

4 Red blood cells contain haemoglobin.

(a) Oxygen molecules enter red blood cells and bind to haemoglobin.

Glucose molecules can also enter red blood cells.

The table gives some information about these molecules.

| Molecule | Properties                |
|----------|---------------------------|
| Glucose  | large, polar molecule     |
| Oxygen   | small, non-polar molecule |

Describe how oxygen and glucose molecules can enter red blood cells.

(2)

Oxygen.....

.....

.....

.....

Glucose.....

.....

.....

.....

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- 7 Obesity indicators, such as body mass index (BMI), can be used to assess the risk of a person developing coronary heart disease (CHD).

(a) The table shows categories of BMI.

| BMI             | Classification |
|-----------------|----------------|
| Less than 20    | underweight    |
| 20–24.9         | normal         |
| 25–29.9         | overweight     |
| 30–40           | obese          |
| Greater than 40 | severely obese |

A man has a body mass of 65 kg.

He has a normal BMI.

Calculate the minimum and maximum possible heights for this man in metres.

Use the formula

$$\text{BMI} = \frac{\text{mass}}{(\text{height in m})^2}$$

(2)

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minimum height ..... m

maximum height ..... m



P 7 4 4 7 2 A 0 2 1 3 2

(d) Atherosclerosis is a type of cardiovascular disease (CVD) that causes the narrowing of coronary arteries.

(i) How many of the following types of medication would reduce the risk of CVD?

(1)

- anticoagulants
- antihypertensives
- statins

☐ **A** none

☐ **B** one

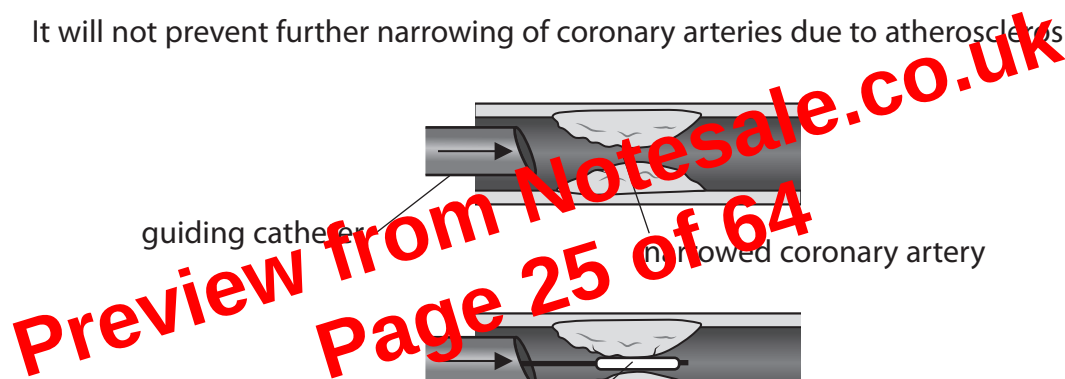
☐ **C** two

☐ **D** three

The diagram shows a procedure called balloon angioplasty.

Balloon angioplasty can reduce the immediate risk of a person having a heart attack.

It will not prevent further narrowing of coronary arteries due to atherosclerosis.



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| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                                                      | Additional Guidance                               | Mark |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------|
| 1(a)(iii)       | <p>A description that makes reference to three of the following:</p> <ul style="list-style-type: none"> <li>closes during diastole (1)</li> <li>(closes) to prevent backflow of blood (into the {heart / (right) ventricle}) (1)</li> <li>opens during ventricular systole (1)</li> <li>opens as blood {is pumped into / enters} the artery / out of the {heart / ventricle} (1)</li> </ul> | <p>ignore atrial systole</p> <p>reject atrium</p> | (3)  |

| Question Number | Answer                                | Additional Guidance | Mark |
|-----------------|---------------------------------------|---------------------|------|
| 1(b)(i)         | vena cava has larger lumen than aorta |                     | (1)  |

| Question Number | Answer                                                                                                                                                                                                                                                                                             | Mark |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 1(b)(ii)        | <p>B – endothelial cells</p> <p><i>A is incorrect because collagen would not be in contact with blood</i></p> <p><i>C is incorrect because epithelial cells would not be in contact with blood</i></p> <p><i>D is incorrect because smooth muscle cells would not be in contact with blood</i></p> | (1)  |

| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                                                                | Additional Guidance                                                                                                      | Mark |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------|
| 4(c)(i)         | <p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> <li>saline / solution with no alcohol / 0.00% alcohol solution / {solvent / saline} used to dilute alcohol solutions (1)</li> <li>to calculate percentage of cells which have undergone haemolysis without alcohol being present / to see if cells undergo haemolysis in absence of alcohol (1)</li> </ul> | <p>ignore {(distilled) water / no alcohol} unqualified</p> <p>ALLOW baseline value to compare with alcohol solutions</p> | (2)  |

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| Question Number | Answer                                                                                                                                                                                                                                                                                                                   | Additional Guidance                                                                          | Mark |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------|
| 5(a)(i)         | <p>A description that makes reference to two of the following:</p> <ul style="list-style-type: none"> <li>• (catalyses) condensation reactions (1)</li> <li>• to {join / bond} DNA (mono)nucleotides together (1)</li> <li>• forming phosphodiester bonds (between phosphate group and deoxyribose sugar) (1)</li> </ul> | <p>ALLOW nucleotides unqualified<br/>reject RNA nucleotides</p> <p>ignore hydrogen bonds</p> | (2)  |

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| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Additional Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Mark |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 5(a)(ii)        | <p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> <li>• (this property of DNA polymerase) would reduce the number of {mutations / faulty alleles} (1)</li> <li>• (ensuring) the correct {base sequence / mRNA sequence / allele} is produced (1)</li> <li>• (ensuring) the correct {amino acid sequence / polypeptide / protein} is produced (1)</li> <li>• reducing the chance of {cancer / genetic disease} (1)</li> </ul> | <p>ALLOW errors in DNA replication cause {mutations / change in base sequence / changes in bases}</p> <p>ALLOW faulty bases are replaced<br/>ALLOW the (original) base sequence is {not changed / restored}<br/>ignore errors are corrected</p> <p>ALLOW incorrect base sequence can result in the production of a {polypeptide with a different primary structure / non-functioning protein}<br/>ALLOW description of change in active site shape changing {number of enzyme-substrate complexes formed / rate of reaction}</p> <p>ALLOW uncontrolled cell division<br/>ignore disease unqualified</p> | (4)  |



| Additional Guidance |     |                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Level 1             | 1-2 | <p>An explanation of how the investigation should be modified may be attempted but with limited analysis, interpretation and/or evaluation of the scientific information. Generalised comments made.</p> <p>The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.</p>     | <p>A basic method described with reference to range of enzyme concentrations and use of starch and iodine solutions.</p> <p>Consideration of one of the following:</p> <ul style="list-style-type: none"> <li>performed at both temperatures – 30°C and 45°C</li> <li>variables to be controlled</li> <li>how to control at least one variable</li> <li>how to measure rate of reaction</li> <li>how to calculate rate of reaction</li> </ul> |
| Level 2             | 3-4 | <p>An explanation of how the investigation should be modified will be given with occasional evidence of analysis, interpretation and/or evaluation of the scientific information.</p> <p>The explanation shows some linkages and lines of scientific reasoning with some structure.</p>                                                             | <p>Level 1 plus</p> <p>Consideration of two more of the following:</p> <ul style="list-style-type: none"> <li>performed at both temperatures – 30°C and 45°C</li> <li>variables to be controlled</li> <li>how to control at least one variable</li> <li>how to measure rate of reaction</li> <li>how to calculate rate of reaction</li> </ul>                                                                                                 |
| Level 3             | 5-6 | <p>An explanation of how the investigation should be modified is given which is supported throughout by evidence from the analysis, interpretation and/or evaluation of the scientific information.</p> <p>The explanation shows a well-developed and sustained line of scientific reasoning which is clear, coherent and logically structured.</p> | <p>A detailed method for a valid investigation which also includes how to calculate rate of reaction from the dependent variable data</p>                                                                                                                                                                                                                                                                                                     |

| Question Number | Answer                                                                                                                                      | Additional Guidance                                                                                                                                                                                                                                                                                       | Mark |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 7(b)(ii)        | <p>An answer that makes reference to the following:</p> <ul style="list-style-type: none"> <li>• correct risk factor for CHD (1)</li> </ul> | <p>e.g. {genetic / family history of CHD}, stress, high cholesterol diet, low HDL:LDL, high salt diet, smoking, high blood pressure, lack of exercise / diabetes<br/> ignore diet unqualified<br/> ignore alcohol unless refer to excess<br/> ignore age – unless stated that risk increases with age</p> | (1)  |