

Q1. (2018)

|   |  |  |     |   |     |  |
|---|--|--|-----|---|-----|--|
| 1 |  |  | C ✓ | 1 | 1.1 |  |
|---|--|--|-----|---|-----|--|

Q2. (2018)

|   |  |  |     |   |     |  |
|---|--|--|-----|---|-----|--|
| 2 |  |  | B ✓ | 1 | 1.2 |  |
|---|--|--|-----|---|-----|--|

Q3. (2018)

|   |  |  |     |   |     |  |
|---|--|--|-----|---|-----|--|
| 3 |  |  | B ✓ | 1 | 2.1 |  |
|---|--|--|-----|---|-----|--|

Q4. (2018)

|   |  |  |     |   |     |  |
|---|--|--|-----|---|-----|--|
| 6 |  |  | C ✓ | 1 | 1.1 |  |
|---|--|--|-----|---|-----|--|

Q5. (2018)

|   |  |  |     |   |     |  |
|---|--|--|-----|---|-----|--|
| 7 |  |  | A ✓ | 1 | 1.1 |  |
|---|--|--|-----|---|-----|--|

Q6. (2018)

|    |  |  |     |   |     |  |
|----|--|--|-----|---|-----|--|
| 12 |  |  | D ✓ | 1 | 2.2 |  |
|----|--|--|-----|---|-----|--|

Q7. (2018)

|    |  |  |     |   |     |  |
|----|--|--|-----|---|-----|--|
| 13 |  |  | C ✓ | 1 | 1.1 |  |
|----|--|--|-----|---|-----|--|

Q8. (2018)

|    |  |  |     |   |     |  |
|----|--|--|-----|---|-----|--|
| 14 |  |  | B ✓ | 1 | 1.1 |  |
|----|--|--|-----|---|-----|--|

Q9. (2018)

A)

|    |     |  |                                                                                                                   |   |         |                                                                                                               |
|----|-----|--|-------------------------------------------------------------------------------------------------------------------|---|---------|---------------------------------------------------------------------------------------------------------------|
| 16 | (a) |  | can control temperature (easier)/<br>can be set to a specific / constant temperature ✓<br><br>limited fire risk ✓ | 2 | 2 x 2.2 | <b>IGNORE</b> reference to ease of measurement<br><br><b>ALLOW</b> less risk of burns<br><br><b>ALLOW</b> ORA |
|----|-----|--|-------------------------------------------------------------------------------------------------------------------|---|---------|---------------------------------------------------------------------------------------------------------------|

B)

|  |     |  |                                                                                                                                                                                                                                                                                     |   |         |                                                                                                                                                                                          |
|--|-----|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | (b) |  | for 60°C / high temperatures:<br><br>idea that (membranes break down) at 60°C releasing more DNA / DNA is extracted easily ✓<br><br>against 60°C / high temperatures:<br><br>increased risk of DNA breaking down at 60°C / more DNA destroyed at 60°C / DNA not preserved at 60°C ✓ | 2 | 2 x 2.2 | <b>ALLOW</b> idea that enzymes destroying DNA are denatured so less DNA destroyed<br><br><br><br>Answers must make it clear which temperature they are referring to.<br><b>ALLOW</b> ORA |
|--|-----|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

C)

|  |     |                                                                                                                                                                                                                                                    |   |         |                                                                                                                   |
|--|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|-------------------------------------------------------------------------------------------------------------------|
|  | (c) | wear face mask / goggles<br>to prevent protease/ethanol/chemicals being inhaled /<br>entering eyes✓<br><br>gloves / use tongs<br>prevent ethanol/protease/chemicals being in contact with<br>skin✓<br><br>turn Bunsen off as ethanol is flammable✓ | 2 | 2 x 2.2 | <b>ALLOW</b> use tongs as solution/ tube may be hot<br><br><b>IGNORE</b> reference to lab coats / glass breakages |
|--|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|-------------------------------------------------------------------------------------------------------------------|

D)

|  |     |     |                                                                                                                                                               |   |                |  |
|--|-----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----------------|--|
|  | (d) | (i) | <b>First check answer on answer line</b><br><b>If answer = 33.1 (mg) award 2 marks</b><br><br>$\frac{99.2}{3}$ <b>OR</b> 33.067 / 33.07✓<br><br>= 33.1 (mg) ✓ | 2 | 1.2<br><br>2.2 |  |
|--|-----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----------------|--|

E)

|  |  |      |                                                                                                                                              |   |          |                                                                                                        |
|--|--|------|----------------------------------------------------------------------------------------------------------------------------------------------|---|----------|--------------------------------------------------------------------------------------------------------|
|  |  | (ii) | (yes because)<br><br>idea that there is a greater mean / yield / mass produced<br>(of DNA)✓<br><br>there is less range/variation in results✓ | 2 | 2 x 3.1b | <b>ALLOW</b> ECF<br><br><b>ALLOW</b> examples of data from table to indicate<br>less range/variability |
|--|--|------|----------------------------------------------------------------------------------------------------------------------------------------------|---|----------|--------------------------------------------------------------------------------------------------------|

Q10. (2019)

|   |  |  |   |   |     |  |
|---|--|--|---|---|-----|--|
| 3 |  |  | A | 1 | 1.1 |  |
|---|--|--|---|---|-----|--|

Q11. (2019)

|   |  |  |   |   |     |  |
|---|--|--|---|---|-----|--|
| 4 |  |  | C | 1 | 1.1 |  |
|---|--|--|---|---|-----|--|

Q12. (2019)

|   |  |  |   |   |     |  |
|---|--|--|---|---|-----|--|
| 5 |  |  | C | 1 | 1.1 |  |
|---|--|--|---|---|-----|--|

Q13. (2019)

|   |  |  |   |   |     |  |
|---|--|--|---|---|-----|--|
| 8 |  |  | B | 1 | 1.2 |  |
|---|--|--|---|---|-----|--|

Q14. (2019)

|    |  |  |   |   |     |  |
|----|--|--|---|---|-----|--|
| 11 |  |  | B | 1 | 1.2 |  |
|----|--|--|---|---|-----|--|

Q15. (2019)

|    |  |  |   |   |     |  |
|----|--|--|---|---|-----|--|
| 12 |  |  | B | 1 | 2.2 |  |
|----|--|--|---|---|-----|--|

Q16. (2019)

A)

|    |     |  |                                               |   |     |                                                            |
|----|-----|--|-----------------------------------------------|---|-----|------------------------------------------------------------|
| 17 | (a) |  | alcohol / ethanol <b>and</b> carbon dioxide ✓ | 1 | 1.1 | <b>ALLOW</b> either order<br><b>ALLOW</b> correct formulae |
|----|-----|--|-----------------------------------------------|---|-----|------------------------------------------------------------|

B)

|    |     |  |                                                                                                                                                                                     |   |     |                                                                                                                                                                                        |
|----|-----|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17 | (b) |  | Any two from:<br>alcohol produced in yeast (not humans) / ORA✓<br><br>lactic acid produced by humans (not yeast) / ORA✓<br><br>carbon dioxide produced by yeast (not humans) / ORA✓ | 2 | 1.1 | If any incorrect product is stated, then max 1 mark.<br>If yeast or humans are not stated assume answer refers to yeast<br><br><b>IGNORE</b> reference to oxygen debt / ATP production |
|----|-----|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

C)

|    |     |     |           |   |      |  |
|----|-----|-----|-----------|---|------|--|
| 17 | (c) | (i) | sucrose ✓ | 1 | 3.2a |  |
|----|-----|-----|-----------|---|------|--|

D)

|    |     |      |                                                                                                                      |   |     |  |
|----|-----|------|----------------------------------------------------------------------------------------------------------------------|---|-----|--|
| 17 | (c) | (ii) | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br><b>If answer = 12 award 2 marks</b><br><br>6.0 ÷ 0.5 ✓<br><br>= 12 ✓ | 2 | 2.2 |  |
|----|-----|------|----------------------------------------------------------------------------------------------------------------------|---|-----|--|

E)

|    |     |       |           |   |      |  |
|----|-----|-------|-----------|---|------|--|
| 17 | (c) | (iii) | glucose ✓ | 1 | 3.2a |  |
|----|-----|-------|-----------|---|------|--|

F)

|    |     |      |                                                                                                                          |   |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----|-----|------|--------------------------------------------------------------------------------------------------------------------------|---|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17 | (c) | (iv) | (Yeast B) doesn't ferment fructose ✓<br><br><br><br><br><br><br><br><br><br>(Yeast B) produces some fermented products ✓ | 2 | 3.1a | <b>ALLOW</b> (Yeast B) does not use up fructose / fructose levels decrease slightly / fructose levels remain high / higher yield of fructose / fructose levels remain constant<br><b>ALLOW</b> reverse arguments for Yeast A<br><b>DO NOT ALLOW</b> fructose is produced<br><br><b>ALLOW</b> fermented products increased<br><b>DO NOT ALLOW</b> fermented products produced from fructose<br><b>DO NOT ALLOW</b> produces high levels of fermented products<br><b>IGNORE</b> fermented product level stays the same / less fermented product than A |
|----|-----|------|--------------------------------------------------------------------------------------------------------------------------|---|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Q17. (2019)

|    |     |  |                                                                                                                                                                                                                                             |   |          |                                                                                                                                                                                                                                                                                                                    |
|----|-----|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 18 | (a) |  | iodine (molecules) moved into bag / through membrane ✓<br><br>starch (molecules) cannot move through membrane / out of the bag ✓<br><br>starch molecule are large / iodine molecule are small / starch molecules larger than iodine / ORA ✓ | 3 | 2 x 3.2a | <b>ALLOW</b> iodine moved into starch solution<br><b>DO NOT ALLOW</b> iodine moved by osmosis through membrane<br><br><b>ALLOW</b> starch cannot diffuse through membrane<br><b>DO NOT ALLOW</b> starch cannot move by osmosis through membrane<br><br>2.1 <b>ALLOW</b> iodine smaller than pores in membrane/ORA✓ |
|----|-----|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Q18. (2019)

A)

|    |     |  |                                                                                                                                                    |   |     |                                                  |
|----|-----|--|----------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|--------------------------------------------------|
| 20 | (c) |  | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br>If answer = $4 \times 10^{-2}$ (mm) award 2 marks<br><br>0.04 ✓<br><br>= $4 \times 10^{-2}$ (mm) ✓ | 2 | 2.2 | <b>ALLOW</b> correct variations of standard form |
|----|-----|--|----------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|--------------------------------------------------|

B)

|    |     |  |                                                                                                                                                                                                                                                                                                                               |   |     |                                                                          |
|----|-----|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|--------------------------------------------------------------------------|
| 20 | (d) |  | increased resolution / high magnification / sub-cellular structures visible ✓<br><br>(can only be done on) dead material / thin sections only / gives 2-D / expensive (equipment) / possible distortion of material in preparation / less mobile / preparation takes longer/is more complex / (only) black and white images ✓ | 2 | 2.2 | <b>IGNORE</b> clearer/sharper/more detailed images / can see small cells |
|----|-----|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|--------------------------------------------------------------------------|

Q19. (2019)

A)

|    |     |     |                                                                                                                                                                                                                                 |   |     |  |
|----|-----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|--|
| 22 | (a) | (i) | <b>Any two from:</b><br><u>transcription</u> ✓<br><br>DNA (template) used to code for/make mRNA ✓<br><br>mRNA nucleotides/bases used to synthesis a mRNA molecule /<br>mRNA nucleotides/bases pair with DNA nucleotides/bases ✓ | 2 | 1.1 |  |
|----|-----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|--|

B)

|  |  |      |                                                                                                                                                                                                                                                 |   |     |                                                                                                                                    |
|--|--|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|------------------------------------------------------------------------------------------------------------------------------------|
|  |  | (ii) | <b>Any two from:</b><br><u>translation</u> ✓<br><br>mRNA attaches to ribosome ✓<br><br>tRNA is a carrier molecule for amino acids /<br>tRNA/carrier molecule brings (correct) amino acids into place /<br>tRNA reads the triplets on the mRNA ✓ | 2 | 1.1 | <b>ALLOW</b> each triplet code on tRNA/carrier molecule is specific for an amino acid.<br><b>DO NOT ALLOW</b> amino acids are made |
|--|--|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|------------------------------------------------------------------------------------------------------------------------------------|

Q20. (2020)

|   |  |  |     |   |     |  |
|---|--|--|-----|---|-----|--|
| 4 |  |  | B ✓ | 1 | 1.1 |  |
|---|--|--|-----|---|-----|--|

Q21. (2020)

|   |  |  |     |   |     |  |
|---|--|--|-----|---|-----|--|
| 8 |  |  | B ✓ | 1 | 2.1 |  |
|---|--|--|-----|---|-----|--|

Q22. (2020)

A)

|    |     |  |                                                               |   |      |                                                                                                                        |
|----|-----|--|---------------------------------------------------------------|---|------|------------------------------------------------------------------------------------------------------------------------|
| 18 | (a) |  | more accurate/precise measurement (of volume/amount of gas) ✓ | 1 | 3.3b | <b>ALLOW</b> gas could dissolve in water / less gas can escape<br><b>IGNORE</b> gives exact measurement of gas release |
|----|-----|--|---------------------------------------------------------------|---|------|------------------------------------------------------------------------------------------------------------------------|

B)

|  |     |     |                                                                                                                                                                                                                                                            |   |                                |                                                                                            |
|--|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------|--------------------------------------------------------------------------------------------|
|  | (b) | (i) | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br>If answer = $2.3 \text{ (cm}^3 \text{ / min)}$ award 3 marks<br><br>$\frac{25+23+22}{3} = 23.333333 \text{ ✓}$<br><br>$\frac{23.3}{10} = 2.333333 \text{ ✓}$<br><br>= $2.3 \text{ (cm}^3 \text{ / min)}$ ✓ | 3 | <br><br>1 x 1.2<br><br>2 x 2.2 | <b>ALLOW</b> one mark for clear evidence of rounding incorrect answer correctly to one dp. |
|--|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------|--------------------------------------------------------------------------------------------|

C)

|  |  |      |                                                                                                                                                                                                      |   |         |                                                                                                                                       |
|--|--|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|---------------------------------------------------------------------------------------------------------------------------------------|
|  |  | (ii) | increased movement of molecules / increased kinetic energy ✓<br><br>therefore, more chance of substrate colliding with enzymes/active sites ✓<br><br>more chance of substrate entering active site ✓ | 3 | 2 x 2.1 | increased KE of enzymes and substrates leads to more collisions = 2 marks<br><br><b>ALLOW</b> more enzyme-substrate complexes forming |
|--|--|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|---------------------------------------------------------------------------------------------------------------------------------------|

D)

|  |  |     |                                                                                                                                                     |   |     |                                                                                                  |
|--|--|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|--------------------------------------------------------------------------------------------------|
|  |  | (c) | (phenols) alter the shape of the active site/enzyme / block active site/enzyme ✓<br><br>so substrate no longer fits/binds with active site/enzyme ✓ | 2 | 2.1 | <b>IGNORE</b> reference to denaturing<br><br>need reference to active site once only for 2 marks |
|--|--|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|--------------------------------------------------------------------------------------------------|

Q23. (2020)

A)

|    |     |  |                                                                                                                                                                                                                                                                                                         |   |         |                                              |
|----|-----|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|----------------------------------------------|
| 22 | (a) |  | <b>Any four from:</b><br>DNA unwinds/unzips ✓<br><br>during transcription mRNA is made ✓<br><br>mRNA moves from the nucleus to the cytoplasm/ribosomes ✓<br><br>translation on the ribosomes ✓<br><br>carrier molecules/tRNA bring specific amino acids ✓<br><br>amino acids joined to form a protein ✓ | 4 | 4 x 1.1 | <b>DO NOT ALLOW</b> amino acids are produced |
|----|-----|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|----------------------------------------------|

B)

|  |     |     |                            |   |         |  |
|--|-----|-----|----------------------------|---|---------|--|
|  | (b) | (i) | polymers ✓      monomers ✓ | 2 | 2 x 1.1 |  |
|--|-----|-----|----------------------------|---|---------|--|

Q24. (2021)

|   |  |  |    |   |     |  |
|---|--|--|----|---|-----|--|
| 5 |  |  | D✓ | 1 | 1.2 |  |
|---|--|--|----|---|-----|--|

Q25. (2021)

|   |  |  |    |   |     |  |
|---|--|--|----|---|-----|--|
| 7 |  |  | C✓ | 1 | 1.1 |  |
|---|--|--|----|---|-----|--|

Q26. (2021)

A)

|  |     |     |                                                                                                                                                                                                |   |         |                                                                                                                                                                                                                                                 |
|--|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | (b) | (i) | Menstrual blood cells are adult stem cells / Menstrual blood cells/adult stem cells can only form certain types of cells ✓<br><br>(Embryo stem cells) can produce a wide range of cell types ✓ | 2 | 2 x 2.1 | <b>ALLOW</b> Menstrual blood cells can only specialise into blood cells / menstrual blood cells are multipotent/partially differentiated<br><br><b>ALLOW</b> Embryo stem cells can produce any type of cell / embryo stem cells are pluripotent |
|--|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

B)

|  |  |      |                                                                                                                                                         |   |         |  |
|--|--|------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|--|
|  |  | (ii) | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br><b>If answer = 77.6 (hours) award 2 marks</b><br><br>4 (generations) ✓<br><br>4 x 19.4 = 77.6 (hours) ✓ | 2 | 2 x 2.2 |  |
|--|--|------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|--|

C)

|  |  |       |                                    |   |     |                                                |
|--|--|-------|------------------------------------|---|-----|------------------------------------------------|
|  |  | (iii) | $\frac{48}{19.4} = 2.5 \checkmark$ | 1 | 2.2 | ALLOW 2.4742 etc<br>ALLOW any correct rounding |
|--|--|-------|------------------------------------|---|-----|------------------------------------------------|

D)

|  |  |      |                                                                                                                                                                                                                                                                                                          |   |          |                                                                                                                                                                                                      |
|--|--|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | (iv) | <b>Any two from:</b><br>Quick to culture / divide rapidly / fast growth $\checkmark$<br>Easily obtainable source of stem cells $\checkmark$<br>Frequently accessible source of stem cells $\checkmark$<br>Less ethical issues in obtaining them (compared to stem cells from embryo tissue) $\checkmark$ | 2 | 2 x 3.1b | ALLOW reverse argument for embryo stem cells if stated<br>assume menstrual blood stem cells if not stated<br>IGNORE just quicker<br>ALLOW idea of less invasive technique<br>IGNORE just supply more |
|--|--|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Q27. (2021)

A)

|    |     |     |                                                                                                    |   |         |                                                                                                                 |
|----|-----|-----|----------------------------------------------------------------------------------------------------|---|---------|-----------------------------------------------------------------------------------------------------------------|
| 22 | (a) | (i) | S = DNA synthesis / replication $\checkmark$<br>M = movement of chromosomes / mitosis $\checkmark$ | 2 | 2 x 1.1 | ALLOW chromosome replication<br>ALLOW cytokinesis / cell division / chromosomes divided or split into two cells |
|----|-----|-----|----------------------------------------------------------------------------------------------------|---|---------|-----------------------------------------------------------------------------------------------------------------|

B)

|  |  |      |                                                        |   |     |  |
|--|--|------|--------------------------------------------------------|---|-----|--|
|  |  | (ii) | Allows organisms to become more efficient $\checkmark$ | 1 | 1.1 |  |
|--|--|------|--------------------------------------------------------|---|-----|--|

C)

|  |  |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--|--|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | (b) | Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.<br><b>Level 3 (5–6 marks)</b><br>Demonstrates detailed knowledge and understanding to describe protein synthesis.<br><b>AND</b><br>Applies knowledge and understanding of protein synthesis to explain the action of Actinomycin D.<br><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i><br><b>Level 2 (3–4 marks)</b><br>Demonstrates detailed knowledge and understanding to describe protein synthesis.<br><b>OR</b><br>Applies knowledge and understanding of protein synthesis to explain the action of Actinomycin D.<br><b>OR</b><br>Demonstrates knowledge and understanding to describe protein synthesis.<br><b>AND</b><br>Attempts to apply knowledge and understanding of protein synthesis to explain the action of Actinomycin D. | 6 | 2 x 1.1<br>4 x 2.1 | <b>AO1.1 Demonstrate knowledge and understanding to describe protein synthesis</b> <ul style="list-style-type: none"> <li>the unzipping of the DNA molecule around the gene</li> <li>copying to mRNA in nucleus (transcription)</li> <li>(translation) of the nucleotide sequence in the cytoplasm</li> </ul> <b>AO2.1 Apply knowledge and understanding of protein synthesis to explain the action of Actinomycin D/drug</b> <ul style="list-style-type: none"> <li>only unzipped DNA blocked so this means copying to mRNA does not happen</li> <li>no new mRNA made/transcription is prevented</li> <li>mRNA already made / DNA unwound is unaffected</li> <li>the mRNA already in cytoplasm can continue to translate the nucleotide sequence to form proteins on ribosomes</li> </ul> |
|--|--|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |
|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
|  |  | <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b><br/>Demonstrates limited knowledge and understanding to describe protein synthesis.</p> <p><b>OR</b><br/>Attempts to apply knowledge and understanding of protein synthesis to explain the action of Actinomycin D.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p><b>0 marks</b><br/>No response or no response worthy of credit.</p> |  |  |  |
|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|

D)

|  |     |                                                                                                                                  |   |         |                                                                                                                                                    |
|--|-----|----------------------------------------------------------------------------------------------------------------------------------|---|---------|----------------------------------------------------------------------------------------------------------------------------------------------------|
|  | (d) | <p>DNA determines the sequence of amino acids in a protein ✓</p> <p>Order of bases (in DNA) determines the type of protein ✓</p> | 2 | 2 x 1.1 | <p><b>IGNORE</b> order of bases determine which amino acids are made</p> <p>Order of bases in DNA determines the amino acid sequence = 2 marks</p> |
|--|-----|----------------------------------------------------------------------------------------------------------------------------------|---|---------|----------------------------------------------------------------------------------------------------------------------------------------------------|

Q28. (2022)

|   |     |   |     |  |
|---|-----|---|-----|--|
| 7 | C ✓ | 1 | 1.1 |  |
|---|-----|---|-----|--|

Q29. (2022)

|   |     |   |     |  |
|---|-----|---|-----|--|
| 8 | C ✓ | 1 | 2.1 |  |
|---|-----|---|-----|--|

Q30. (2022)

|    |     |   |     |  |
|----|-----|---|-----|--|
| 12 | B ✓ | 1 | 2.2 |  |
|----|-----|---|-----|--|

Q31. (2022)

|    |     |   |     |  |
|----|-----|---|-----|--|
| 13 | B ✓ | 1 | 2.1 |  |
|----|-----|---|-----|--|

Q32. (2022)

|    |     |   |     |  |
|----|-----|---|-----|--|
| 14 | B ✓ | 1 | 1.1 |  |
|----|-----|---|-----|--|

Q33. (2022)

A)

|    |     |     |                                                        |   |         |                     |
|----|-----|-----|--------------------------------------------------------|---|---------|---------------------|
| 16 | (a) | (i) | <p>Lipase ✓</p> <p>Fatty acids ✓</p> <p>Glycerol ✓</p> | 3 | 3 x 2.1 | <b>ALLOW</b> enzyme |
|----|-----|-----|--------------------------------------------------------|---|---------|---------------------|

B)

|  |  |      |                                                                                              |   |         |                                                 |
|--|--|------|----------------------------------------------------------------------------------------------|---|---------|-------------------------------------------------|
|  |  | (ii) | <p>Curve that goes up (and down) ✓</p> <p>Curve that shows peak/maximum in alkaline pH ✓</p> | 2 | 2 x 2.1 | <b>ALLOW</b> any pH peak/maximum greater than 7 |
|--|--|------|----------------------------------------------------------------------------------------------|---|---------|-------------------------------------------------|

C)

|  |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |          |                                                                                                                                                                                                                                                                                                                             |
|--|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | (b) | <p><b>Independent variable (max 2)</b></p> <ul style="list-style-type: none"> <li>Change the temperature ✓</li> <li>Method of maintaining/changing the temperature e.g. water bath/Bunsen burner ✓</li> </ul> <p><b>Observations to be made (max 2)</b></p> <ul style="list-style-type: none"> <li>Record the time it takes (for the indicator) to change colour ✓</li> <li>To colourless ✓</li> <li>Ref to use of a stop clock ✓</li> </ul> <p><b>Variables to be controlled (max 2)</b></p> <ul style="list-style-type: none"> <li>Volume/mass of milk ✓</li> <li>Concentration of enzyme ✓</li> <li>Volume/mass of enzyme ✓</li> <li>Type of milk ✓</li> </ul> | 5 | 5 x 3.3a | <p>Marks can be credited if scored in the incorrect section as long as the explanation is clear</p> <p><b>IGNORE</b> heater</p> <p><b>ALLOW</b> see which flask turns colourless first = 2</p> <p><b>IGNORE</b> amount/quantity throughout</p> <p><b>ALLOW</b> use the same milk</p> <p><b>DO NOT ALLOW</b> temperature</p> |
|--|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Q34. (2022)

A)

|    |     |                 |   |         |  |
|----|-----|-----------------|---|---------|--|
| 23 | (a) | CA(E) ✓<br>DB ✓ | 2 | 2 x 1.1 |  |
|----|-----|-----------------|---|---------|--|

B)

|  |     |                                                                                                                                                                                                                                                                 |   |         |                                                                                                                                                                            |
|--|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | (b) | <p><b>Any two from:</b></p> <p>Each triplet/3 bases/codon codes for one amino acid ✓</p> <p>The order of the triplet codes determines the sequence of amino acids ✓</p> <p>The sequence of amino acids determines protein structure/which protein is made ✓</p> | 2 | 2 x 1.1 | <p><b>DO NOT ALLOW</b> codes for the production of amino acids / forms different amino acids</p> <p><b>ALLOW</b> order of bases determines the sequence of amino acids</p> |
|--|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

C)

|  |     |     |                                                                                                                                                                                  |   |         |                                                                                                                                                                                                                                                 |
|--|-----|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | (c) | (i) | <p>A different order of the amino acids would result ✓</p> <p>Different proteins have different orders of amino acids / the protein would have a different shape/structure ✓</p> | 2 | 2 x 2.1 | <p><b>DO NOT ALLOW</b> idea that each section would now code for a different amino acid</p> <p><b>DO NOT ALLOW</b> codes for the production of different amino acids</p> <p><b>DO NOT ALLOW</b> the idea that amino acids code for proteins</p> |
|--|-----|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

D)

|  |  |      |    |   |         |  |
|--|--|------|----|---|---------|--|
|  |  | (ii) | 6✓ | 1 | 1 x 1.2 |  |
|--|--|------|----|---|---------|--|

E)

|  |     |                                                                                                                                                                                                                                                                                                          |   |         |  |
|--|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|--|
|  | (d) | <p><b>Any three from:</b></p> <p>In eukaryotes it is contained in the nucleus ✓</p> <p>In prokaryotes it is in the cytoplasm ✓</p> <p>In eukaryotes it/DNA/chromosome is a strand but in prokaryotes it is a loop/circle/ring ✓</p> <p>Prokaryotes have plasmids / eukaryotes do not have plasmids ✓</p> | 3 | 3 X 1.1 |  |
|  |     | <p>In both it is made of the same component parts/base, sugar and phosphate/nucleotides ✓</p>                                                                                                                                                                                                            |   |         |  |

## Q35. (2022)

|    |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |   |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 24 | (a) | <p>Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question.</p> <p><b>Level 3 (5–6 marks)</b><br/>Describes the general role of stem cells<br/><b>AND</b><br/>Describes the development of red blood cells as specialised cells<br/><b>AND</b><br/>Explains the change in RNA concentration <b>or</b> the loss of the nucleus</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b><br/>Describes the general role of stem cells <b>and</b> describes the development of red blood cells as specialised cells<br/><b>OR</b><br/>Describes the development of red blood cells as specialised cells <b>and</b> explains the change in RNA concentration <b>or</b> the loss of the nucleus<br/><b>OR</b><br/>Describes the general role of stem cells <b>and</b> explains the change in RNA concentration <b>or</b> the loss of the nucleus</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b><br/>Describes the general role of stem cells<br/><b>OR</b></p> | 6 | <p>2 x 1.1<br/>3 x 2.1<br/>1 x 3.2b</p> | <p><b>AO1 Demonstrate knowledge and understanding of scientific ideas of the general role of stem cells.</b></p> <ul style="list-style-type: none"> <li>Stem cells are undifferentiated cells/are able to differentiate to form different cells</li> <li>Stem cells become specialised for specific functions/become specialised cells</li> </ul> <p><b>AO2 Apply knowledge and understanding of scientific ideas to the development of the red blood cell from a stem cell to a cell that contains the protein haemoglobin.</b></p> <ul style="list-style-type: none"> <li>Red blood cells (are specialised cells as they) <ul style="list-style-type: none"> <li>do not have a nucleus</li> <li>contain haemoglobin</li> </ul> </li> <li>Haemoglobin is made by protein synthesis/by using RNA</li> </ul> <p><b>AO3 Analyse information from the graph to explain changes that occur to RNA and the loss of the nucleus</b></p> <ul style="list-style-type: none"> <li>Amount of RNA falls due to the loss/decrease in size of the nucleus</li> <li>The cell loses the nucleus to give room for large amounts of haemoglobin that have been produced</li> </ul> |
|    |     | <p>Describes the development of red blood cells as specialised cells<br/><b>OR</b><br/>Explains the change in RNA concentration <b>or</b> the loss of the nucleus</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i><br/><b>0 marks</b></p> <p><i>No response or no response worthy of credit.</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## Q36. (2023)

|   |   |   |     |           |
|---|---|---|-----|-----------|
| 9 | D | 1 | 2.2 | ALLOW 512 |
|---|---|---|-----|-----------|

## Q37. (2023)

|    |   |   |     |  |
|----|---|---|-----|--|
| 10 | A | 1 | 2.1 |  |
|----|---|---|-----|--|

## Q38. (2023)

|    |   |   |     |  |
|----|---|---|-----|--|
| 13 | D | 1 | 1.1 |  |
|----|---|---|-----|--|

Q39. (2023)

A)

|    |     |  |                                                                                                                                                                                                                                                                                                                                               |   |         |                                                                                                                                                                                       |
|----|-----|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16 | (a) |  | <p><b>Sub-cellular structure</b></p> <p>cell membrane</p> <p>chloroplast</p> <p>mitochondria</p> <p><b>Contents</b></p> <p>chlorophyll</p> <p>enzymes</p> <p>receptors</p> <p><b>Function</b></p> <p>allows communication with other cells</p> <p>catalyses reactions in aerobic respiration</p> <p>needed for photosynthesis</p> <p>✓✓✓✓</p> | 4 | 4 x 1.1 | <p>6 correct lines = 4 marks<br/>5/4 correct lines = 3 marks<br/>3 correct lines = 2 marks<br/>2 correct lines = 1 mark</p> <p><b>DO NOT ALLOW</b> more than 1 line from each box</p> |
|----|-----|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

B)

|  |     |     |                                                                                                                                                                        |   |         |                             |
|--|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|-----------------------------|
|  | (b) | (i) | <p>Correct outline shape of this mitochondrion drawn with continuous lines and no shading ✓</p> <p>Double outer membrane and internal membranes accurately drawn ✓</p> | 2 | 2 x 2.2 | <p><b>IGNORE</b> labels</p> |
|--|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|-----------------------------|

C)

|  |  |      |                                                                                                                                                                 |   |         |                                                                                                                                                                                            |
|--|--|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | (ii) | <p>Electron microscope ✓</p> <p>The image is highly magnified /<br/>The image is in a lot of detail /<br/>Can see organelles /<br/>The resolution is high ✓</p> | 2 | 2 x 2.1 | <p><b>ALLOW</b> TEM or SEM</p> <p>Second marking point is dependent on the first<br/><b>IGNORE</b> image is black and white<br/><b>ALLOW</b> ORA for light microscopes for each reason</p> |
|--|--|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

D)

|  |     |  |                                        |   |     |  |
|--|-----|--|----------------------------------------|---|-----|--|
|  | (c) |  | Ribosome / cell membrane / cytoplasm ✓ | 1 | 1.1 |  |
|--|-----|--|----------------------------------------|---|-----|--|

Q40. (2023)

A)

|    |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |         |  |
|----|-----|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|--|
| 20 | (a) | (i) | <p><i>In method 1 / fresh pineapple:</i><br/>The bromelain/enzyme will break down the gelatin/protein (so the jelly cannot set) ✓</p> <p><i>In method 2 / tinned pineapple:</i><br/>The bromelain/enzymes have been denatured ✓</p> <p>The active site of the bromelain/enzymes will change shape / the gelatin/protein will no longer fit into the active site ✓</p> <p>The gelatin/protein has not been broken down (so the jelly can set) ✓</p> | 4 | 4 x 2.1 |  |
|----|-----|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|--|

B)

|  |     |  |                                                                                                                                                                                         |   |                  |  |
|--|-----|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------|--|
|  | (b) |  | <p>X placed at approximately half the maximum rate of reactions ✓</p> <p>Explanation: idea that this is half the maximum rate (so assume that half the active sites are occupied) ✓</p> | 2 | 3.1a<br><br>3.1b |  |
|--|-----|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------|--|

## Q41. (2023)

|    |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 24 | (a)* | <p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><b>Level 3 (5–6 marks)</b><br/>Explains the impact the insertion has on the base sequence of the DNA, the mRNA produced <b>AND</b> explains how this produces a different protein.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b><br/>Explains how the impact of the insertion of the bases affects the structure of the DNA and therefore mRNA<br/><b>OR</b><br/>Explains how a change in mRNA causes a change in the protein produced.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b><br/>Explains the function of DNA and why a change in DNA can produce a different protein.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p><b>0 marks</b><br/><i>No response or no response worthy of credit.</i></p> | 6 | <p>2 x 1.1</p> <p>4 x 2.1</p> | <p><b>AO1.1</b><br/>Explains the function of DNA and why a change in DNA can produce a different protein</p> <ul style="list-style-type: none"> <li>the order of the bases/nucleotides in DNA codes for the production of a protein</li> <li>so a different order of bases means a different order of amino acids/different protein.</li> </ul> <p><b>AO2.1</b><br/>Explains how the impact of the insertion of the bases affects the structure of the DNA and therefore mRNA</p> <ul style="list-style-type: none"> <li>idea that in transcription DNA is used as a template to produce mRNA</li> <li>therefore, a change in the bases in DNA will cause a change in the bases in mRNA</li> </ul> <p><b>AO2.1</b><br/>Explains how a change in mRNA causes a change in the protein produced</p> <ul style="list-style-type: none"> <li>the order of bases in mRNA determines the order of the amino acids joined together in translation</li> <li>this is because different tRNA/carrier molecules will bind to the mRNA</li> </ul> <p>Any answer referring to the production of amino acids is limited to Level 2</p> |
|----|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Q42. (2023) – 24c

|  |     |                                                                                                                                                                                                                         |   |         |                                                            |
|--|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|------------------------------------------------------------|
|  | (c) | <p>Stem cells can differentiate/become specialised into (red) blood cells ✓</p> <p>(As they are from another person) they would not have the defective allele/disorder / will have functioning/normal haemoglobin ✓</p> | 2 | 2 x 3.1 | <p><b>IGNORE</b> they will have normal red blood cells</p> |
|--|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|------------------------------------------------------------|

## Q43. (2024)

|   |   |   |     |  |
|---|---|---|-----|--|
| 1 | D | 1 | 1.1 |  |
|---|---|---|-----|--|

## Q44. (2024)

|   |   |   |     |  |
|---|---|---|-----|--|
| 6 | C | 1 | 2.2 |  |
|---|---|---|-----|--|

## Q45. (2024)

|   |   |   |     |  |
|---|---|---|-----|--|
| 7 | D | 1 | 1.1 |  |
|---|---|---|-----|--|

## Q46. (2024)

|   |   |   |     |  |
|---|---|---|-----|--|
| 8 | A | 1 | 1.1 |  |
|---|---|---|-----|--|

Q47. (2024)

A)

|    |     |     |                                                                                               |   |         |                                                               |
|----|-----|-----|-----------------------------------------------------------------------------------------------|---|---------|---------------------------------------------------------------|
| 21 | (a) | (i) | Any two from:<br>Cell membrane ✓<br>Nucleus ✓<br>Ribosomes ✓<br>Cytoplasm ✓<br>Mitochondria ✓ | 2 | 2 x 1.1 | ALLOW ER / golgi / nucleolus / storage granules / chromosomes |
|----|-----|-----|-----------------------------------------------------------------------------------------------|---|---------|---------------------------------------------------------------|

B)

|  |  |      |                                                                                         |   |      |  |
|--|--|------|-----------------------------------------------------------------------------------------|---|------|--|
|  |  | (ii) | Fungi have a cell wall/vacuoles, so not an animal but no chloroplasts, so not a plant ✓ | 1 | 3.2a |  |
|--|--|------|-----------------------------------------------------------------------------------------|---|------|--|

C)

|                             |       |       |                                                                                                                                                                                                                                                                                                                   |       |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |    |      |      |    |                   |       |       |       |       |                           |       |       |       |       |                             |       |       |       |       |
|-----------------------------|-------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----|------|------|----|-------------------|-------|-------|-------|-------|---------------------------|-------|-------|-------|-------|-----------------------------|-------|-------|-------|-------|
|                             | (b)   |       | <p><b>First check the answer on the answer line</b><br/> <b>If answer = 11 400 award 4 marks</b></p> <p>Measures the line as 3.2cm/32mm ✓</p> <p>Converts 32mm to 32000 μm<br/> OR 2.8μm converted to 0.0028mm ✓</p> <p>32 000 ÷ 2.8 = 11 428.57<br/> OR 32 ÷ 0.0028 = 11 428.57 ✓</p> <p>= 11 400 (3 s.f.) ✓</p> | 4     | 3 x 2.2 | <p><b>ALLOW</b> answers in range 31 to 33mm</p> <p><b>ECF</b> if line incorrectly measured</p> <p><b>ECF</b> if line incorrectly measured or incorrect/no conversion</p> <p><b>1.2</b> <b>ALLOW</b> 1 mark for clear evidence of incorrect answer correctly rounded to 3 significant figures</p>                                                                                                                                                                                                                                                           |                 |    |      |      |    |                   |       |       |       |       |                           |       |       |       |       |                             |       |       |       |       |
|                             |       |       |                                                                                                                                                                                                                                                                                                                   |       |         | <p><b>ALLOW</b> full marks for correct answers calculations based on diameters in the range 31 to 33mm eg:</p> <table border="1"> <tr> <td><b>Diameter</b></td> <td>31</td> <td>31.5</td> <td>32.5</td> <td>33</td> </tr> <tr> <td><b>Conversion</b></td> <td>31000</td> <td>31500</td> <td>32500</td> <td>33000</td> </tr> <tr> <td><b>Calculation answer</b></td> <td>11071</td> <td>11250</td> <td>11607</td> <td>11785</td> </tr> <tr> <td><b>Answer to 3 sig figs</b></td> <td>11100</td> <td>11300</td> <td>11600</td> <td>11800</td> </tr> </table> | <b>Diameter</b> | 31 | 31.5 | 32.5 | 33 | <b>Conversion</b> | 31000 | 31500 | 32500 | 33000 | <b>Calculation answer</b> | 11071 | 11250 | 11607 | 11785 | <b>Answer to 3 sig figs</b> | 11100 | 11300 | 11600 | 11800 |
| <b>Diameter</b>             | 31    | 31.5  | 32.5                                                                                                                                                                                                                                                                                                              | 33    |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |    |      |      |    |                   |       |       |       |       |                           |       |       |       |       |                             |       |       |       |       |
| <b>Conversion</b>           | 31000 | 31500 | 32500                                                                                                                                                                                                                                                                                                             | 33000 |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |    |      |      |    |                   |       |       |       |       |                           |       |       |       |       |                             |       |       |       |       |
| <b>Calculation answer</b>   | 11071 | 11250 | 11607                                                                                                                                                                                                                                                                                                             | 11785 |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |    |      |      |    |                   |       |       |       |       |                           |       |       |       |       |                             |       |       |       |       |
| <b>Answer to 3 sig figs</b> | 11100 | 11300 | 11600                                                                                                                                                                                                                                                                                                             | 11800 |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |    |      |      |    |                   |       |       |       |       |                           |       |       |       |       |                             |       |       |       |       |

D)

|  |     |  |                  |   |     |                       |
|--|-----|--|------------------|---|-----|-----------------------|
|  | (c) |  | Carbon dioxide ✓ | 1 | 1.1 | ALLOW CO <sub>2</sub> |
|--|-----|--|------------------|---|-----|-----------------------|

Q48. (2024)

|    |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 24 | (a) | <p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><b>Level 3 (5–6 marks)</b><br/>Describes how a change in triplet codes alters the formation of an enzyme <b>and</b> how this affects enzyme function.<br/><b>AND</b><br/>Describes the resulting impact on glucose levels in the blood.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b><br/>Describes how a change in triplet codes can alter the formation of an enzyme <b>and</b> explains how a change in enzyme structure can alter enzyme function.<br/><b>OR</b><br/>Describes how a change in triplet codes can alter the formation of an enzyme <b>and</b> identifies the resulting impact on glucose levels in the blood.<br/><b>OR</b><br/>Explains how a change in enzyme structure can alter enzyme function <b>and</b> identifies the resulting impact on glucose levels in the blood.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> | 6 | <p>2 x 1.1<br/>4 x 2.1</p> <p><b>AO1.1 Demonstrates knowledge and understanding of scientific ideas to describe how a change the triplet code alters protein formation.</b></p> <ul style="list-style-type: none"> <li>Different triplet codes will code for different (sequences of) amino acids.</li> <li>Different (sequences of) amino acids result in a different protein/enzyme being formed.</li> </ul> <p><b>AO2.1 Applies knowledge and understanding to explain why a change in enzyme structure alters enzyme function.</b></p> <p>If the enzyme changes shape glycogen cannot be broken down into glucose because:</p> <ul style="list-style-type: none"> <li>the active site is not complementary to the substrate/glycogen.</li> <li>the substrate/glycogen cannot fit into/bind with the enzyme's active site.</li> </ul> <p><b>AO2.1 Applies knowledge and understanding to explain why a failure of the enzyme affects blood glucose levels</b></p> <ul style="list-style-type: none"> <li>Glucose will not be released into the blood.</li> <li>If the person has low blood glucose levels, they cannot raise this level / blood glucose levels may be too low/decrease</li> </ul> |
|    |     | <p><b>Level 1 (1–2 marks)</b><br/>Describes how a change in triplet codes can alter the formation of an enzyme<br/><b>OR</b><br/>Describes how a change in enzyme structure can alter enzyme function.<br/><b>OR</b><br/>Identifies the resulting impact on glucose levels in the blood.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p><b>0 marks</b><br/><i>No response or no response worthy of credit.</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   | <ul style="list-style-type: none"> <li>Glucagon cannot function.</li> </ul> <p>If reference to different types of amino acids being formed/made, then limited to Level 2</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |