Introduction

This document provides guidance on how to construct and mark Higher Human Biology assessments and should be read in conjunction with the *Higher Human Biology: Guidance on gathering key evidence in session 2020-21.*

Assessment structure

Approximately 30% of the available marks across the assessment should be targeted at grade A candidates and the remaining marks at grade C candidates. There is no intention of targeting grade B candidates. The probability is that grade B candidates would achieve most grade C marks and some of the grade A marks.

The Higher Human Biology question paper brief in Appendix 1 gives the structure of the SQA question paper, and the range of marks allocated to scientific problem-solving skills and knowledge and understanding. It gives the abbreviated codes for the knowledge and skills that are assessed. The question paper brief is a useful starting point to ensure that your questions have the correct balance and level of demand for constructing an assessment.

Grade C marks

Questions with grade C marks require candidates to demonstrate successful performance in relation to the skills, knowledge and understanding for the course.

Examples of questions with grade C marks in Paper 1 – Multiple-choice

Example 1 – 2019 Question 10

This question requires candidates to demonstrate their knowledge and understanding through recall of one fact.

At the end of the electron transport chain hydrogen ions and electrons combine with

A NAD

B ATP

C water

D oxygen.

Example 2 – 2019 Question 2

This question requires candidates to apply their knowledge and understanding of base pairing to a specific example.

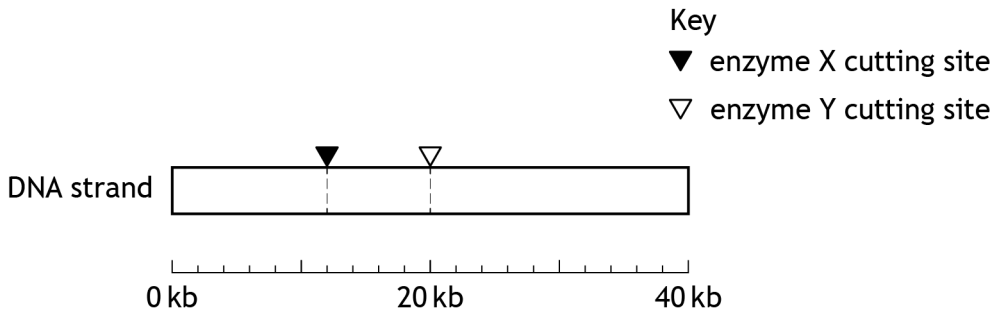
Identify the RNA codon and anticodon for the DNA base sequence GAT.

	RNA codon	RNA anticodon
A	CTA	GAT
B	GAT	CTA
C	CUA	GAU
D	GAU	CUA

Example 3 – 2019 Question 6

This question requires candidates to select information. Candidates have to use the key to choose the cutting site of enzyme X on the DNA strand and then select the correct DNA fragment lengths produced from the scale below.

Enzymes can be used to cut strands of DNA into fragments.
The diagram shows the cutting sites of two different enzymes on a DNA strand that is 40 kilobases (kb) long.



What length of fragments (kb) would be produced if the DNA strand was cut with enzyme X only?

A 12, 20

B 12, 28

C 20, 20

D 12, 8, 20

Example 4 – 2019 Question 24

This question requires candidates to process information using a calculation. Candidates are given the figures and have to perform the same percentage calculation for each year.

The table shows the number of cases of a disease and the number of deaths resulting from this disease in a country over four years.

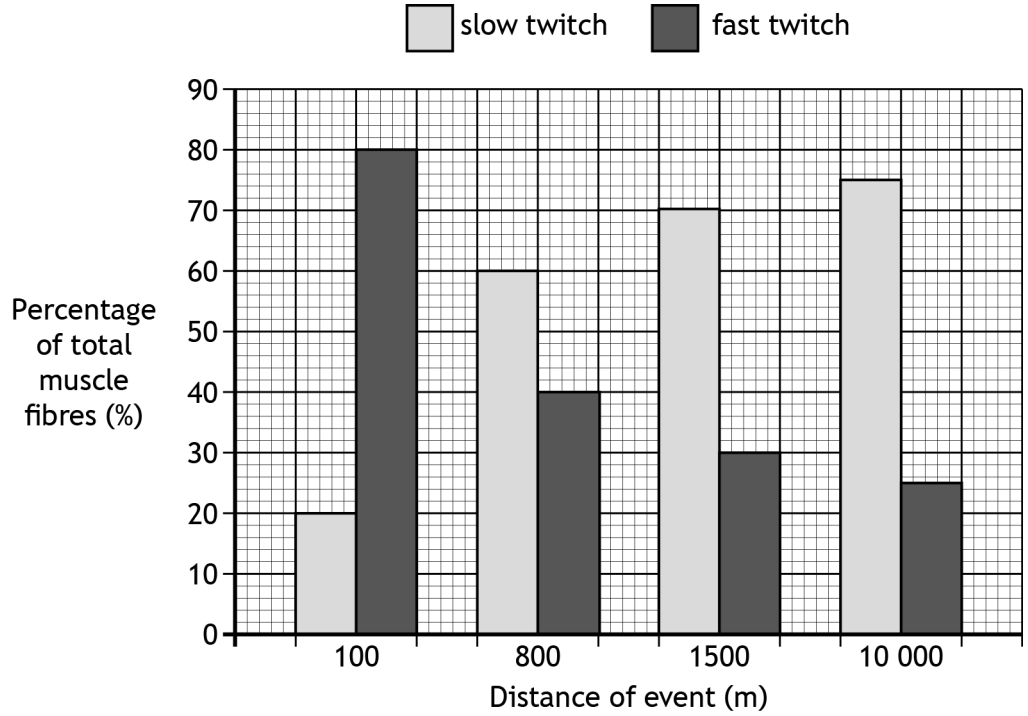
In which year did the greatest percentage of deaths occur?

	Year	Number of cases	Number of deaths
A	2014	1070	45
B	2015	420	12
C	2016	1960	60
D	2017	2290	90

Example 5 – 2018 Question 11

This question requires candidates to draw a valid conclusion. Candidates are expected to look at each statement in turn and relate it to the graph to determine whether the conclusion is true or false.

The graph shows the percentage of slow and fast twitch muscle fibres present in athletes who trained for events of different distances.



Which of the following conclusions can be drawn from this graph?

A Athletes who trained for the 100m event have 5 times more fast twitch muscle fibres than slow twitch muscle fibres.

B Athletes who trained for the 10 000m event have 4 times more slow twitch muscle fibres than fast twitch muscle fibres.

C Athletes who trained for the 800m event have twice as many slow twitch muscle fibres as athletes in the 1500m event.

D Athletes who trained for the 100m event have twice as many fast twitch muscle fibres as athletes in the 800m event.

Examples of questions with grade C marks in Paper 2

Example 1 – 2019 Question 12(a)

This question allows candidates to demonstrate their knowledge and understanding of endorphins. There are a number of alternative correct answers for both parts (i) and (ii) that are relatively straightforward.

Endorphins and dopamine are neurotransmitters that affect mood and behaviour.

(a)(i) State **one** activity which increases endorphin production. **1**

_____

_____

(ii) State **one** function of endorphins. **1**

_____

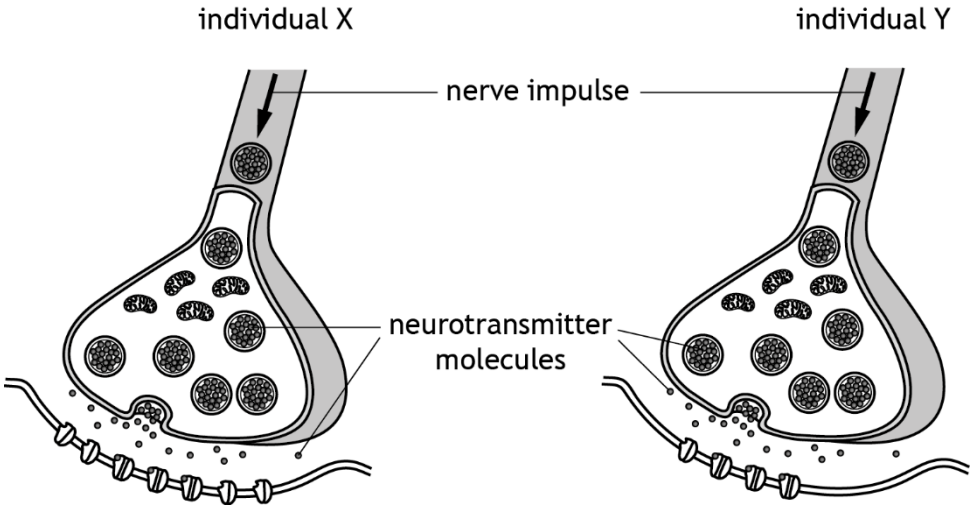
_____

Example 2 – 2019 Question 12(c)

This question allows candidates to apply their understanding of how recreational drugs can affect synapses to a specific example. In part (i) candidates have to examine the diagram and spot that the synapse of individual Y has less receptors. Then, in part (ii), they have to indicate how this will impact the drug taking behaviour of individual Y.

(c) The diagram shows synapses from the brains of two individuals.

Individual X has never taken recreational drugs while individual Y has used a recreational drug for a long time.



(i) Describe how the recreational drug has acted on the synapse of individual Y. **1**

(ii) Describe how changes to the synapses of individual Y will affect their drug-taking behaviour. **1**

Example 3 – 2019 Questions 11(a)(i), (a)(ii)

These skills questions are designed to determine if candidates can evaluate investigations. Very few candidates will have seen a water flea but the method of the investigation is comprehensively outlined and from this outline candidates are expected to determine why certain procedures were used. The marking instructions for both parts (i) and (ii) accommodates a variety of alternative answers.

(a) The water flea, *Daphnia pulex*, is a small invertebrate animal that lives in ponds.

Water fleas can be used as model organisms to investigate the effect of chemicals on heart rate.

A student carried out an investigation to find out how caffeine concentration affects the heart rate of water fleas.
A water flea was placed in a small container of pond water and left for 5 minutes. The container was then placed under a microscope and the water flea videoed for a period of time. The video was analysed and the heart rate of the water flea calculated.

(i) Suggest why the student left the water flea in the solution for 5 minutes before videoing its heart rate. **1**

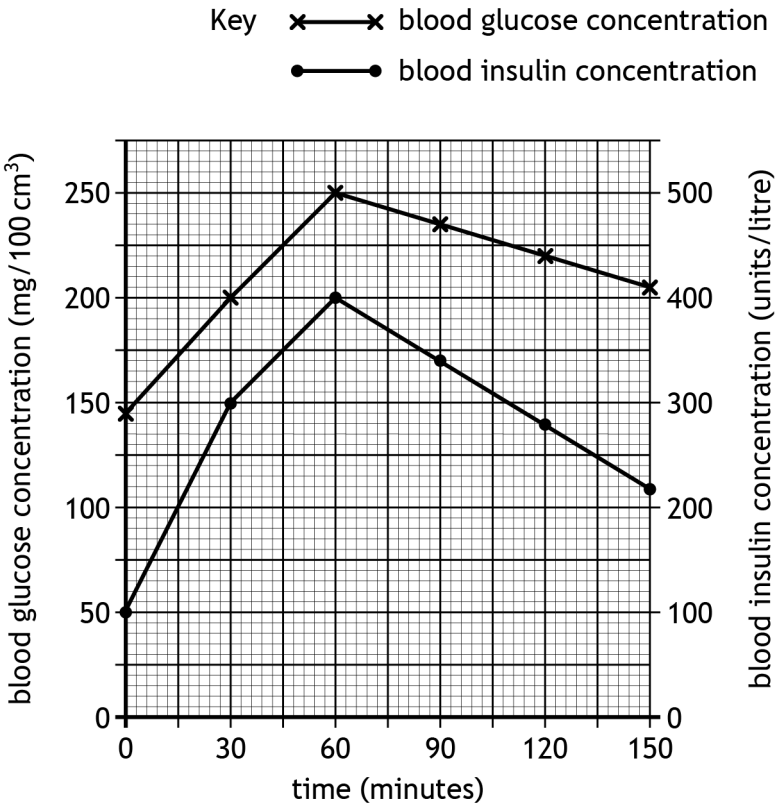
(ii) Suggest why the student videoed the water flea rather than simply counting its heart beat at the time. **1**

Example 4 – 2019 Question 9(a)

This question is designed to see if candidates have the skills required to take a reading from a graph with two vertical axes. Candidates have to identify the point of a given reading on one axis and then select the reading which occurs at the same time on the other axis. Candidates are expected to have encountered graphs with two vertical axes as Higher Human Biology question papers usually contain at least one graph with two vertical axes.

A man had a glucose tolerance test to indicate if he had type 2 diabetes.

The graph shows changes in the concentrations of glucose and insulin in his blood during 150 minutes, after drinking the glucose solution.



(a) State the man's blood insulin concentration when his blood glucose concentration was 200 mg/100 cm^3. **1**

_____ units/litre

Example 5 – 2019 Question 4(b)(i)

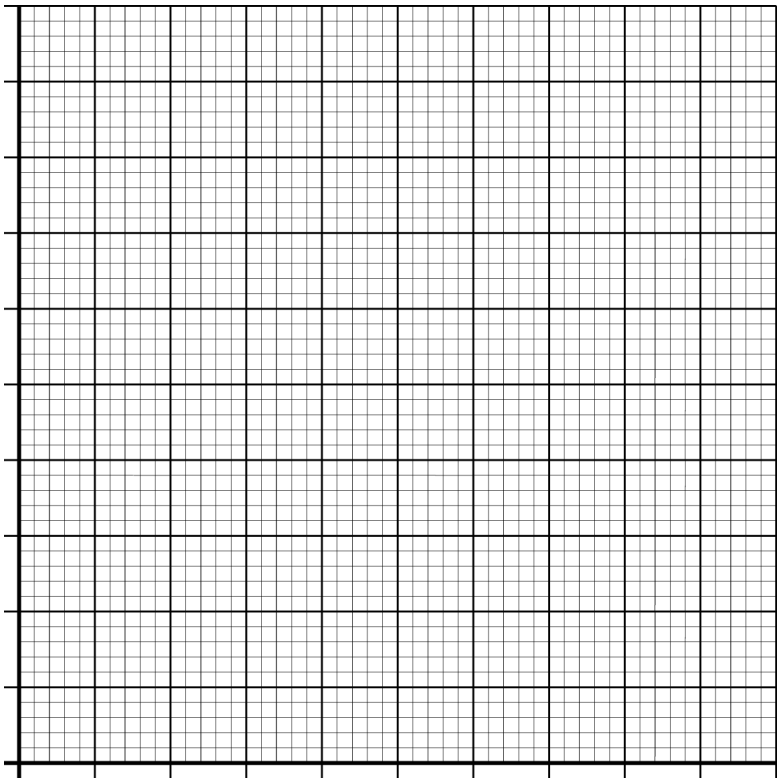
This question allows candidates to indicate that they can present information in an appropriate form. Candidates are given readings in a table which they have to present as a line graph. Higher Human Biology question papers always contain one question where candidates have to draw a graph.

(b) The results from the investigation are shown in **Table 1**.

Table 1

	Average maximum weight raised (kg)					
Time(weeks) / Group	0	2	4	6	8	10
A (protein supplement)	52	57	64	72	86	95
B (placebo)	50	55	60	68	74	80

(i) Construct a line graph to show **all** the data in **Table 1**. **3**



Grade A marks

Approximately 30% of total available marks should be targeted at grade A candidates.

Questions with grade A marks are more demanding and test more complex skills.

Examples of questions with grade A marks in Paper 1 – Multiple-choice

Example 1 – 2017 Question 7

This question requires candidates to demonstrate their knowledge and understanding of lactate (lactic acid) metabolism. Candidates have to consider two different processes. Firstly, whether there is net production or use of ATP during glycolysis and secondly whether NADH is used or generated during lactic acid production.

Which of the following equations summarises lactic acid metabolism?

A glucose → (ADP + Pi → ATP) pyruvate → (NAD → NADH) lactic acid

B glucose → (ATP → ADP + Pi) pyruvate → (NAD → NADH) lactic acid

C glucose → (ADP + Pi → ATP) pyruvate → (NADH → NAD) lactic acid

D glucose → (ATP → ADP + Pi) pyruvate → (NADH → NAD) lactic acid

Example 2 – 2017 Question 5

This question requires candidates to apply their knowledge and understanding of four different processes to mature red blood cells. Candidates have to figure out the implications of red blood cells having no nucleus and mitochondria on each of the processes.

Mature red blood cells have no nucleus and no mitochondria.

Which of the following processes can be carried out by a mature red blood cell?

A Glycolysis

B Cell division

C Protein synthesis

D Electron transport chain

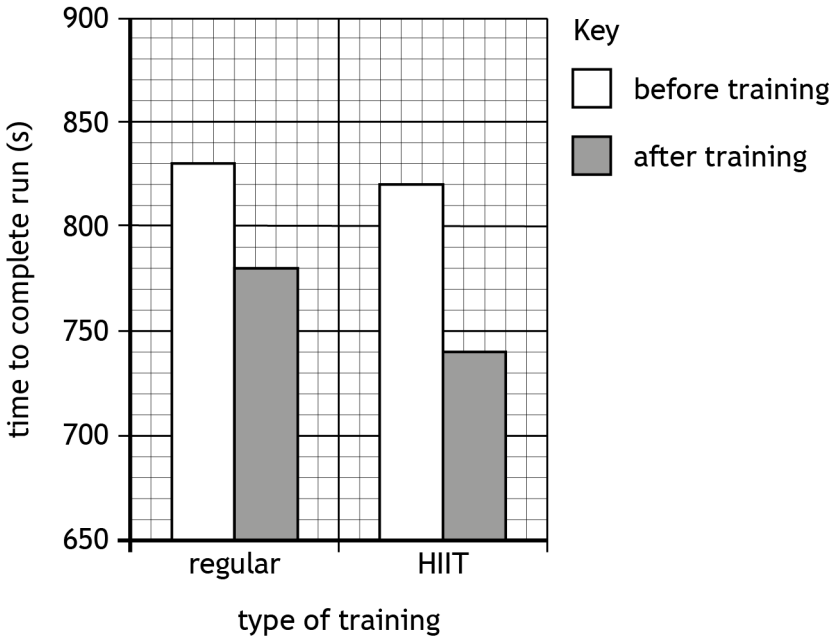
Example 3 – 2019 Question 12

This is a challenging skills question which requires three separate procedures to be completed. Candidates have to firstly select the correct columns to compare. They then have to calculate the improvement in the time to complete the run after training for both the regular group and the HIIT training group. Finally, candidates have to subtract the improvement in time for the regular group from the improvement in time for the HIIT group.

Many candidates simply use the after training columns and subtract the value for HIIT training from the value for regular training so do not fully analyse the data.

Two athletes took part in different training programmes. One undertook regular training sessions while the other undertook high intensity interval training (HIIT) sessions.

The graph shows the time taken to complete a run before and after each training programme.



The improvement in performance as a result of HIIT training compared to regular training is

A 30 s

B 40 s

C 50 s

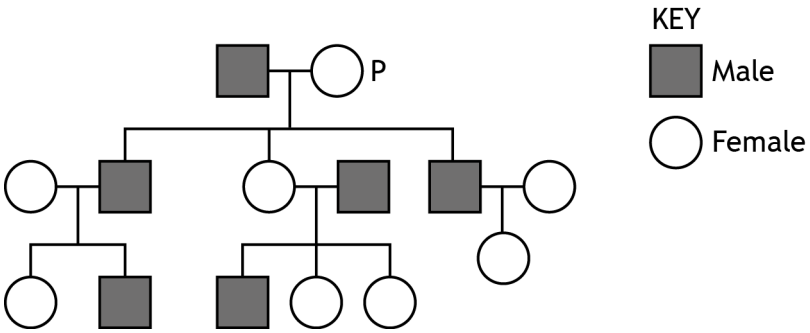
D 80 s.

Example 4 – 2018 Question 12

This is a novel skills question in which candidates have to select whether individuals in the family tree have received DNA from woman P. Candidates have to use the information they have been given about mitochondrial DNA as well as showing that they can interpret the family history provided.

The mitochondria of human cells contain DNA.
Women can pass mitochondrial DNA to their offspring but men cannot.

The diagram shows a family tree.



Identify the number of individuals in the family tree that have inherited mitochondrial DNA which originated from P.

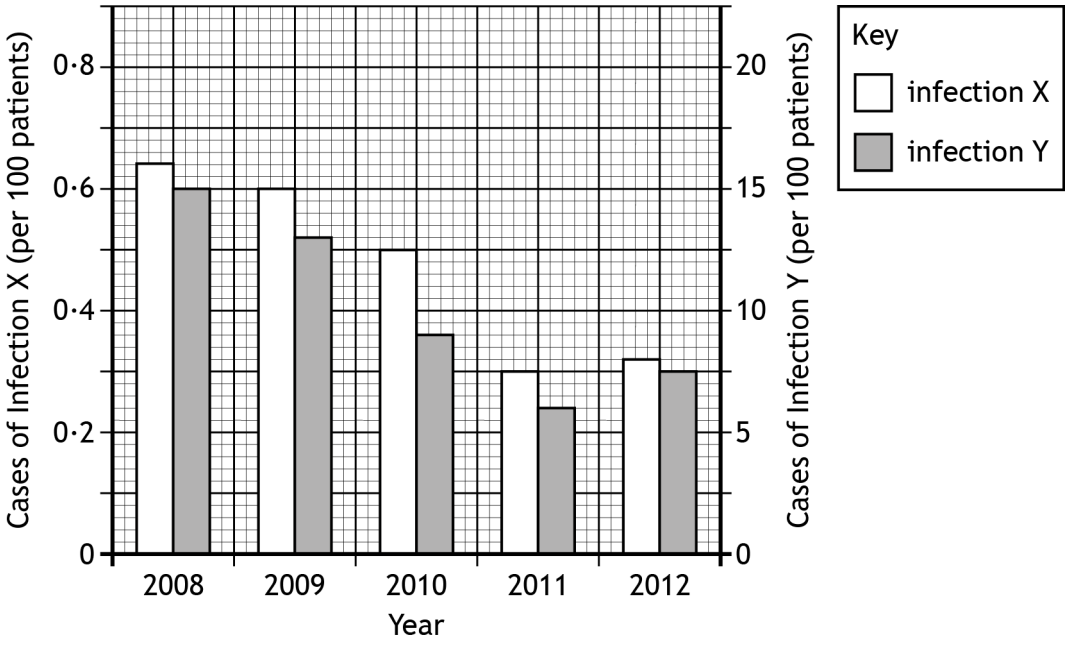
A 3
B 4
C 5
D 6

Example 5 – 2018 Question 20

There are several reasons why this is a challenging skills-based question. There are two vertical axes with different scales. The stem of the question also contains 'not', a negative term, the presence of which has been shown to increase the difficulty of questions. Finally, the four statements that candidates have to consider involve them analysing the data in different ways.

A hospital introduced a programme of handwashing in 2008.

The graph shows the impact of this on the number of cases of two infections.



Which of the following statements is **not** correct?

A The cases of both infections fell by 50% over the 5 year period.

B The number of cases of infection Y was always greater than the number of cases of infection X.

C The highest number of cases of infection X was 0·62 /100 patients while the highest number of cases of infection Y was 15 /100 patients.

D The lowest number of cases of infection X was 0·3 /100 patients while the lowest number of cases of infection Y was 6 /100 patients.

Examples of Questions with grade A marks in Section 2

Example 1 – 2019 Questions 3(b)(i), 3(b)(ii)

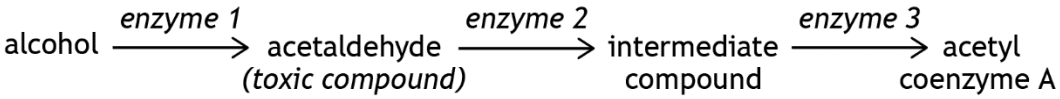
Part (i) of this question requires candidates to demonstrate their knowledge and understanding of the impact of a missense mutation. Candidates must indicate that the mutation results in the enzyme containing a different amino acid or that the enzyme's shape is changed. Essentially, this involves two thinking steps.

Many candidates make the first step, indicating that in a missense mutation a nucleotide in the DNA is altered. They do not make the additional step of considering the impact on the enzyme.

Part (ii) of this question requires candidates to show that they understand the effects of enzyme 2 not working. Candidates have to apply their knowledge of metabolic pathways to the diagram and indicate that acetaldehyde / the toxic compound will build up.

Many candidates do not refer back to the metabolic pathway diagram and incorrectly state that these individuals will be unable to break down alcohol.

The diagram shows some of the stages in the breakdown of alcohol by the liver.



(b) Some individuals cannot produce enough fully functioning enzyme 2.

(i) In these individuals an altered form of enzyme 2 is produced due to a missense mutation.

Suggest why this mutated form of enzyme 2 works less well than the unaltered form. **1**

_____

_____

(ii) Explain why these individuals are less tolerant of alcohol. **1**

_____

_____

Example 2 – 2019 Question 8(a)

This is a grade A question because candidates have to demonstrate their knowledge and understanding of the genetics behind two different disorders and then indicate a difference between them.

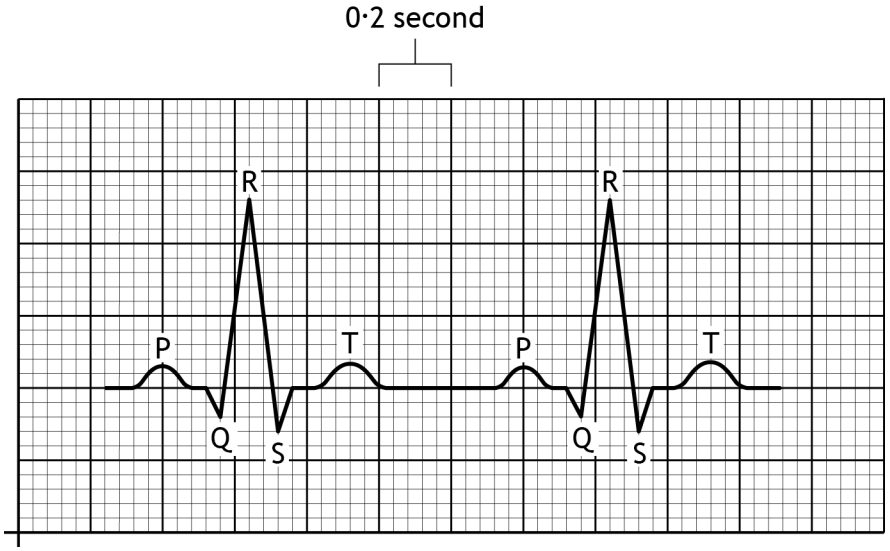
Adenosine deaminase (ADA) deficiency is an autosomal recessive disorder that affects the immune system. It is caused by a mutation in the gene that codes for this enzyme.

(a) Describe the difference between an autosomal disorder and a sex-linked disorder. **1**

Example 3 – 2018 Question 5(c)(i)

This is a grade A question because it involves several steps to get the correct answer. Candidates must demonstrate their understanding of ECGs and realise that two heartbeats are shown. They then have to apply the scale and work out that there is a gap of 1 second between heartbeats. Finally, candidates have to calculate that this translates into a heart rate of 60 beats per minute.

(c) The diagram shows an electrocardiogram (ECG) of an individual's heart.



(i) Use the diagram to calculate the individual's heart rate. **1**

_____ beats / min

Example 4 – 2018 Question 2(c)(ii)

In this skills-based question candidates have to look at the aim of the investigation and from it realise that a lower final alcohol concentration equates to more enzyme activity. They then have to look at the results which show two patterns and consequently two marks are available. The first mark is given for describing that as inhibitor concentration increases enzyme activity decreases. The second mark is given for indicating that beyond 4·5 mM enzyme activity stops.

Many candidates tend to describe the results in terms of alcohol concentration instead of enzyme activity. Many also fail to spot that enzyme activity stops after 4·5mM.

A common error that candidates make when drawing conclusions from investigation results is to not relate their conclusion to the aim of the investigation.

An investigation was carried out on the effect of inhibitor concentration on the activity of an enzyme in liver cells which breaks down alcohol.

The results of the investigation are shown in the table.

Inhibitor concentration (mM)	Final alcohol concentration (% of initial concentration)
0·5	20
1·5	28
2·5	60
3·5	96
4·5	100
5·5	100

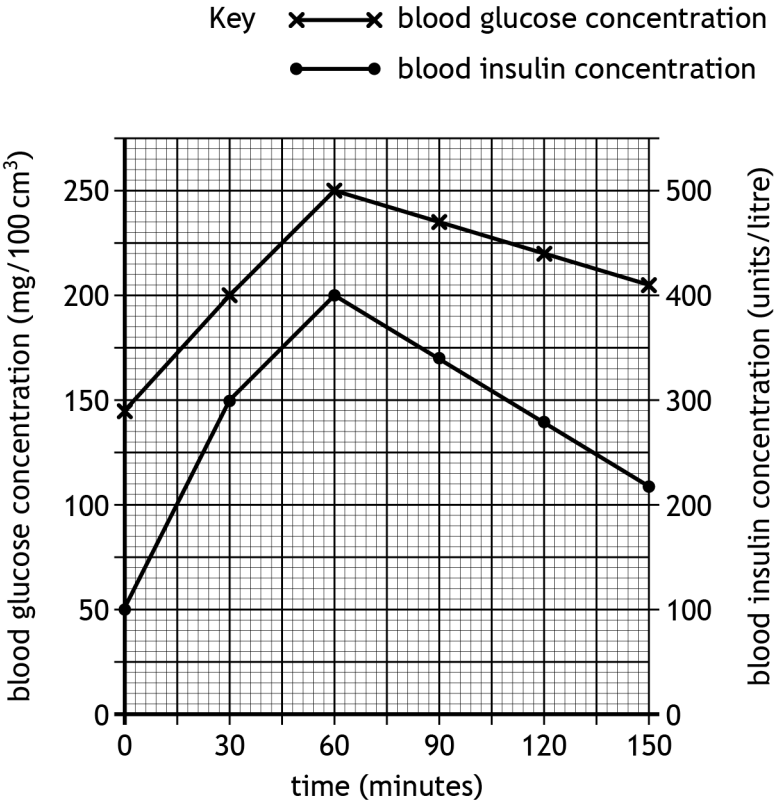
(ii) **Use the data** to describe the relationship between the concentration of inhibitor and enzyme activity. **2**

Example 5 – 2019 Question 9(b)

This is a challenging grade A skills question which requires candidates to take a number of steps in order to make the prediction. Candidates have to firstly choose the correct line and scale that represents blood glucose. They then have to realise that the trend between 60 and 150 minutes has the concentration decreasing by 45 mg/100 cm3 over 90 minutes or 0·5 mg per minute. Candidates then have to determine that the difference between the glucose concentration at 0 and 150 minutes is 60 mg meaning that it will take a further 120 minutes for the glucose concentration to return to its original value.

A man had a glucose tolerance test to indicate if he had type 2 diabetes.

The graph shows changes in the concentrations of glucose and insulin in his blood during 150 minutes, after drinking the glucose solution.



(b) The man's blood glucose concentration will eventually return to its original value.

Predict how much longer this will take after 150 minutes. **1**

Space for calculation

_____ minutes

Additional information

Extended-response questions

Each assessment should contain two or three extended-response questions of 10–15 marks in total. At least one of these questions should include a choice of topic. In Human Biology the last question in paper 2 is a large extended-response question, which contains a choice and has at least three grade A marks. In addition, there is always one extended-response question worth 3 marks in the paper and at least one of these marks will be a grade A mark.

The task of linking together many sentences on a topic is a challenging one and grade C candidates typically do not manage to cover enough points to gain full marks. The subject matter of the question can determine the level of demand, increasing the number of grade A marks.

The following table shows the extended-response questions from SQA past papers and the topics covered.

Year	Question	Topic	Marks
2015	14A/B 5(c)	Menstrual cycle/Cardiac cycle Muscle fibres	10 3
2016	13A/B 3(b)	Atherosclerosis/Diabetes Cancer development and spread	8 3
2017	12A/B 8(b)	DNA/RNA Impulse transmission at a synapse	9 3
2018	13A/B 3(d)	Sperm production/Infertility Chromosome mutations	8 3
2019	14A/B 11(b)	Memory/Vaccination Autonomic control of heart rate	9 3

Large data-handling question

Each assessment should contain one large data-handling question of 5-9 marks. This style of question should have at least one grade A mark.

Large experimental design question

Each assessment should contain one large experimental design question of 5-9 marks. This style of question should have at least one grade A mark.

The following table shows the large data-handing, and large experimental design questions from SQA past papers and the topics covered.

Key

DH Data-handling

ED Experimental Design

Year	Question	Topic	Marks
2015	DH – 8 ED – 3	Heart rate and stroke volume Skin cancer and UV radiation	7 9
2016	DH – 11 ED – 4	Measles cases and vaccination Respiration rate and physical activity	7 8
2017	DH – 7 ED – 3	Hormone replacement therapy Inhibitor effect on phosphatase	8 8
2018	DH – 4 ED – 2	Breastfeeding and infant mortality Inhibitor effect on alcohol breakdown	6 8
2019	DH – 7 ED – 4	Age and IVF success rate Protein supplements and muscle mass	6 9

The data analysis grids, published separately, provide the structure of the questions in the SQA Higher Human Biology past papers (2015-2019) by knowledge/skill; key area; maximum mark, and tags questions that performed as grade A. It also indicates where content is no longer part of the Higher Human Biology course as a result of revised national qualification (RNQ). The annual course report gives further detail on how specific questions performed.

Marking reliably

Teachers and lecturers should be familiar with the general marking principles for Higher Human Biology (see Appendix 2) and the published marking instructions that accompany SQA past papers, as these demonstrate the required marking standard.

It is recommended that centre-devised marking instructions follow the same format and standard as those published by SQA. It is good practice to prepare the marking instructions at the same time as the assessment is constructed. Marking instructions can then be refined in light of candidate responses.

Some common marking issues include:

- Inaccurate or inconsistent application of the marking instructions.
- Arithmetical errors when totalling marks.
- Missing marks or allocating marks twice in extended response questions: using numbered ticks helps to identify where marks are allocated; it is important to be consistent in the approach to marking these, and that the marks are totalled correctly.

Marks should only be allocated based on the written response and not what the response infers.

Marking instructions should be agreed between all markers and applied consistently. Cross-marking of a sample of each markers work should occur to ensure the marking instructions have been applied accurately and consistently.

Using cut-off scores

The notional cut-off scores for course assessment are:

70% A grade
60% B grade
50% C grade
40% D grade

Cut-off scores should be appropriate to the instrument of assessment. They should be amended to reflect any differences between centre assessments and SQA question papers.

Such differences could include:

- an assessment being split over a number of sessions rather than a single sitting
- assessments with an insufficient number of grade A marks
- assessments that do not adequately sample the skills, knowledge and understanding of the course, eg they focus on one or two units only
- assessments that do not adequately integrate the skills, knowledge and understanding of the course, eg they focus on knowledge from one unit

You should raise the cut-off scores above notional difficulty to reflect such differences.

It is important to note that sometimes intended grade A marks perform as relatively straightforward marks. The overall performance of the cohort should therefore be reviewed after all candidates' assessments have been marked. If the grade A marks did not perform as intended, you should consider why this might be and whether the grade cut-off score should be adjusted to reflect candidate performance. For example, if after reviewing candidate answers, an A grade question was deemed too straightforward, you could raise the A grade boundary by 1 mark to reflect this.

A question that is considered as relatively straightforward may yield responses that are significantly different to the marking instructions, suggesting that the wording of the question caused confusion, or that the question was too challenging. Grade cut-off scores may need to be adjusted to reflect this. For example, if after reviewing candidate answers a C grade question was deemed too demanding, you could lower the C grade boundary by 1 mark to reflect this.

Appendix 1 – Higher Human Biology question paper brief

	Marks		
Component	**Knowledge and understanding**	**Skills**	**Total**
Question papers	85+/-5	35+/-5	120

Knowledge and understanding/skills	**Range of marks**
♦ demonstrating knowledge and understanding of human biology by making statements, describing information, providing explanations and integrating knowledge (dKU)	min 30
♦ applying knowledge and understanding of human biology to new situations, interpreting information and solving problems (aKU)	min 30
♦ planning and designing experiments/investigations (PLAN)	30–40
♦ selecting information from a variety of sources (SEL)	
♦ presenting information appropriately in a variety of forms (PRES)	
♦ processing information/data (using calculations and units, where appropriate) (PROC)	
♦ making predictions and generalisations based on evidence/information (PRED)	
♦ drawing valid conclusions and giving explanations supported by evidence/justification (CONC)	
♦ evaluating experiments/investigations and suggesting improvements (IMPR)	

Additional information

Two or three extended-response questions: 10–15 marks in total. At least one of the extended-response questions will include a choice of topic.
One large data-handling question: 5–9 marks.
One large experimental design question: 5–9 marks.
Grade A marks: approximately 30%.

Appendix 2 – General marking principles for Higher Human Biology

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

(a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.

(b) If a candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your team leader.

(c) Do not award half marks.

(d) Where a candidate makes an error in the first part of a question, award marks for subsequent answers that are correct with regard to this original error. Do not penalise candidates more than once for the same error.

(e) Unless a numerical question specifically requires evidence of working to be shown, award full marks for a correct final answer (including units, if appropriate) on its own.

(f) Candidates should not use bulleted lists to answer extended-response questions. They must respond to the 'command' word as appropriate and provide extended answers to communicate fully their knowledge and understanding. Candidate responses in the form of bulleted lists may not be able to access the full range of available marks.

(g) In the detailed marking instructions, if a word is underlined then it is essential; if a word is (bracketed) then it is not essential.

(h) In the detailed marking instructions, words separated by / are alternatives.

(i) A correct response can be negated if the candidate includes:

- an extra, incorrect, response
- additional information that contradicts the correct response

(j) Where the candidate is instructed to choose one question to answer but instead answers two questions, mark both responses and award the higher mark.

(k) Unless otherwise required by the question, the use of abbreviations (for example DNA, ATP) or chemical formulae (for example CO_2, H_20) are acceptable alternatives to naming.

(l) If a numerical answer is required and units are not given in the stem of the question or in the answer space, candidates must supply the units to gain the mark. If units are required on more than one occasion, do not penalise candidates repeatedly.

(m) If incorrect spelling is given, sound out the words.

- If the correct word is recognisable then award the mark.
- If the word can easily be confused with another biological term then do not award the mark, for example glucagon and glycogen.

(n) Presentation of data:

- If a candidate provides two graphs, in response to one question, mark both and award the higher mark.
- If a question asks for a particular type of graph/chart and the candidate gives the wrong type, do not award full marks. Candidates cannot achieve the plot mark but may be able to achieve the mark for scale and label. If the x and y data are transposed, then do not award the scale and label mark.
- If the graph uses less than 50% of the axes, then do not award the scale and label mark.
- If 0 is plotted when no data for this is given, then do not award the plot mark — candidates should only plot the data given.

(o) Only award marks for a valid response to the question asked. For example, in response to questions that ask candidates to:

- **identify**, **name**, **give** or **state**, they need only answer or present in brief form
- **describe**, they must provide a statement as opposed to simply one word
- **explain**, they must provide a reason for the information given
- **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between topics being examined
- **calculate**, they must determine a number from given facts, figures or information
- **predict**, they must indicate what may happen based on available information
- **suggest**, they must apply their knowledge and understanding to a new situation