>Percentage of participants with glaucoma (%)</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td></tr> <tr><td>5</td><td>2</td></tr> <tr><td>10</td><td>3</td></tr> <tr><td>15</td><td>4</td></tr> <tr><td>20</td><td>6</td></tr> <tr><td>25</td><td>8</td></tr> <tr><td>30</td><td>11</td></tr> <tr><td>35</td><td>13</td></tr> </tbody> </table>	Duration of diabetes (years)	Percentage of participants with glaucoma (%)	0	0	5	2	10	3	15	4	20	6	25	8	30	11	35	13	<p>Mod 8 Homeostasis            BIO12-4, 12-6, 12-15      Bands 3-4</p> <ul style="list-style-type: none"> <li>• Draws a graph with a line of best fit.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Plots points correctly.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Uses an appropriate scale.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Labels the axes AND includes the correct units . . . . . 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Any THREE of the above points . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Any TWO of the above points . . . . 1</li> </ul>
Duration of diabetes (years)	Percentage of participants with glaucoma (%)																		
0	0																		
5	2																		
10	3																		
15	4																		
20	6																		
25	8																		
30	11																		
35	13																		
<p>(b) The longer an individual person has type 1 diabetes, the more likely they are to develop glaucoma.</p>	<p>Mod 8 Homeostasis            BIO12-5, 12-15      Bands 2-3</p> <ul style="list-style-type: none"> <li>• Constructs an appropriate hypothesis . . . . . 1</li> </ul>																		
<p>(c)</p>  <pre>           graph TD             A[too low] --&gt; B[pancreas releases glucagon]             B --&gt; C[blood glucose levels]             C --&gt; D[liver breaks down glycogen and releases glucose into the blood]             D --&gt; C             E[too high] --&gt; F[pancreas releases insulin]             F --&gt; G[blood glucose levels]             G --&gt; H[liver removes glucose from blood and stores it as glycogen]             H --&gt; G           </pre>	<p>Mod 8 Homeostasis            BIO12-15      Bands 4-5</p> <ul style="list-style-type: none"> <li>• Draws an appropriate negative feedback loop.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Shows the fall and rise in glucose levels.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Shows the pancreas releasing glucagon and insulin at the correct points.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Shows the liver releasing and removing glucose . . . . . 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Any TWO of the above points . . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Draws a loop with some relevant information . . . . . 1</li> </ul>																		

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
<p><b>Question 33</b></p> <p><i>For example:</i></p> <p>Sickle-cell anaemia is a disease that can be prevented by genetic engineering. The disease is caused by an A gene mutating into a T gene, leading to the production of abnormal, sickle-shaped, red blood cells.</p> <p>Gene therapy is a method of genetic engineering that can modify DNA to correct the defective gene causing a disease, rather than the symptoms. One way of utilising gene therapy is targeting specific gene sequences and changing the affected DNA base pairs.</p> <p>In the case of sickle-cell anaemia, gene therapy is used to convert A–T gene pairs to G–C gene pairs. This also converts the haemoglobin that produces sickle-shaped blood cells into a form that produces healthy blood cells and thus eliminates the disease.</p> <p>This method is still being developed, and is a complex and expensive process. Thus, only a small number of patients have been successfully treated. The mutated gene causing the disease must be identified very early so that gene therapy can be used to prevent the disease before symptoms develop. This type of gene therapy can also be used as a cure.</p> <p>Although gene therapy has some limitations, it shows long-term promise as a way of preventing sickle-cell anaemia, especially as more research is carried out to improve the effectiveness and affordability of the process.</p> <p>(continues on next page)</p>	<p>Mod 8 Prevention BIO12–15 Bands 4–5</p> <ul style="list-style-type: none"> <li>Identifies AND describes an appropriate disease.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Describes a method of genetic engineering used to prevent the identified disease.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Describes how the method of genetic engineering is used to prevent the identified disease.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Evaluates the effectiveness of the method of genetic engineering .....5</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Identifies and describes an appropriate disease.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Describes a method of genetic engineering used to prevent the identified disease.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Outlines how the method of genetic engineering is used prevent the identified disease .....4</li> </ul> <hr/> <ul style="list-style-type: none"> <li>Identifies and describes an appropriate disease.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Identifies a type of genetic engineering used to prevent the identified disease.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Refers to ONE benefit AND ONE limitation of the method of genetic engineering .....3</li> </ul>

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
(continued)	<ul style="list-style-type: none"> <li>• Identifies an appropriate disease.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Identifies a method of genetic engineering used to prevent the identified disease.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Refers to ONE benefit OR ONE limitation of the method of genetic engineering .....2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Provides some relevant information .....1</li> </ul>

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
<p><b>Question 34</b></p> <p><i>For example:</i></p> <p>The hearing specialist may have recommended cochlear implants to assist with Roman’s hearing loss.</p> <p>Hearing aids and cochlear implants are designed to help with the effects of hearing loss, but the technologies work in different ways and are suited to different types of hearing loss.</p> <p>Hearing aids are more widely used than cochlear implants and help individuals who have minor to moderate hearing loss. On the other hand, cochlear implants help individuals who have hearing loss that is too severe to be affected by conventional hearing aids. This level of hearing loss can be caused by damage to the inner ear, which is bypassed by cochlear implants.</p> <p>Hearing aids do not only amplify sound levels; they also clarify sounds and reduce background noise. Comparatively, cochlear implants receive sounds and transform them into electrical signals. The implant has two major sections. On the outside of the ear, there is a microphone, sound processor and transmitter, which receive the incoming sound and transform it into an electrical signal. Under the skin, there is a receiver that receives the electrical signal and sends it to the brain, which processes the signal as sound.</p> <p>Hearing aids can be placed behind an ear and connected to an ear canal, allowing the user to remove them at any time. In contrast, part of a cochlear implant must be surgically implanted; hence, the external part of the implant can be removed but not the portion under the skin.</p> <p>Hearing aids amplify sound and sometimes enhance certain frequencies. Therefore, individuals who wear hearing aids do not experience any major changes to the nature of the sound they hear. On the other hand, recipients of cochlear implants usually need training to learn how to recognise sounds, which are often very different to what they had previously experienced.</p> <p><i>Note: Responses may also refer to bone conduction implants as the alternative technology.</i></p>	<p>Module 8 Technologies and Disorders BIO12–15 Bands 5–6</p> <ul style="list-style-type: none"> <li>• Identifies an appropriate technology that assists with hearing loss.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides at least FOUR detailed points of comparison between the identified technology and hearing aids . . . . 6–7</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Identifies an appropriate technology that assists with hearing loss.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides THREE detailed points of comparison between the identified technology and hearing aids . . . . . 4–5</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Identifies an appropriate technology that assists with hearing loss.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides TWO points of comparison between the identified technology and hearing aids . . . . . 3</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Identifies an appropriate technology that assists with hearing loss.</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>• Provides ONE point of comparison between the identified technology and hearing aids . . . . . 2</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Provides some relevant information . . . . . 1</li> </ul>