

# Human Biology

## Unit: F224: Energy, Reproduction and Populations: High banded candidate style answer.

### Introduction

OCR has produced these candidate style answers to support teachers in interpreting the assessment criteria for the new GCE specifications and to bridge the gap between new specification release and availability of exemplar candidate work.

This content has been produced by senior OCR examiners, with the input of Chairs of Examiners, to illustrate how the sample assessment questions might be answered and provide some commentary on what factors contribute to an overall grading. The candidate style answers are not written in a way that is intended to replicate student work but to demonstrate what a “good” or “excellent” response might include, supported by examiner commentary and conclusions.

As these responses have not been through full moderation and do not replicate student work, they have not been graded and are instead, banded “medium” or “high” to give an indication of the level of each response.

Please note that this resource is provided for advice and guidance only and does not in any way constitute an indication of grade boundaries or endorsed answers.

|   |  |
|---|--|
| <b>1 The growing concern over the increase in obesity has made adequate exercise an important issue</b>   |  |
| <b>(a) Explain the term <i>aerobic exercise</i>.</b>  |  |
| <b>[2]</b>  |  |
| <i>Candidate style answer</i>   | <i>Examiner's commentary</i>   |
| <i>Aerobic exercise allows the body to use and improve the cardiovascular system. It causes It requires the heart rate to be increased to 80% of its maximum (220 minus the person's age) for at least 20 minutes 3 times a week. This requires the body to carry out more aerobic respiration.</i> | An excellent answer covering more detail than is required for a 2-mark question. |

|  |  |
|--|--|
| <b>(b) Fig 1.1 shows the effect of a short period of exercise on blood pressure. With reference to Fig 1.1, describe the effects of exercise on the cardiovascular system which would result in the changes to blood pressure shown in Figure 1.1.</b> |  |
| <b>[4]</b>   |  |
| <i>Candidate style answer</i>  | <i>Examiner's commentary</i>   |
| <i>As the body exercises it has to carry out more aerobic respiration as it needs more energy to allow the muscles to contract. This means the heart has to contract more frequently as well as emptying the ventricles more. The blood</i>            | A detailed answer covering the biological content to a high standard. However, as a learning point, the candidate should also make note that if a question states “With reference to Fig *.*...” then data should be quoted from both axis and giving both units as there will usually be at least one mark for interpreting |

pressure goes up because the SV and CO both increase.

tables/graphs accurately.

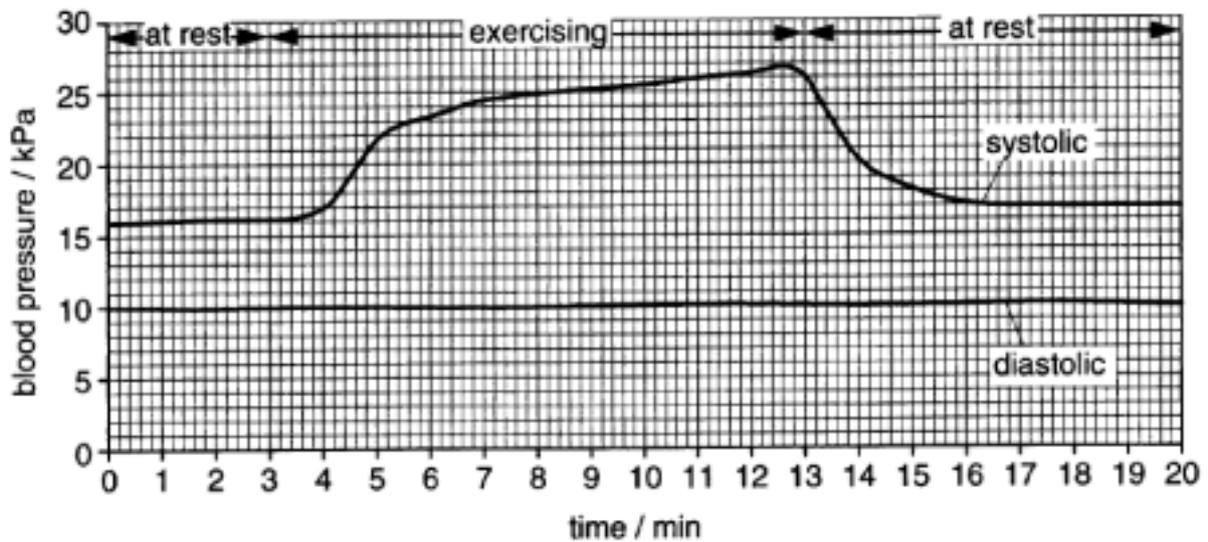


Fig 1.1

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

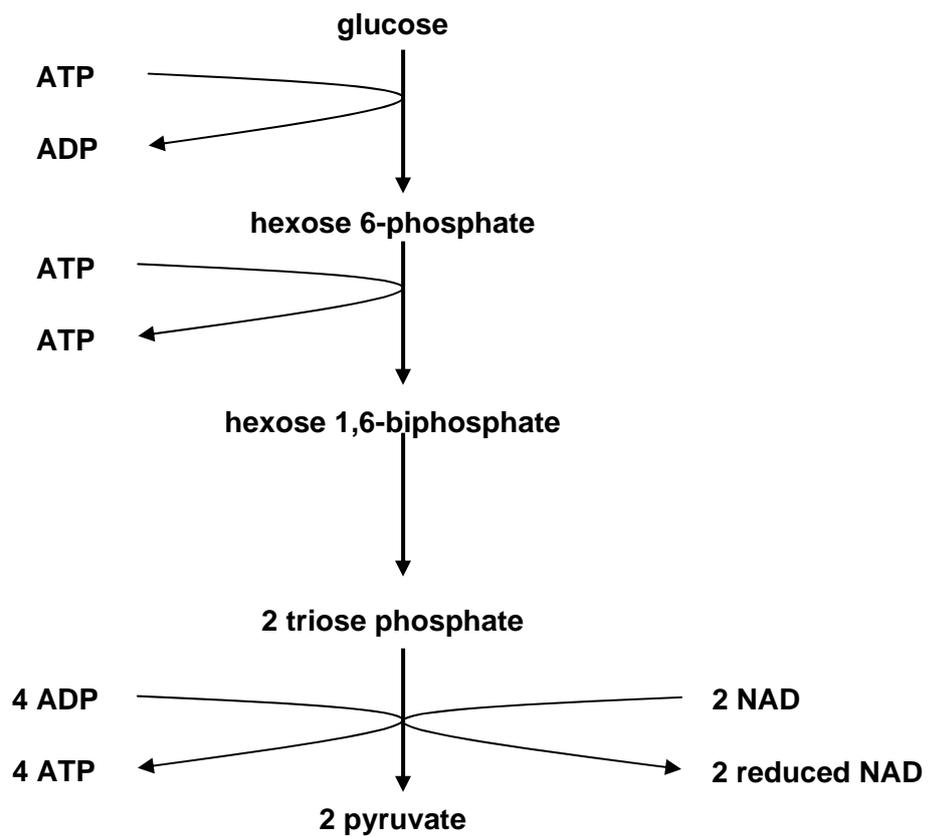


Fig. 1.

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

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

[1]

|                               |                              |
|-------------------------------|------------------------------|
| <i>Candidate style answer</i> | <i>Examiner's commentary</i> |
| <i>Glycolysis</i>             | Correct answer.              |

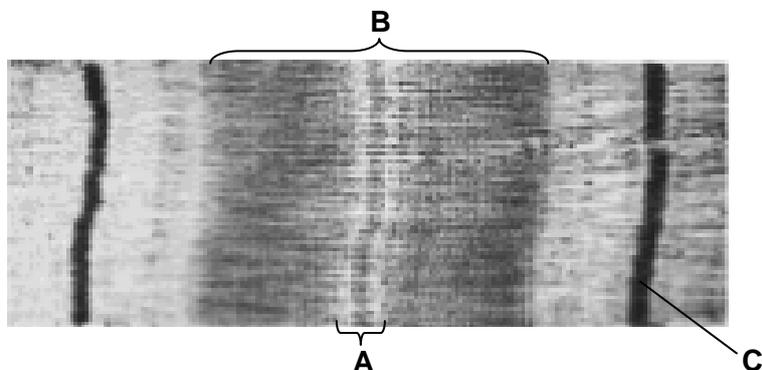
**(ii) Calculate the theoretical net yield of ATP when one molecule of glucose is metabolised by this pathway** [1]

|                               |                              |
|-------------------------------|------------------------------|
| <i>Candidate style answer</i> | <i>Examiner's commentary</i> |
| <i>2 ATP</i>                  | Correct answer.              |

**(iii) Outline what happens to the pyruvate formed in this pathway in the absence of oxygen.** [1]

|  |                              |
|--|------------------------------|
| <i>Candidate style answer</i>                  | <i>Examiner's commentary</i> |
| <i>It will be broken down into lactic acid</i> | Correct answer.              |

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



**Fig. 1.2**

**(i) Name A to C in Fig. 1.2** [3]

|  |   |
|--|---|
| <i>Candidate style answer</i>                            | <i>Examiner's commentary</i>  |
| <b>A..H band</b><br><b>B..Myosin</b><br><b>C..Z line</b> | All three marks are awarded. Candidates should be able to interpret electron micrographs as well as manipulate scale bars/magnification data. |

**(ii) The sarcomere shown in Fig. 1.2 is in a relaxed state. State one feature that gives evidence to support this.** [1]  
[Total: 13]

|   |                              |
|---|------------------------------|
| <i>Candidate style answer</i>   | <i>Examiner's commentary</i> |
| <i>The H band is looks quite narrow, whereas if it had contracted it would be wider</i> | Correct answer.              |

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

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

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

**[2]**

*Candidate style answer*

*Examiner's commentary*

80%

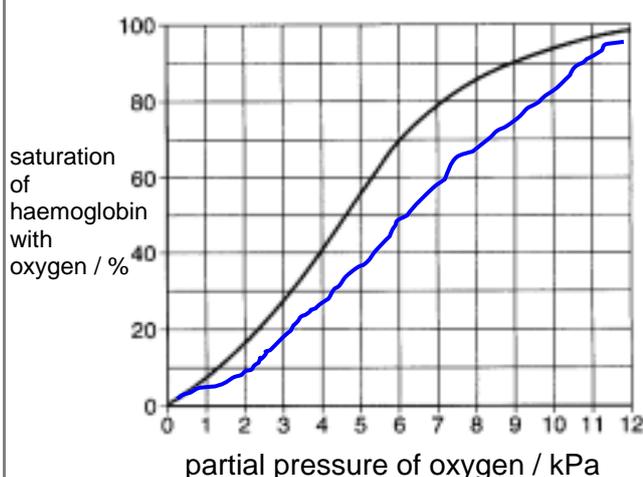
Correct answer.

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

**[1]**

*Candidate style answer*

*Examiner's commentary*



**Fig 2.1**

Correct answer, however, the curve should ideally be more sigmoidal and if two marks had been available for this question it is likely that only the mark for 'right and lower' would have been awarded. More questions of this type can be found on the legacy papers 2803/01 (Biology: Transport) and 2866 (Human Biology: Energy, Control and Reproduction).

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

**[3]**

*Candidate style answer*

*Examiner's commentary*

*If there is a high amount of carbon dioxide present then the following processes occur: Carbon dioxide + water = carbonic acid this splits into  $\text{HCO}_3^- + \text{H}^+$  These  $\text{H}^+$  then react with  $\text{Hb}:\text{Hb} + \text{H}^+ \rightarrow \text{H}.\text{Hb} \rightarrow$  release of oxygen. The Hb is acting as a buffer and mopping up the extra  $\text{H}^+$  ions.*

The candidate has provided an excellent response.

|   |   |            |
|---|---|------------|
| <b>(iii) Comment on the significance of this effect in leg muscles during exercise.</b> |   | <b>[2]</b> |
| <i>Candidate style answer</i>   | <i>Examiner's commentary</i>  |            |
| <i>The Bohr shift is important in promoting oxygen release from Hb during exercise</i>  | Mark points 5 can be awarded. The candidate can not be awarded mark point 3 as there is no indication of <u>more</u> oxygen being released. |            |

|   |   |  |
|---|---|--|
| <b>(c) Sickle cell anaemia is a disease caused by a gene mutation which affects the structure of haemoglobin.</b>   |   |  |
| <b>(i) Describe how a gene mutation can cause a change in the structure of haemoglobin.</b>   |   |  |
| <b>[3]</b>  |   |  |
| <i>Candidate style answer</i>   | <i>Examiner's commentary</i>                            |  |
| <i>A substitution mutation occurs in the DNA to change one base in the DNA. This changes the codon which then means a different anticodon will pair with it and bring in a different amino acid. In this case it will bring in valine. This changes the primary structure of the protein which then changes how it folds up and then the Hb will not be able to carry as much oxygen.</i> | The candidate has given a detailed and accurate answer. |  |

|   |  |  |
|---|--|--|
| <b>(ii) Describe how the changed haemoglobin can affect the role of the red blood cells.</b>  |  |  |
| <b>[2]</b>  |  |  |
| <b>[Total: 13]</b>  |  |  |
| <i>Candidate style answer</i>   | <i>Examiner's commentary</i>   |  |
| <i>The red blood cells will carry less oxygen and they will become sickle shaped which makes their surface area much smaller than it normally is. This makes it harder for the person to carry out exercise and they get tired more easily.</i> | This is a detailed answer gaining marks despite the candidate going off on a tangent in the latter half of their answer. |  |

|   |   |  |
|---|---|--|
| <b>3 The early detection of pregnancy is important so that routine antenatal tests may be conducted to monitor the health of the mother and the foetus.</b>     |   |  |
| <b>As the zygote implants, human chorionic gonadotrophin (hCG) is secreted by the developing cells of the zygote.</b>   |   |  |
| <b>(a)(i) Describe how the secretion of hCG may be detected, <u>using monoclonal antibodies</u>, in a pregnancy test.</b>                                       |   |  |
| <b>[5]</b>  |   |  |
| <i>Candidate style answer</i>   | <i>Examiner's commentary</i>            |  |
| <i>.Monocolnal antibodies react with hCG if there is any present in the urine. They are in a higher concentration in the urine collected first thing in the</i> | Comprehensive answer, strongly evident. |  |

|   |  |
|---|--|
| <i>morning. As the urine travels up the stick it carries the hCG with it and when it passes over the immobilised mAntibodies they react to leave a blue colour.</i> |  |
|---|--|

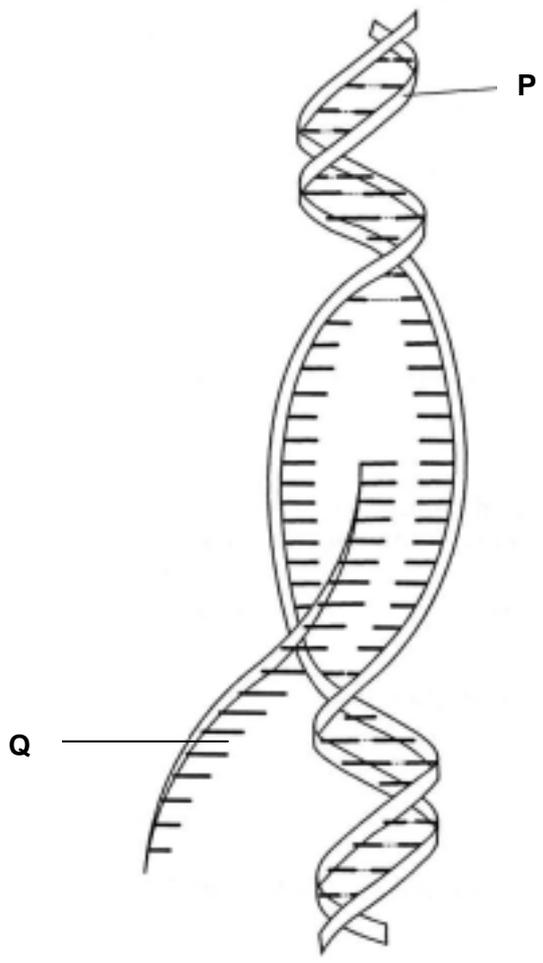
|  |  |
|--|--|
| <b>(ii) Suggest why monoclonal antibodies are particularly suited to detect the presence of hCG.</b> |  |
| <b>[2]</b>   |  |
| <i>Candidate style answer</i>  | <i>Examiner's commentary</i>   |
| <i>Each antibody is specific to one antigen and so the mAntibodies will only react with hCG</i>      | As two marks are available, the candidate should automatically suggest two comments but in this case has only suggested one. |

|   |  |
|---|--|
| <b>(iii) Describe the role of hCG in maintaining a pregnancy.</b>   |  |
| <b>[2]</b>  |  |
| <i>Candidate style answer</i>   | <i>Examiner's commentary</i>   |
| <i>This hormone is vital in maintaining a pregnancy as it keeps the corpus luteum functioning properly. This means that it will be able to receive any fertilised zygote where it can then develop into an embryo</i> | One mark only is awarded - again for a lack of detail in the answer. |

|  |  |
|--|--|
| <b>(b) Describe the role of prolactin.</b>   |  |
| <b>(i) during pregnancy;</b>   |  |
| <b>[2]</b>   |  |
| <i>Candidate style answer</i>  | <i>Examiner's commentary</i>                       |
| <i>Prolactin is essential in developing breast tissue. This is important as it is the gland which will produce the colostrums and breast milk after child birth has occurred</i> | One mark can be awarded for the growth of breasts. |

|   |   |
|---|---|
| <b>(ii) following the birth of the baby.</b>  |   |
| <b>[2]</b>  |   |
| <i>Candidate style answer</i>   | <i>Examiner's commentary</i>  |
| <i>The developed breast tissue will produce colostrums in the first few days and then breast milk. This is important in providing natural passive immunity to the baby. As the baby uses the breast then this stimulates more prolactin to be made and more breast tissue to develop.</i> | The first mark point can be awarded and the AVP can be used to credit the correct reference to the immunity gained by the baby. |

|  |   |
|--|---|
| <p><b>(c) Prolactin also inhibits the release of FSH and LH.</b><br/> <b>Comment on the possible effects of prolactin on menstruation and fertility</b></p> <p style="text-align: right;"><b>[4]</b><br/> <b>[Total: 17]</b></p>                     |   |
| <i>Candidate style answer</i>  | <i>Examiner's commentary</i>  |
| <p><i>Prolactin reduces the chance that a woman will ovulate and hence she is less likely to become pregnant again as her menstrual cycle is stopped. This is because her oestrogen levels remain low and do not rise to stimulate ovulation</i></p> | <p>As with previous question, the candidate has only provided three facts for a question worth four marks. All three points are worth marks but the candidate should note that they have not made any direct reference to the effect on the fertility of the woman. Underlining the key aspects to the question can ensure all areas are covered in the candidates answer e.g.:<br/> <u>Comment</u> on the possible effects<u> of prolactin</u> on <u>menstruation</u> and <u>fertility</u></p> |

|   |                              |
|---|------------------------------|
| <p><b>4 Fig. 4.1 shows some of the events during the first stage of protein synthesis.</b></p> <p style="text-align: center;"><b>Fig. 4.1</b></p> <div style="text-align: center;">  </div> <p><b>(a)(i) Name the molecules labelled P and Q on Fig. 4.1.</b></p> <p style="text-align: right;"><b>[2]</b></p> |                              |
| <i>Candidate style answer</i>   | <i>Examiner's commentary</i> |
| <p><b>P</b> DNA<br/> <b>Q</b> messenger RNA</p>   | <p>Correct answer.</p>       |

|  |                              |
|--|------------------------------|
| <b>(ii) Name this stage of protein synthesis</b>   |                              |
|  <b>In your answer, you should use the appropriate technical term, spelled correctly.</b> |                              |
| <b>[1]</b>   |                              |
| <i>Candidate style answer</i>  | <i>Examiner's commentary</i> |
| <i>Transcription</i>   | Correct answer.              |

|  |   |
|--|---|
| <b>(b)(i) Describe what is happening during this stage of protein synthesis.</b>   |   |
| <b>[4]</b>   |   |
| <i>Candidate style answer</i>  | <i>Examiner's commentary</i>  |
| <i>The double helix of DNA unwinds using the enzyme DNA helicase. The hydrogen bonds between the bases break and the two strands separate. RNA polymerase attaches to the operator region and then moves along the sense strand to join activated RNA nucleotides together. They are joined using condensation reactions The new mRNA then detaches and the DNA helix reforms and winds up again using the DNA helicase.</i> | An excellent answer, which is detailed and well constructed. There is good evidence of synoptic points from the AS unit and the candidate has a good understanding of the inter-relationship of the key terms. Candidates can be encouraged to write a list of 10 key points for both transcription and translation in revision sessions using key terms. It is also important that they have an overview of the relationship between these processes and that of DNA replication, which often get muddled. This can be achieved by simplifying both DNA replication and protein synthesis onto a single diagram of a cell and annotating the key points. |

|  |                              |
|--|------------------------------|
| <b>(ii) Describe what happens next to the molecule labelled Q.</b> |                              |
| <b>[1]</b>   |                              |
| <b>[Total: 8]</b>  |                              |
| <i>Candidate style answer</i>                                      | <i>Examiner's commentary</i> |
| <i>The mRNA exits the nucleus via the nuclear pores</i>            | Correct answer.              |

|   |   |
|---|---|
| <b>6 Human activity has a considerable impact on the environment.</b>   |   |
| <b>(a) Explain the term <i>succession</i>.</b>  |   |
| <b>[2]</b>  |   |
| <i>Candidate style answer</i>   | <i>Examiner's commentary</i>  |
| <i>Succession is the directional change over time in a community in a habitat leading to a climax community</i> | This definition appears to have been learnt rote but does not include sufficient detail for two marks. Candidates can use previous exam papers and mark schemes to look for definitions of terms that have already been examined and use these to write their own glossaries for revision purposes. |

(b) Fig. 5.1 shows a primary succession in a temperate climate. X represents an example of deflected succession.



Fig. 5.1

(i) Suggest how the deflected succession X could be caused.

[2]

| Candidate style answer  | Examiner's commentary |
|---|-----------------------|
| <i>Deflected succession is succession whose direction is affected by farming or other human activities such as mowing, grazing, burning crops etc</i> | Correct answer.       |

(ii) Explain how biomass changes during primary succession.

[1]

| Candidate style answer           | Examiner's commentary |
|----------------------------------|-----------------------|
| <i>The biomass will increase</i> | Correct answer.       |

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

Explain how this change will affect the sustainability of production.

[4]

[Total: 9]

[Paper Total 60]

| Candidate style answer   | Examiner's commentary   |
|--|---|
| <i>The farmer has decided to change from extensive to intensive farming and this usually has high costs at the beginning. In this case he will have to build the sheds to keep the turkeys in and then he will have to buy feeders and lights and heaters for the sheds. However, after this he will be able to keep more turkeys and he will probably be able to allow them to grow faster and to get bigger quicker so his yield will go up and his profit will also go up. But the lights and the heaters will cost him more money to run and people may not want to buy turkeys that are not free-range and so he might still only make the same amount of money</i> | High marks are awarded The AVP can be awarded for the statement regarding the preference of customers and linking it to profit. |

**Overall Banding:** High.

**Overall Comments:** This candidate has demonstrated ability typical of a high ability candidate

There are key areas in which this candidate can improve:

- Use the number of marks available to guide the level of detail provided in their answer.
- Underlining command questions and key words in the question to focus the answer in the correct area
- More use of synoptic knowledge from F221 and F222.
- Use of bullet points and flow diagrams to aid the construction of clear and concise answers.