National 5 Biology:

Guidance on assessment construction and marking assessments

Contents

Introduction

This document provides guidance on how to construct and mark National 5 Biology assessments and should be read in conjunction with the National 5 Biology Guidance on gathering key evidence for producing estimates 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.

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 Section 1 – Multiple-choice

Example 1 – 2014 Question 1

This question requires candidates to demonstrate their knowledge and understanding through factual recall.

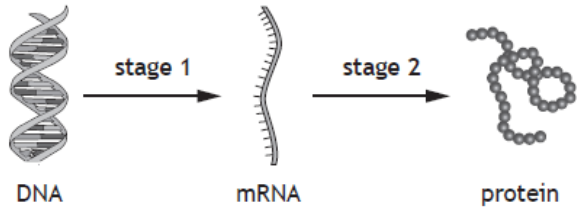
1. Which structural feature is found in a plant cell and not in an animal cell?

   A Nucleus
   B Cell wall
   C Cell membrane
   D Cytoplasm

Example 2 – 2019 Question 3

This question requires candidates to apply their knowledge and understanding to interpret information from a diagram.

3. The diagram shows stages in the production of a protein in a cell.



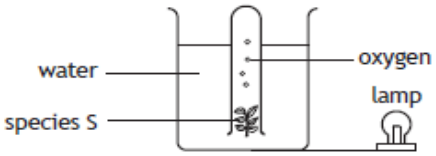
Which row in the table identifies the exact location of each stage?

	Stage 1	Stage 2
A	nucleus	cytoplasm
B	nucleus	ribosome
C	cytoplasm	ribosome
D	cytoplasm	nucleus

Example 3 – 2016 Question 7

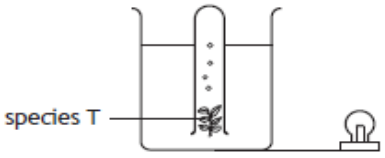
This question requires candidates to consider experimental variables in the planning and designing of an investigation.

7. An investigation was carried out to compare the rate of oxygen gas production by two different species of water plant, S and T.

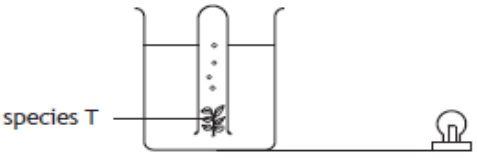


Which diagram below shows the set-up for species T, that would allow a valid comparison in the rate of oxygen production of the two species?

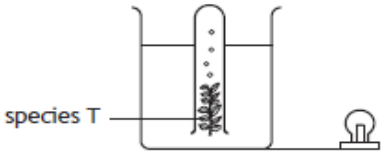
A



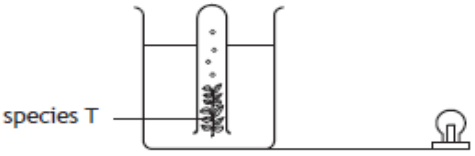
C



B



D



Example 4 – 2015 Question 14

This question requires candidates to process information using the given formula.

14. The size of a population of snails can be estimated using the following formula.

$$\text{Population} = \frac{\text{Number collected on 1st day} \times \text{Number collected on 2nd day}}{\text{Number of marked individuals found on 2nd day}}$$

A student investigated the population of snails in a garden. He collected 40 snails, marked their shells and released them. Next day, 35 snails were collected and 14 of these were found to be marked.

The snail population was estimated to be

A 16

B 100

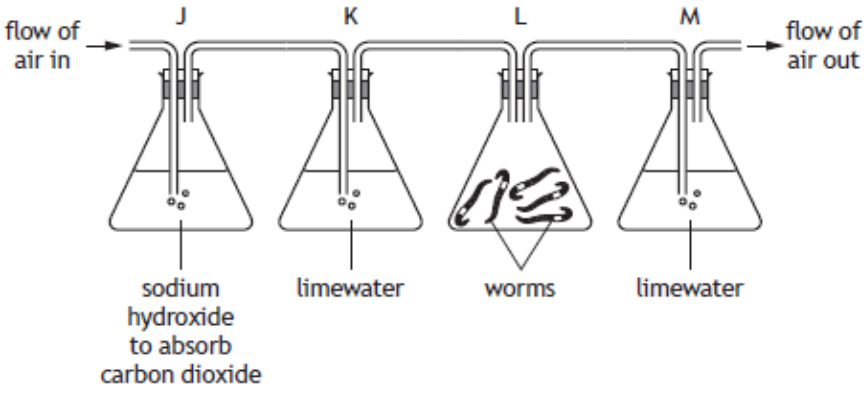
C 560

D 1400.

Example 5 – 2019 Question 6

This question requires candidates to make a straightforward prediction based on the experimental set-up shown.

Four flasks, J, K, L and M, were set up to investigate the production of carbon dioxide during respiration.



Limewater turns increasingly cloudy as more carbon dioxide is passed through it.

Predict what would happen if only one worm was used in flask L.

The limewater in flask

A K would turn cloudy more slowly

B K would turn cloudy more quickly

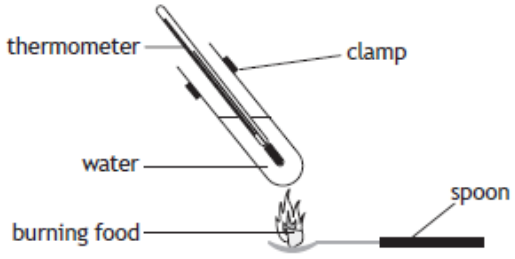
C M would turn cloudy more slowly

D M would turn cloudy more quickly.

Example 6 – 2018 Question 7

This question requires candidates to identify an improvement to an experimental investigation.

The diagram shows an experiment which can be used to find the energy content of different foods. Each food was completely burned and the energy content was estimated by the rise in temperature of the water.



The reliability of this experiment could be improved by

A burning each food for the same length of time

B repeating the experiment with each food several times

C removing the thermometer from the tube to read it accurately

D repeating the experiment using a different food each time.

Example 7 – 2016 Question 10

This question requires candidates to identify a valid conclusion from the information given.

The table below shows the blood glucose levels of two people after eating the same meal.

The normal range of blood glucose levels is 82–110 mg/dL.

Time after eating meal (min)	*Blood glucose levels* (mg/dL)	
	Person A	*Person B*
30	120	140
60	140	170
90	110	190
120	90	180
150	85	170
180	90	160

Using the information given, which of the following statements is correct?

A Person A always stayed within the normal range.

B Person B was outwith the normal range 180 minutes after eating.

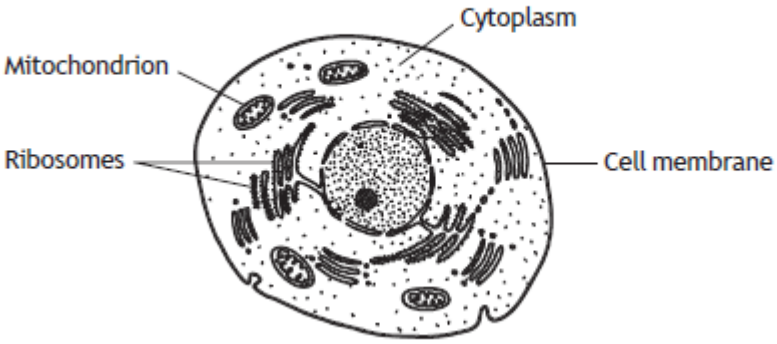
C Person B had a level twice as high as that of person A 180 minutes after eating.

D Person A and person B both had their highest levels 90 minutes after eating.

Examples of questions with grade C marks in Section 2

Example 1 – 2018 Question 1(a)

(a) The diagram shows a typical animal cell and some of its structures.



Choose two of the structures labelled and state their functions. 2

1 Structure _____

Function _____

_____

2 Structure _____

Function _____

_____

This question allows candidates to demonstrate their knowledge and understanding of cell structure.

This is an example of a question where the candidate is given a choice. It would be good practice to include one question of this type in a centre-devised exam.

Example 2 – 2019 Question 1(b)(i)

The table gives information on the numbers of mitochondria in different types of mammalian cells.

Cell type	Number of mitochondria per cell			
	Cell 1	Cell 2	Cell 3	Average
Muscle	1352	1203	1450	1335
Skin epithelium	250	330	275	
Lymphocyte	953	1112	860	975

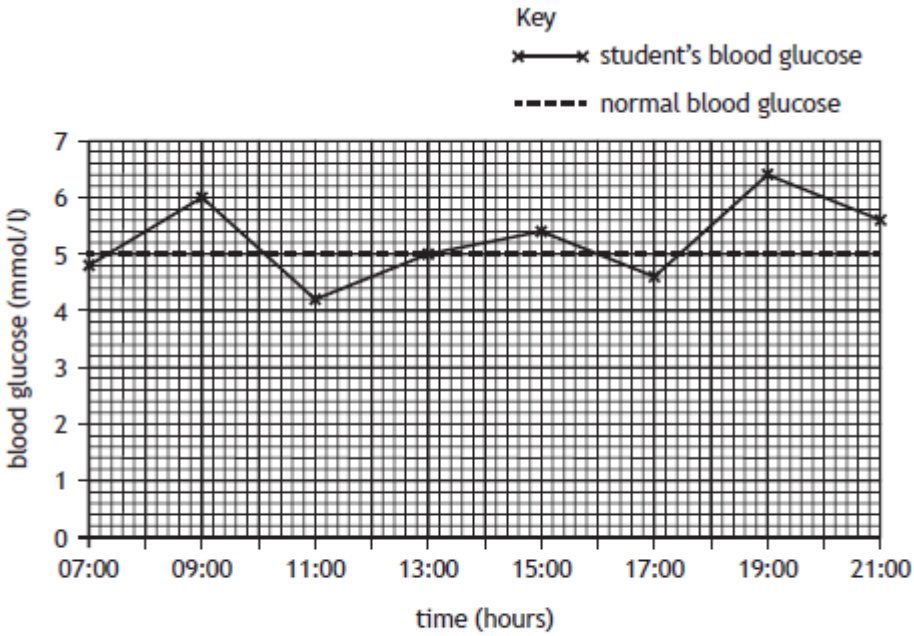
(i) Complete the table by calculating the average number of mitochondria per cell in skin epithelium.

This is a processing information question where candidates are asked to calculate an average of three numbers.

Other examples of processing information questions with grade C marks include:

- Calculating how many times greater one value is compared to another. Example: 2014 Section 2 Question 10(a)(ii).
- Calculating a simple percentage. Example: 2019 Section 2 Question 11(b)(i).

Example 3 – 2019 Question 6(a)



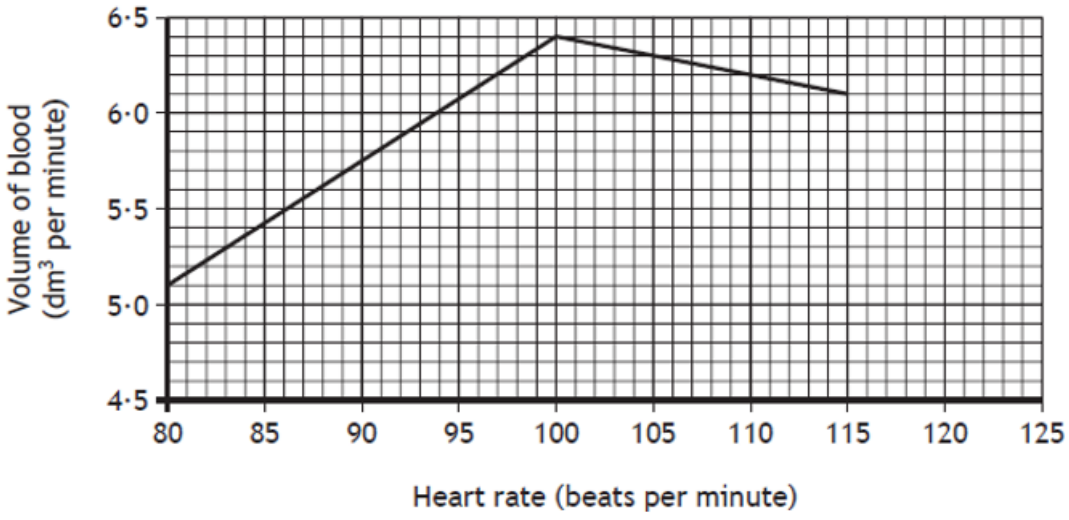
(a) Identify the time when this student's blood glucose reached its maximum value.

This question requires candidates to select one data point (the maximum blood glucose) from the graph.

The point is on one of the grid lines, and the scale on the y-axis is simple to interpret.

Example 4 – 2018 Question 10(b)(ii)

(b) The graph shows the effect of changes in heart rate on the volume of blood pumped by the left ventricle.



This question requires candidates to make a straightforward prediction from the data provided in the graph. Both scales on the graph are simple to interpret.

(ii) Predict the volume of blood pumped by the left ventricle at 120 beats per minute. 1

_____ dm^3 per minute

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 Section 1 – Multiple-choice

Example 1 – 2016 Question 12

This question requires candidates to demonstrate their knowledge and understanding by considering two facts. It is also a challenging concept.

12. Most features of an individual phenotype are

A controlled by a single gene and show continuous variation

B controlled by a single gene and show discrete variation

C polygenic and show continuous variation

D polygenic and show discrete variation.

Example 2 – 2017 Question 5

This question requires candidates to demonstrate their knowledge and understanding by considering two facts from two different key areas. This is an example of an integrated question.

Which row in the table describes a process in plants which requires sugar and a substance into which sugar is converted?

	Process	*Substance*
A	Photosynthesis	Cellulose
B	Respiration	Starch
C	Photosynthesis	Protein
D	Respiration	ATP

Example 3 – 2015 Question 17

This question requires candidates to apply their knowledge and understanding to complex information and in an unfamiliar context.

17. Antibiotic resistance in bacteria is an example of evolution. Which of the following shows the sequence of events leading to this?

A Natural selection → mutation → use of antibiotic

B Mutation → natural selection → use of antibiotic

C Mutation → use of antibiotic → natural selection

D Natural selection → use of antibiotic → mutation

Example 4 – 2015 Question 19

This question requires candidates to calculate a percentage increase, which is a complex skill.

19. DDT can be sprayed onto crops to kill insects. It can be washed off the crops by rainwater and flow into rivers where it accumulates in food chains.

A typical freshwater food chain and the concentration of DDT in each organism is shown below.

Food chain:	algae	→ stickleback	→ trout	→ osprey
DDT concentration:	0·001	2·0	5·0	20·0

The percentage increase in DDT concentration between the trout and osprey is

A 15

B 100

C 300

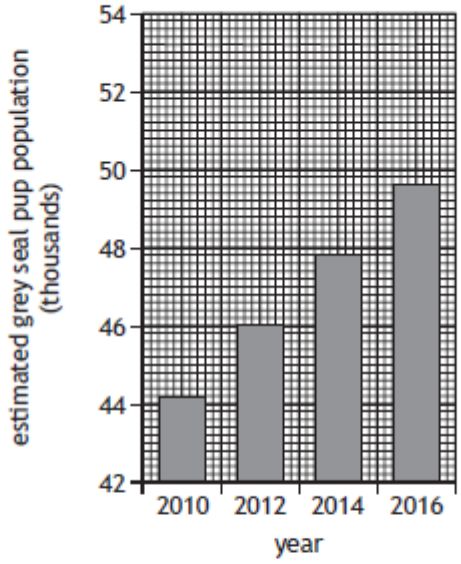
D 400.

Example 5 – 2019 Question 17

This question requires candidates to determine a trend then make a prediction.

Many candidates gave the population in 2018 rather than 2020.

The graph shows survey results of estimated grey seal pup populations every two years from 2010 to 2016.



If the grey seal pup population continues to increase by the same number at each survey, what will the estimated population be in 2020?

A 51 400

B 53 200

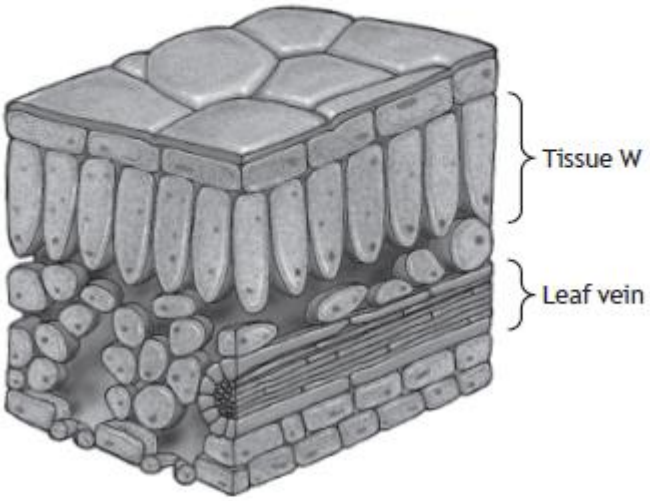
C 55 000

D 56 800

Examples of questions with grade A marks in Section 2

Example 1 – 2018 Question 12(a)(i) and (ii)

The diagram represents a section through a leaf.



(a) (i) Name tissue W. 1

_____

(ii) The cells in tissue W have a greater number of chloroplasts than other leaf cells.

Suggest the advantage of these cells being located near the upper surface of the leaf. 1

_____

_____

Question 12(a)(i)
This question requires candidates to demonstrate their knowledge and understanding in a challenging area of course content.

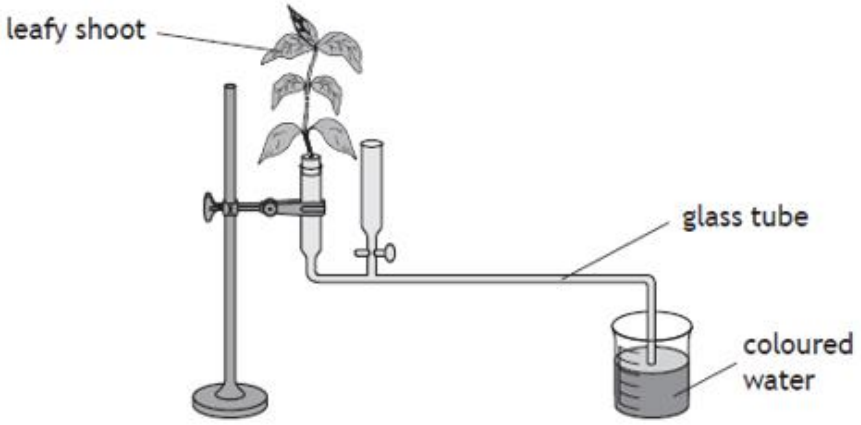
Question 12(a)(ii)
This question requires candidates to apply their knowledge and understanding across two different areas of course content. It is an example of an integrated question.

Example 2 – 2016 Question 7(a)(ii)

This question requires candidates to plan and design an experimental set-up for a chosen variable. This is a complex skill.

7. (a) The rate of transpiration in plants can be measured using the apparatus shown below.

As the plant transpires, coloured water is drawn up the glass tube and its volume measured, over a set period of time, to give the rate of transpiration.



Changes in the surrounding environment can have an effect on the rate of transpiration.

increase in humidity	increase in temperature	increase in wind speed

(ii) Choose any of the environmental changes listed above and describe an addition to the apparatus shown, which would allow an investigation into its effect. 1

Environmental change _____

Description of addition _____

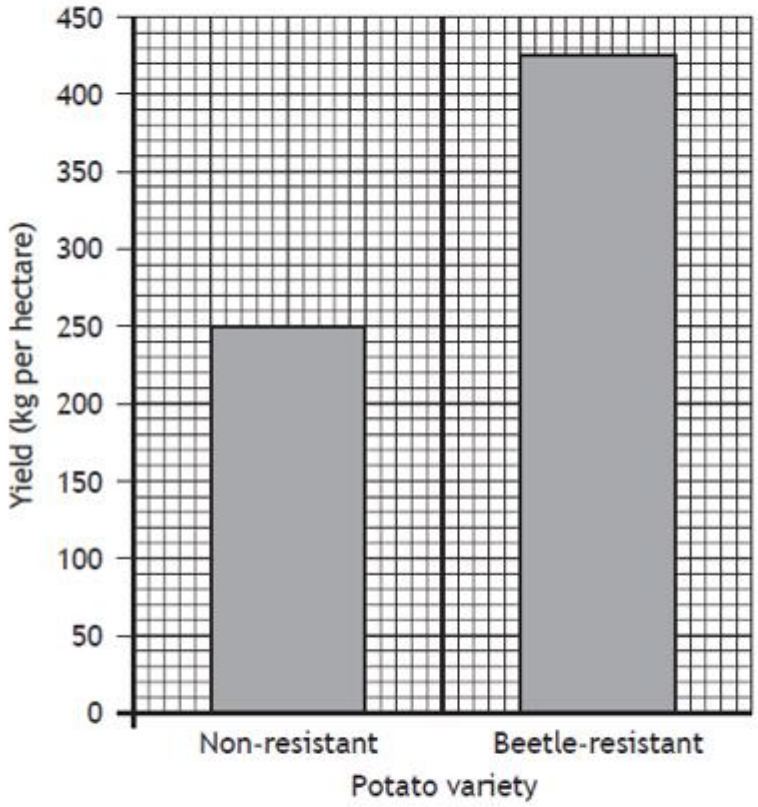
_____

Example 3 – 2017 Question 11(a) and 11(c)

11. Certain varieties of potato plant are eaten by beetles, reducing the yield of potatoes. A beetle-resistant variety of potato plant was developed.

In an investigation, the beetle-resistant variety was grown outdoors in one field and the non-resistant variety grown in another.

The yields of both varieties were recorded and the results are shown in the graph below.



(a) Describe how the reliability of these results could be increased. 1

(c) Identify a variable that would have to be kept the same between the two fields to ensure the results were valid. 1

Question 11(a)
This question requires candidates to describe an improvement for this investigation. This is a complex skill.

Question 11(c)
This question requires candidates to consider aspects of the planning and design of this investigation, which is in an unfamiliar context.

Additional information

Extended writing questions

Each assessment should contain at least one and no more than two extended writing questions of 3–5 marks. This style of question has at least one grade A mark. The subject matter can also determine the level of demand, increasing the number of grade A marks.

The grid shows the extended response questions from SQA past papers and the key areas covered.

Key

dKu Demonstrating knowledge and understanding

aKu Applying knowledge and understanding

* Grade A mark

Year	Question	Key area	Topic	Marks
2014	4	2.7(c),(e)	Absorption of materials (villi)	1 dKu, 1 dKu*,1 aKu*
	12	3.6(d)	Speciation	2 dKu, 2 dKu**
2015	8(b)	2.5	Water transport (plants)	1 aKu, 2 aKu**
2016	4(b)	1.6(c)	Fermentation pathway in muscle cells	1 dKu, 2 dKu**
2017	9(b)	2.2(a)(ii)	Reflex arc	1 aKu, 3 aKu***
2018	4(b)	1.4(b)	Enzyme reaction	1 dKu, 1 dKu*,1 aKu
	7	2.1(a)	Sequence of events in mitosis	2 dKu, 2 dKu**
2019	6(c)	2.2(b)(ii)	Blood glucose regulation	1 dKu, 1 dKu*, 1 aKu, 1aKu*
	15	1.5	Genetic Engineering	1 dKu ,1 dKu*, 2 aKu

Scientific literacy

A scientifically literate person should be able to evaluate the quality of scientific information based on its source and the methods used to generate it. They should analyse and evaluate data, claims and arguments in a variety of formats and draw appropriate scientific conclusions.

There is one scientific literacy question in the SQA National 5 Biology question paper. This is based on a short passage, extracted from a piece of contemporary scientific research, which allows the techniques of analysis and evaluation to be demonstrated. The length of the passage and the language needs to be considered to avoid a reading burden, while still containing sufficient information to give a meaningful account of the research involved. Most of the questions are skills based. Any of the skills can be included but there is no requirement to assess all.

The skills questions could include:

- identifying the aim of the research
- drawing a conclusion from the findings
- evaluating the method used to gather information
- suggesting improvements to methodology
- consideration of the planning required to carry out the research
- factors affecting the reliability of the research
- the validity of the findings
- the presentation of the outcomes

This list is not exhaustive.

There should be a range of 4-6 marks in total, including 1-3 grade A marks. There can also be 1 or 2 knowledge and understanding marks integrated into this style of question.

The grid shows the scientific literacy questions from SQA past papers, and the breakdown of skills.

Year	Question Number	Skill	Comment
2018	9(a)	Selecting information (SEL)	
	9(b)	Presenting information (PRES)	
	9(c)	Planning investigations (PLAN)	Grade A mark
	9(d)	Drawing valid conclusions (CONC)	Grade A mark
	9(e)	Planning investigations (PLAN)	Grade A mark
2019	10(a)	Planning investigations (PLAN)	
	10(b)	Presenting information (PRES)	
	10(c)	Suggesting improvements to investigations (IMPR)	
	10(d)	Suggesting improvements to investigations (IMPR)	Grade A mark

Question 13 in the SQA National 5 Biology specimen question paper is another example of a scientific literacy question.

A question paper and an additional scientific literacy question for session 2020–21 will also be provided on the SQA secure website.

Marking reliably

Teachers and lecturers should be familiar with the general marking principles for National 5 Biology (see Appendix) 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:

- Inconsistent application of the marking instructions.
- Arithmetical errors when totalling marks.
- Extended response questions: a tick can help to identify where the mark is 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 A-type marks

- assessments that do not adequately sample the skills, knowledge and understanding of the course
- assessments that do not adequately integrate the skills, knowledge and understanding of the course

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.

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.

Appendix – General marking principles for National 5 Biology

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

(a) Marks for each candidate response must always be assigned in line with these general marking principles and the detailed marking instructions for this assessment.

(b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding; they are not deducted from a maximum on the basis of errors or omissions.

(c) If a specific 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.

(d) There are no half marks awarded.

(e) Where a candidate makes an error at an early stage in the first part of a question, credit should normally be given for subsequent answers that are correct with regard to this original error.
Candidates should not be penalised more than once for the same error.

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

(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 answer can be negated if:

- an extra, incorrect, response is given
- additional information that contradicts the correct response is included.

(j) Unless otherwise required by the question, use of abbreviations (eg DNA, ATP) or chemical formulae (eg CO2, H20) are acceptable alternatives to naming.

(k) Where incorrect spelling is given, sound out the word(s).

- If the correct word is recognisable then give the mark.

- If the word can easily be confused with another biological term, then do not give the mark, eg mitosis and meiosis.
- If the word is a mixture of other biological words then do not give the mark, eg osmotis, respirduction, protosynthesis.

(l) Presentation of data

- If a candidate provides two graphs or charts, mark both and give the higher score.
- If a question asks for a particular type of graph and the wrong type is given, then full marks cannot be awarded. 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 give the scale and label mark.
- If the graph uses less than 50% of the axes, then do not give the scale and label mark.
- If 0 is plotted when no data is given, then do not give the plot mark, (ie candidates should only plot the data given).
- No distinction is made between bar graphs and histograms for marking purposes.
- In a pie chart, lines must originate from the central point and extend to tick marks. Labels must be given in full.

(m) Marks are awarded only 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.