

# B1 You and your genes – Higher

## Workbook answers

|          |          |  |
|----------|----------|--|
| <b>1</b> | <b>a</b> | Missing words: alike, features, unique, variation, genes, environment  |
|          | <b>b</b> | Environment: pierced ears, scar<br>Genes: (natural) hair colour, eye colour, blood type<br>Both environment and genes: height, weight<br>(Note: Students may well consider hair colour to be affected by both environment and genes if they dye their hair.)   |
| <b>2</b> | <b>a</b> | Labels from left to right: nucleus, NUCLEUS, chromosomes, genes  |
|          | <b>b</b> | Structural proteins are used to build cell parts and cells.<br>Enzymes speed up chemical reactions.  |
| <b>3</b> | <b>a</b> | Each child gets a mixture of their parents' genes. So brothers and sisters may look alike, but they will all be unique because they each get a different mixture of their parents' genes.  |
|          | <b>b</b> | <ul style="list-style-type: none"> <li>• Inherited from Kyle: e.g. shape of nose</li> <li>• Not inherited from anyone: e.g. hair length</li> </ul>   |
| <b>4</b> | <b>a</b> | One gene: blood type<br>Many genes: height   |
|          | <b>b</b> | There are four distinct blood types. If many genes were involved there would be more combinations and therefore many possible blood types. You would expect a smoother curve, as with height.  |
|          | <b>c</b> | e.g. nutrition and health as a child (i.e. when growing)   |
| <b>5</b> | <b>a</b> | An organism that is genetically identical to another organism  |
|          | <b>b</b> | Bacteria, some simple plants and animals, e.g. <i>Hydra</i>  |
|          | <b>c</b> | The plants have grown in different environmental conditions. They may have received different amounts of water, light, or nutrients from the soil.   |
|          | <b>d</b> | <ul style="list-style-type: none"> <li>• Natural animal cloning (from left to right): egg cell, sperm cell, fertilized egg cell, fertilized egg cell starts to divide, embryo splits into two, producing two identical fetuses/babies</li> <li>• Artificial animal cloning: (top left) nucleus removed from an unfertilized egg cell, (top right) nucleus from a body cell put into the empty egg cell, (bottom) embryo grown for a few days then implanted into uterus</li> </ul> |

|           |          |   |    |    |    |    |
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| <b>6</b>  | <b>a</b> | <p>Answer will depend on the method students have experienced during the course. Description of taking cuttings or tissue culture would both be acceptable.</p> <p>For example: cut a piece of healthy shoot (just below a joint), dip the end into rooting powder, plant it into some compost; some of the cells at the base of the stem will develop into root cells, other cells will form new leaves.</p>   |    |    |    |    |
|           | <b>b</b> | <ul style="list-style-type: none"> <li>• Advantages of cloning: e.g. Grow plants with favourable characteristics which you want them to have (e.g. disease resistance, flower colour); produce large numbers of plants more quickly than growing from seed.</li> <li>• Disadvantages of cloning plants: e.g. There is no genetic variation, so all plants could be destroyed by a disease or other harsh environmental conditions. (If there is genetic variation some of the plants may be able to survive harsh environmental conditions.)</li> </ul> |    |    |    |    |
| <b>7</b>  | <b>a</b> | Missing words: 23, sex, X, Y, XY, X, XX   |    |    |    |    |
|           | <b>b</b> | <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>XX</td> <td>XY</td> </tr> <tr> <td>XX</td> <td>XY</td> </tr> </table> <p>Male 50%, female 50%</p>  | XX | XY | XX | XY |
| XX        | XY       |   |    |    |    |    |
| XX        | XY       |   |    |    |    |    |
|           | <b>c</b> | Every fertilization happens randomly and separately from every other fertilization. There is a 50% chance for every egg of being fertilized by an X sperm or a Y sperm.   |    |    |    |    |
|           | <b>d</b> | <p>(SRY = sex-determining region of the Y chromosome)</p> <ul style="list-style-type: none"> <li>• SRY gene causes a male embryo's testes to develop (at about 6 weeks).</li> <li>• The testes produce a male sex hormone.</li> <li>• Male sex hormone makes the embryo develop into a male.</li> </ul>   |    |    |    |    |
| <b>8</b>  | <b>a</b> | Missing words: fertilization, female, twice/double  |    |    |    |    |
|           | <b>b</b> | Missing numbers from the diagram: 23 (egg), 23 (sperm), 46 (fertilized egg)   |    |    |    |    |
|           | <b>c</b> | Chromosomes of egg and sperm are in singles, chromosomes of fertilized egg are in pairs.  |    |    |    |    |
|           | <b>d</b> | 1, 6, 12, 7, 9, 11, 5, 3, 8, 4, 10, 2   |    |    |    |    |
| <b>9</b>  | <b>a</b> | Missing words: two, same, place, two  |    |    |    |    |
|           | <b>b</b> | <ul style="list-style-type: none"> <li>• Completed diagram of pair 7 showing taste receptor gene and colour vision gene on each chromosome.</li> <li>• Completed diagram of pair 15 showing hair colour gene and eye colour gene on each chromosome.</li> </ul>   |    |    |    |    |
| <b>10</b> | <b>a</b> | You need only have one copy of a dominant allele to have its features.  |    |    |    |    |
|           | <b>b</b> | You must have two copies of a recessive allele to have its features.  |    |    |    |    |
|           | <b>c</b> | dimples = D, no dimples = d   |    |    |    |    |

|           |          |   |  |   |   |   |    |    |   |    |    |
|-----------|----------|---|--|---|---|---|----|----|---|----|----|
|           | <b>d</b> | <p><b>i</b> One of Jim, Jane, Simon, or Paul</p> <p><b>ii</b> Louise must have inherited a d allele from both her parents. Her father, Carlo, does not have dimples, so he must have dd alleles. Her mother, Jane, must have Dd alleles. Jane passed on a copy of her d allele to Louise.</p>   |  |   |   |   |    |    |   |    |    |
| <b>11</b> |          | A person with Huntington's disorder has problems controlling their muscles, they get forgetful, find it harder to understand things, and eventually they can't control their movements. Sadly the condition is fatal.   |  |   |   |   |    |    |   |    |    |
| <b>12</b> | <b>a</b> | Missing words: Z, Y, half, one, fertilization, cross  |  |   |   |   |    |    |   |    |    |
|           | <b>b</b> | <table border="1" style="margin-left: 40px;"> <tr> <td></td> <td>d</td> <td>d</td> </tr> <tr> <td>D</td> <td>Dd</td> <td>Dd</td> </tr> <tr> <td>d</td> <td>dd</td> <td>dd</td> </tr> </table> <p>Chance of baby having dimples is 50%</p>   |  | d | d | D | Dd | Dd | d | dd | dd |
|           | d        | d   |  |   |   |   |    |    |   |    |    |
| D         | Dd       | Dd  |  |   |   |   |    |    |   |    |    |
| d         | dd       | dd  |  |   |   |   |    |    |   |    |    |
|           | <b>c</b> | Brothers and sisters each get a different mixture of genes from their parents (except identical twins).   |  |   |   |   |    |    |   |    |    |
| <b>13</b> |          | <ul style="list-style-type: none"> <li>• Symptoms: Lungs blocked with mucus, leading to chest infections. Mucus blocks enzymes in the gut, leading to poor digestion and lack of nutrients being absorbed.</li> <li>• Treatment: Physiotherapy to clear lungs of mucus, antibiotics for chest infections, tablets containing missing enzymes</li> <li>• A carrier is a person who has one normal allele (dominant) and one faulty allele (recessive). They can pass the faulty allele on to offspring.</li> </ul> |  |   |   |   |    |    |   |    |    |
| <b>14</b> | <b>a</b> | A decision based on what you believe is 'right' and 'wrong'   |  |   |   |   |    |    |   |    |    |
|           | <b>b</b> | <ul style="list-style-type: none"> <li>• Any decision that does not involve ethics, e.g. which bus route to take to get to the cinema</li> <li>• Any decision that does involve ethics, e.g. whether to drop your litter in the street, read someone's diary, have your baby immunized</li> </ul>   |  |   |   |   |    |    |   |    |    |
| <b>15</b> |          | <ul style="list-style-type: none"> <li>• False-positive: a test result that wrongly says a person has a medical condition when they don't</li> <li>• False-negative: a test result that wrongly says a person doesn't have a medical condition when they do</li> </ul>  |  |   |   |   |    |    |   |    |    |

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| 16 | <p>Any three opinions about testing fetuses for genetic disorders, e.g.:</p> <p>A positive test might lead to a decision to terminate the pregnancy. Some people believe termination is wrong. They believe that a human being begins when an egg is fertilized, and that a fertilized egg should have the same protection as an adult human being.</p> <p>A family may feel that they could not look after a child with a serious illness properly, so they want to have a genetic test.</p> <p>Many people lead happy lives, despite having a serious genetic disorder, so terminating those pregnancies denies them the right to life.</p> |
| 17 | <p><b>a</b></p> <ul style="list-style-type: none"> <li>• Genetic screening programmes: to find out who in a population are carriers/sufferers so they can inform parents of the risks of passing on a genetic disorder before conception.</li> <li>• Insurance companies: to find out the risk of having to pay out for medical treatment/care for a person in the future.</li> <li>• Employers: to find out the risk of an employee being unable to do a particular job through illness in the future, which might be disruptive and expensive for the employer.</li> </ul>  |
|    | <p><b>b</b></p> <p>Reasons for one of the above might be:</p> <ul style="list-style-type: none"> <li>• Genetic screening programmes: Individuals may not want to know if they are carriers because this would affect how they feel, live, and the choices they make.</li> <li>• Insurance companies: Individuals may find themselves paying high premiums or being refused insurance altogether.</li> <li>• Employers: Individuals may be discriminated against when going for job interviews, or treated adversely at work.</li> </ul>   |
|    | <p><b>c</b> Student's personal views, with explanation</p>  |
| 18 | <p>Doctors give a woman fertility drugs so that her body produces several eggs at the same time. The eggs are collected and mixed in a glass dish with sperm from a man. Sperm fertilize the eggs. The fertilized eggs grow into embryos. Doctors test the embryos for the genetic disorder. They will only choose an embryo that does not have the genetic disorder to implant into the mother's womb.</p>   |
| 19 | <p><b>a</b> Missing words: alleles, normal, therapy, SCID, cystic fibrosis</p>  |
|    | <p><b>b</b></p> <ol style="list-style-type: none"> <li>1. The gene that causes the genetic disorder is located on a chromosome.</li> <li>2. Chromosomes from someone who does not have the disorder are used to find the 'normal' allele. This is copied.</li> <li>3. Copies of the 'normal' allele are put into the cells of a person suffering from the genetic disorder.</li> </ol>  |

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|    | <p><b>c</b> Any three opinions about gene therapy, e.g.:</p> <p>It is interfering with nature so should not be done.</p> <p>It may cause problems which we cannot predict, so should not be done.</p> <p>It may help improve the quality of lives for some people with very serious illnesses.</p>   |
| 20 | <p><b>a</b> ...they are unspecialized, so can develop into any type of cell the animal/plant needs.</p> <p>...they could be used to treat certain diseases, by making new cells to replace faulty ones.</p> <p>...they can develop into many different types of cells, whereas adult stems cells can develop into only a few types.</p> <p>...the cloned embryo would have the same genes as the patient.</p>  |
|    | <p><b>b</b> See diagram on textbook page 28.</p> <p>Labels from left to right:</p> <p>The nucleus is taken out of human egg cell and replaced with a nucleus from one of the patient's cells.</p> <p>30 hours – the egg cell is triggered to develop into an embryo</p> <p>3 days</p> <p>5 days – cells removed from the embryo with a pipette</p> <p>Stem cells grown in a dish containing nutrients</p>  |
| 21 | <p><b>a</b> Cloning human adults would mean taking a cell from a person's body and using it to produce another adult person with the same genes. Stem cells are taken from cloned embryos that are only a few days old. There is no intention for these embryos to be grown into an adult person.</p>  |
|    | <p><b>b</b> Underlined text could include (in the last section): 'it means human embryos are destroyed', 'religious beliefs', and 'it is the same as killing a child, because human life begins at the moment of fertilization'.</p>   |
|    | <p><b>c</b> Ringed text could include: (second section) 'embryonic stem cells will be more useful in research to cure diseases', (third section) 'Degenerative diseases and serious injuries to organs and tissues may be treated through stem therapies'.</p>   |
|    | <p><b>d</b> For example:</p> <ul style="list-style-type: none"> <li>• Fact: (second section) 'Adult stem cells can only develop into one type of cell.'</li> <li>• Opinion: (last section) 'The destruction of human embryonic life is unnecessary...continue to be developed.'</li> <li>• Theory: (fourth section) 'the cloned embryo would have the same genes as the patient, so cells from it would not be rejected'</li> </ul> <p>Speculation: (third section) 'Degenerative diseases ....stem cell therapies.'</p> |

## B2 Keeping healthy – Higher

### Workbook answers

|          |          |   |
|----------|----------|---|
| <b>1</b> | <b>a</b> | Headings: virus, bacterium, fungus  |
|          | <b>b</b> | Missing words: chemicals, reproduce, destroy, acid, microorganisms  |
|          | <b>c</b> | Warm, moist, available nutrients  |
|          | <b>d</b> | 1 hr 20 mins – 16 bacteria<br>1:40 – 32<br>2:00 – 64<br>2:20 – 128<br>2:40 – 256<br>3:00 – 512  |
|          | <b>e</b> | Missing words: (top left) poisons, toxins; (bottom left) cell; (box) damage, symptoms   |
| <b>2</b> |          | Missing words: markers, white, antibodies, engulf, digest   |
| <b>3</b> | <b>a</b> | Correctly labelled diagram, with complementary antibodies drawn over the markers at X.  |
|          | <b>b</b> | The white blood cell that recognizes the foreign marker must multiply. The white blood cells then have to make enough antibodies to fight the infection.  |
|          | <b>c</b> | Missing words: memory, markers, antibodies, microorganisms, immune  |
| <b>4</b> | <b>a</b> | For example: <ul style="list-style-type: none"> <li>• White blood cells recognize foreign markers from the microorganism in the vaccine. They produce antibodies against this type of microorganism. The child is now immune to this microorganism.</li> <li>• Memory cells that recognize the invading microorganisms are already in the blood. They detect the microorganisms immediately. The correct antibodies are quickly produced.</li> <li>• The antibodies destroy the invading microorganisms before they can reproduce and cause illness.</li> </ul> |
|          | <b>b</b> | Diagram: antibody for virus B has a V-shaped end, complementary to the black markers on the outside of the virus.<br><br>The antibody produced to fight virus A will not 'fit' the markers on virus B. Other white blood cells will only engulf and destroy the microorganisms that antibodies stick to.  |

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|          | <b>c</b> | <ul style="list-style-type: none"> <li>The HIV virus damages some immune system cells, so the body cannot respond to other infections as well as normal.</li> <li>A vaccine is made using one type of HIV virus. It causes antibodies to be made which are specific to this type of HIV virus. If the virus changes by mutation, these antibodies will not work against the new virus.</li> </ul>   |
| <b>5</b> | <b>a</b> | Rows 1 and 2 of the table   |
|          | <b>b</b> | Rows 3 and 4 of the table   |
|          | <b>c</b> | <ul style="list-style-type: none"> <li>Who should decide whether or not a child is vaccinated?</li> <li>Student's personal view, with explanation.</li> </ul>   |
|          | <b>d</b> | <ul style="list-style-type: none"> <li>If fewer children are vaccinated, then large numbers of the disease-causing microorganisms will be left in infected people.</li> <li>There are lots of unvaccinated people who could contract measles. So the chance of a healthy unvaccinated person coming into contact with someone who has measles is much higher than if 95% of the population were vaccinated.</li> </ul>  |
|          | <b>e</b> | <p>Arguments for:</p> <ul style="list-style-type: none"> <li>if lots of children are not vaccinated, this puts others at risk</li> <li>almost everyone who has the vaccination notices no harmful effects</li> <li>if they do, the effects are usually very mild</li> <li>if they are not vaccinated and get measles, they could be severely disabled</li> <li>measles can be fatal, so vaccination can save lives</li> <li>an outbreak of measles would be costly to the NHS and to society</li> </ul> <p>Arguments against:</p> <ul style="list-style-type: none"> <li>a very small number of people do have serious harmful effects from a vaccine</li> </ul> <p>parents should be able to decide what is best for their child</p> |
|          | <b>f</b> | In Africa parents are more likely to have seen children seriously ill or dying from measles. They might consider the benefits of not getting measles to outweigh the risks of possible harmful effects from the vaccine.  |
| <b>6</b> | <b>a</b> | Septic wound, athlete's foot, cystitis, tuberculosis  |
|          | <b>b</b> | Diagram in 2 – some bacteria drawn in the circle (not as many as in circle 1); missing word: kills<br>Diagram 3 – no bacteria drawn in the circle; missing word: all  |
| <b>7</b> | <b>a</b> | The microorganisms in a population are not all completely identical. There is some variation between the microorganisms caused by mutation.   |
|          | <b>b</b> | Diagram 1 – lots of bacteria, as in question 6b diagram 1<br>Diagram 2 – some bacteria<br>Diagram 3 – lots of bacteria. Explanation: Some of the bacteria are more resistant to the antibiotic. They survive and reproduce.   |

|          |          |  |   |   |   |   |   |   |   |   |  |   |  |   |
|----------|----------|--|---|---|---|---|---|---|---|---|--|---|--|---|
|          | <b>c</b> | <ul style="list-style-type: none"> <li>This way you will kill all the bacteria. If you don't, then those bacteria that are more resistant to the antibiotic will survive. The infection may come back.</li> <li>The antibiotics won't work because colds are caused by viruses.</li> <li>Over-use of antibiotics increases the chance of antibiotic-resistant bacteria growing. So in future, the antibiotics would not have an effect.</li> </ul>   |   |   |   |   |   |   |   |   |  |   |  |   |
| <b>8</b> | <b>a</b> | <ul style="list-style-type: none"> <li>How safe the drug is</li> <li>How well the drug works</li> </ul>  |   |   |   |   |   |   |   |   |  |   |  |   |
|          | <b>b</b> | <table border="1"> <tr> <td>1</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>2</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>3</td> <td>✓</td> <td></td> </tr> <tr> <td>4</td> <td></td> <td>✓</td> </tr> </table>  | 1 | ✓ | ✓ | 2 | ✓ | ✓ | 3 | ✓ |  | 4 |  | ✓ |
| 1        | ✓        | ✓  |   |   |   |   |   |   |   |   |  |   |  |   |
| 2        | ✓        | ✓  |   |   |   |   |   |   |   |   |  |   |  |   |
| 3        | ✓        |  |   |   |   |   |   |   |   |   |  |   |  |   |
| 4        |          | ✓  |   |   |   |   |   |   |   |   |  |   |  |   |
|          | <b>c</b> | Testing on cells is not enough – we need to know if a drug is safe and effective to use on whole organisms. It is safer for humans to find out as much as possible about this by testing on other animals first.   |   |   |   |   |   |   |   |   |  |   |  |   |
|          | <b>d</b> | <Question deleted - will be corrected at reprint>  |   |   |   |   |   |   |   |   |  |   |  |   |
|          | <b>e</b> | Open, blind, double-blind  |   |   |   |   |   |   |   |   |  |   |  |   |
|          | <b>f</b> | <p>Best available treatment – treatment that uses tried and tested existing drugs</p> <p>Control group – the people that are not given the trial drug</p> <p>Placebo – treatment that appears similar but does not contain the drug under test</p> <p>Random groups – groups selected without considering any particular characteristics</p>   |   |   |   |   |   |   |   |   |  |   |  |   |
|          | <b>g</b> | <p>Patients must be offered the best available treatment when it is available. Placebos may be used when there is currently no other treatment for the disease, so patients being given the placebo are not missing out on treatment.</p> <p>(However, if the disease is life-threatening it may be wrong to use placebos, as this denies patients the chance of having a drug which may help them. In some trials where a disease is life-threatening, if the trial produces evidence that the drug is working well, patients who are being given the placebo may be told so they can be offered the new drug.)</p> |   |   |   |   |   |   |   |   |  |   |  |   |
|          | <b>h</b> | The results are more reliable. Neither doctor nor patient knows who has been given the drug, so this knowledge cannot influence the way they report results.   |   |   |   |   |   |   |   |   |  |   |  |   |
| <b>9</b> | <b>a</b> | <p>Left: artery (thicker outer wall and thicker layer of muscle and elastic fibre)</p> <p>Right: vein (thinner outer wall and thinner layer of muscle and elastic fibre)</p> <p>Top: outer wall</p> <p>Bottom: muscle and elastic fibre</p>  |   |   |   |   |   |   |   |   |  |   |  |   |
|          | <b>b</b> | Missing words: oxygen/food, food/oxygen, thick, veins, valves  |   |   |   |   |   |   |   |   |  |   |  |   |

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|           | <b>c</b> | <p>1 Diagram of artery cross section, showing fatty build-up on the inner surface.</p> <p>2 A blood clot can form on the fatty lump.</p> <p>3 The blood clot can block the artery.</p> <p>4 The heart is starved of oxygen and cells start to die.</p>  |
| <b>10</b> | <b>a</b> | <ul style="list-style-type: none"> <li>usually caused by ...genetic factors</li> <li>usually caused by ...lifestyle factors</li> <li>nor normally caused caused by microorganisms</li> </ul>  |
|           | <b>b</b> | <p>High-fat diet – your blood cholesterol increases</p> <p>High-salt diet – your blood pressure increases</p> <p>Smoking – your blood carries less oxygen</p> <p>Being overweight – your heart has to work harder</p> <p>Drinking too much alcohol – your weight increases and you may be less active</p> <p>Stress – you may eat, smoke, and drink more</p>  |
|           | <b>c</b> | Exercise  |
| <b>11</b> | <b>a</b> | <p>Cause – there is evidence that a factor produces an outcome</p> <p>Mechanism – steps that explain how a factor causes an outcome</p> <p>Correlation – there is evidence of some link between a factor and an outcome</p>   |
|           | <b>b</b> | The first and third sentences are correct interpretations.  |
|           | <b>c</b> | Missing words: increases, increases, correlation, cause   |
|           | <b>d</b> | <ul style="list-style-type: none"> <li>Correlation – between amount of fat around the waist and diabetes/heart disease</li> <li>Cause – chemicals produced by fat cells with can raise blood pressure and increase cholesterol levels in the bloodstream</li> </ul>   |
| <b>12</b> | <b>a</b> | <ul style="list-style-type: none"> <li>Study A, because it used a larger sample of men</li> <li>If two studies get similar results, the conclusions are more reliable.</li> </ul>   |
|           | <b>b</b> | Age, gender, lifestyle factors (e.g. smoking, diet and exercise)  |
|           | <b>c</b> | <ul style="list-style-type: none"> <li>The method and results are published in a scientific journal for other scientists to read.</li> <li>Was the method valid (is it measuring what it meant to measure)? Are there other possible explanations for the results?</li> <li>If other scientists can replicate the results this means the data is more reliable.</li> <li>The claims are accepted for the time being. If new data is found which does not agree with the findings, then scientists will look again at the evidence.</li> </ul> |

## B3 Life on Earth – Higher

### Workbook answers

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| <b>1</b> | <b>a</b> | <p>Competitor – another organism using the same resources</p> <p>DNA – the chemical that carries genetic information</p> <p>Environment – the surroundings (earth, air, water, and other living things)</p> <p>Evolution – the development of new species from simpler forms, over time</p> <p>Extinct – all individuals of the species have died out</p> <p>Species – a group of organisms that can breed to produce fertile offspring</p> <p>Variation – differences between living organisms</p> |
|          | <b>b</b> | Missing words: similarities, fossils, extinct, evidence, simple, DNA, evolutionary  |
|          | <b>c</b> | Fossils, genes  |
|          | <b>d</b> | Movement, respiration, sensitivity, growth, reproduction, excretion, require nutrition  |
|          | <b>e</b> | For example: colour, size (any genetic or environmental examples of variation)  |
|          | <b>f</b> | <ul style="list-style-type: none"> <li>• Genetic variation – red flower/yellow flower, fine hairy roots/long tap root</li> <li>• Environmental variation – wilted leaves/vigorous leaves, holes in some leaves/complete leaves</li> <li>• Genetic variations</li> </ul>   |
| <b>2</b> | <b>a</b> | 5, 4, 2, 3, 1   |
|          | <b>b</b> | <ul style="list-style-type: none"> <li>• The wild primulas showed variation of flower colour.</li> <li>• The plant breeder selected pink primulas.</li> <li>• They then took these plants and bred them together.</li> <li>• The breeder selected offspring with deep pink flowers.</li> <li>• Over several generations the breeder got primulas with red flowers.</li> </ul>   |
|          | <b>c</b> | Head lice   |
|          | <b>d</b> | Headlice are no longer killed by some poisons that previously killed them (they have become resistant).   |
|          | <b>e</b> | A few headlice were able to survive the poison. This variation in headlice was produced by mutation. The resistant headlice bred and their offspring inherited the genes for resisting the poison. Non-resistant headlice died out. Eventually all the headlice in the population were resistant.   |
| <b>3</b> | <b>a</b> | Missing word: DNA   |
|          | <b>b</b> | Missing words: copy, 3500 million, Solar System, theory, conditions   |

|   | <b>c</b>                    | The evidence for where life started on Earth has been interpreted differently by different people. At the present time there isn't enough evidence to disprove either theory.   |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|---|-----------------------------|---|--|-----------------------|------------------------|-------------------------|-----------------------------|--------|--------------------------------|-----------------------------|----------|-------------------------------|------|------|---|-------|------|
|   | <b>d</b>                    | For example: destruction of habitats, hunting, competition, disease   |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|   | <b>e</b>                    | Conditions on Earth changed in the past. Some living things had characteristics which helped them survive these changes. Other living things became extinct.  |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|   | <b>f</b>                    | ... different species   |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
| <b>4</b>                                  | <b>a</b>                    | From left to right: receptor cell, neuron, effector cell<br>For example: temperature receptors in the fingertips, neurons from the fingers to the CNS, muscles in the hand and arm<br><Note: artwork error to be corrected at reprint – the diagram of the effector cell should be a muscle cell>   |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|   | <b>b i</b>                  | Light, moisture   |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|   | <b>ii</b>                   | Dark places are likely to offer more protection from predators. Wet places will prevent them drying out.  |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|   | <b>c</b>                    | Brain, spinal cord  |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|   | <b>d</b>                    | Arrows from left to middle, and middle to right<br>For example: Adrenal gland produces adrenaline. Adrenaline circulates around the body. Adrenaline quickens heart and breathing rates.  |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|   | <b>e</b>                    | <table border="1"> <thead> <tr> <th></th> <th><b>Nervous system</b></th> <th><b>Hormonal system</b></th> </tr> </thead> <tbody> <tr> <td><b>Tissues involved</b></td> <td>neurons, spinal cord, brain</td> <td>glands</td> </tr> <tr> <td><b>How signals are carried</b></td> <td>electrical/nervous impulses</td> <td>hormones</td> </tr> <tr> <td><b>Response fast or slow?</b></td> <td>fast</td> <td>slow</td> </tr> <tr> <td><b>Response lasts long or short time?</b></td> <td>short</td> <td>long</td> </tr> </tbody> </table> |  | <b>Nervous system</b> | <b>Hormonal system</b> | <b>Tissues involved</b> | neurons, spinal cord, brain | glands | <b>How signals are carried</b> | electrical/nervous impulses | hormones | <b>Response fast or slow?</b> | fast | slow | <b>Response lasts long or short time?</b> | short | long |
|   | <b>Nervous system</b>       | <b>Hormonal system</b>  |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
| <b>Tissues involved</b>                   | neurons, spinal cord, brain | glands  |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
| <b>How signals are carried</b>            | electrical/nervous impulses | hormones  |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
| <b>Response fast or slow?</b>             | fast                        | slow  |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
| <b>Response lasts long or short time?</b> | short                       | long  |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|   | <b>f</b>                    | Missing words: feedback, nerve cells, sweating, nervous system, constant  |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|   | <b>g</b>                    | Insulin is one hormone which keeps the level of glucose in blood constant.  |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
| <b>5</b>                                  | <b>a</b>                    | Individuals within a species vary. Using more data will be more reliable.   |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|   | <b>b</b>                    | Hominids with bigger brains survived better than those with smaller brains.   |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|   | <b>c</b>                    | Hominid species with bigger brains were better equipped to survive changes in their environment. Species with smaller brains could not do this.   |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|   | <b>d</b>                    | <i>Homo sapiens</i> used their larger brains to solve problems so they could survive. They communicated better, so they worked together to help them survive.   |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |
|   | <b>e</b>                    | (Left) common ancestor, (middle) early hominids, (right) modern humans  |  |                       |                        |                         |                             |        |                                |                             |          |                               |      |      |   |       |      |

|            |            |   |
|------------|------------|---|
| <b>6</b>   | <b>a</b>   | <p>Data – facts collected together</p> <p>Evidence – facts tending to support or disprove an explanation</p> <p>Explanation – a way of accounting for some facts</p> <p>Observation – a measurement, or experimental record</p> <p>&lt;Note: error to be corrected at reprint – ‘prove’ will be changed to ‘support’.&gt;</p>   |
|            | <b>b i</b> | <b>B</b>  |
|            | <b>ii</b>  | Human feet are more similar to gorilla feet than to chimpanzee feet.  |
| <b>c</b>   |            | No – the DNA evidence would suggest that we have more in common with chimpanzees.   |
| <b>d i</b> |            | Darwin’s explanation – ‘evolution of life on Earth could have happened through characteristics that were inherited and a process of natural selection’  |
|            | <b>ii</b>  | An observation that is accounted for by this explanation – ‘members of a single species showed considerable variation’ / ‘members of one species are in competition for food and space’   |
|            | <b>iii</b> | Darwin was able to account for all his observations with an explanation that linked these observations in a way that no one had thought of before (‘if some members of a species were better suited to survive they would have more offspring’).  |
|            | <b>iv</b>  | Mendel provided data that was the evidence needed to describe how characteristics were inherited.   |
|            | <b>v</b>   | Darwin’s explanations went against the Bible, which said that all life on Earth was created in six days. The church played a powerful role in society in Darwin’s time, and people did not want to go against the strong views of some clergy by agreeing with him.   |
| <b>7</b>   | <b>a i</b> | They would be better camouflaged on darker trunks from predation by birds.  |
|            | <b>ii</b>  | A change in the gene controlling moth colour. (A change in the DNA code).   |
|            | <b>iii</b> | The mutated gene would be passed on at fertilisation during sexual reproduction.  |
|            | <b>b</b>   | <ul style="list-style-type: none"> <li>• Mutations produce variation in the population.</li> <li>• A change in the environment means that some individuals may no longer be able to survive in the new conditions.</li> <li>• Natural selection means that individuals with characteristics that enable them to survive better will be more successful and reproduce, passing on their genes to their offspring.</li> <li>• Over many generations the genes that produce successful characteristics will be more common in the population than genes that produce less successful characteristics.</li> </ul> |
| <b>8</b>   | <b>a</b>   | <p>Endangered – at risk of becoming extinct</p> <p>Habitat – the place where an organism naturally lives</p> <p>Predator – an animal that kills other animals (its prey) for food</p>   |

|           |          |            |   |
|-----------|----------|------------|---|
|           | <b>b</b> | <b>i</b>   | Vegetation  |
|           |          | <b>ii</b>  | Both depend on lemmings for their food.   |
|           |          | <b>iii</b> | If the vegetation changed in a way that was disadvantageous to lemmings, then the number of lemmings would fall and there would be increased competition between the other species in the food web.   |
|           |          | <b>iv</b>  | There would be more lemmings for the other species (foxes, weasels and snowy owl), so their numbers would increase.   |
|           |          | <b>v</b>   | If the wolves ate lemmings, there would be fewer lemmings to go around, so the numbers of some species in the food web would decrease. Also, a wolf may feed off some of the other animals (e.g. weasels) so their numbers would decrease further.  |
|           | <b>c</b> |            | Disease<br>New species, which may be a competitor or a predator.  |
| <b>9</b>  | <b>a</b> |            | In a random selection, the sites are chosen with no bias or organised method of selection.  |
|           | <b>b</b> |            | By using a standard procedure, the scientists were able to compare like with like. This would make their results more reliable, as it would eliminate other factors that may affect the results.  |
|           | <b>c</b> |            | Variation within a hedge could be wide, so by sampling a long section and averaging the results the scientists could get a better estimate of species found in the hedge.   |
|           | <b>d</b> |            | Collect data on all the species present in many different hedges. Use local records to determine where possible how long each hedge has been there. Compare the distribution of species in hedges of different ages. Is there a correlation between age of hedge and number of different species present?                                 |
| <b>10</b> | <b>a</b> |            | The number of different species of plant living in hedges has decreased, as has the number of dormice.  |
|           | <b>b</b> |            | Machine cutting is indiscriminate - it damages and destroys all species of plants living in the hedge. If this is done annually, plants do not get a chance to establish so fewer species survive. Dormice feed of the fruits, nuts and seeds of these plants, so fewer plants leads to less food for dormice, so their numbers decrease. |
|           | <b>c</b> |            | The more species of plants in a hedge there are, the more variety of food there will be for the dormice.  |
|           | <b>d</b> |            | If machine cutting is inevitable, then cut less often to give time for plant species to establish in the hedge. Otherwise cut by hand for more careful trimming.  |
| <b>11</b> | <b>a</b> |            | Sustainable – does not lead to a reduction of natural resources for the future<br>Direct effect – an immediate straightforward effect<br>Indirect effect – a roundabout effect, not directly connected to the cause<br>Biodiversity – the variety of living organisms present   |

|           |          |  |
|-----------|----------|--|
|           | <b>b</b> | <p>Threats caused by direct human activity:</p> <ul style="list-style-type: none"> <li>• hunted for shell, meat, and eggs</li> <li>• caught and drowned in fishing nets</li> </ul> <p>Threats caused by indirect human activity:</p> <ul style="list-style-type: none"> <li>• egg-laying beaches disrupted</li> </ul> <p>(It could be argued that 'caught and drowned in fishing nets' is indirect because it was not the direct purpose of the activity.)</p>   |
|           | <b>c</b> | <p>They are at risk of extinction.</p>   |
|           | <b>d</b> | <p>Extinctions caused by direct human activity:</p> <ul style="list-style-type: none"> <li>• great auk</li> <li>• passenger pigeon</li> </ul> <p>Extinctions caused by indirect human activity:</p> <ul style="list-style-type: none"> <li>• large blue butterfly</li> <li>• dodo</li> </ul> <p>Students may come up with other valid examples.</p>  |
| <b>12</b> |          | <ul style="list-style-type: none"> <li>• Future foods: we need to maintain a wide variety of plant and animal species so that if one should become extinct there are others still available as food and within food chains/webs. If cultivated crops or farm animals become susceptible to particular disease, then we will need other wild varieties to breed them with to try and develop varieties which are not susceptible to disease.</li> <li>• Future fuels: an alternative to fossils fuels (which will run out) are biofuels, produced from plants of various species. We need to maintain a variety of plant species, so that should one die out there are others to replace it as a source of biofuel.</li> <li>• Future fibres: when oil runs out, so will synthetic fibres. So we need to maintain varied plant and animal species that will provide fibres with varied properties (e.g. cotton, silk).</li> <li>• Future medicines: many plants have medicinal properties, so a reduction in plant species would deprive future generations of natural remedies and useful plant extracts.</li> </ul> |