Qualification Accredited

Oxford Cambridge and RSA

AS LEVEL

Examiners' report

BIOLOGY A

H020
For first teaching in 2015

H020/02 Summer 2018 series

Version 1

Contents

© OCR 2018

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

© OCR 2018

Paper H020/02 series overview

H020/02 is one of the two examination components for the AS Level examination for GCE Biology A. This Depth in Biology component uses a range of short structured questions and extended response questions to test:

- candidates' **knowledge and understanding** of the AS specification subject content and related practical outcomes
- candidates' ability to **apply** their knowledge to novel scenarios and to solve problems and perform calculations
- candidates' ability to **analyse, interpret and evaluate** scientific information.

Compared to H020/01 (Breadth in Biology) there are fewer marks available on this paper for knowledge but more marks for the higher order skills of application and analysis. A feature of the 2018 paper was a large allocation of marks for problem-solving using mathematical skills. To do well on this paper candidates need to practise interpreting and evaluating new information and data in the light of their theoretical knowledge and to be comfortable with a wide range of practical skills.

Questions candidates found easiest	***Questions most often omitted***
• 1(a)(ii) knowledge of peptide bonding • 1(b)(iii) knowledge of fibrous and globular proteins (extended response) • 2(b)(i) and (ii) observations of a heart • 4(b)(i) understanding of non-competitive inhibition • 4(b)(ii) presenting numerical information as a sketch graph • 5(b) finding evidence from data to support a conclusion • 6(a)(ii) naming a quadrat	• 1(c)(ii) Rf value calculation (quantitative work in a practical context) • 3(c)(ii) drawing and labelling part of an antibody (candidates may have just missed this although there was a clear instruction to answer on Fig. 3.1) • 4(a)(ii) quantitative analysis of the theory of fluid movement in and out of a capillary • 4(b)(iv) suggesting a practical procedure to solve a novel problem • 6(b) evaluating a practical procedure to extract DNA from a plant.

Comparing the questions candidates found easiest with those that were omitted the most, it is apparent that candidates were usually well-prepared in terms of subject knowledge and understanding but less confident with quantitative work and with practical procedures. This report will particularly concentrate on providing guidance and support for the teaching of mathematical problem-solving in practical contexts.

© OCR 2018

Question 1(a)(i)

1 **(a)** Fig. 1.1 shows the general structure of an amino acid.

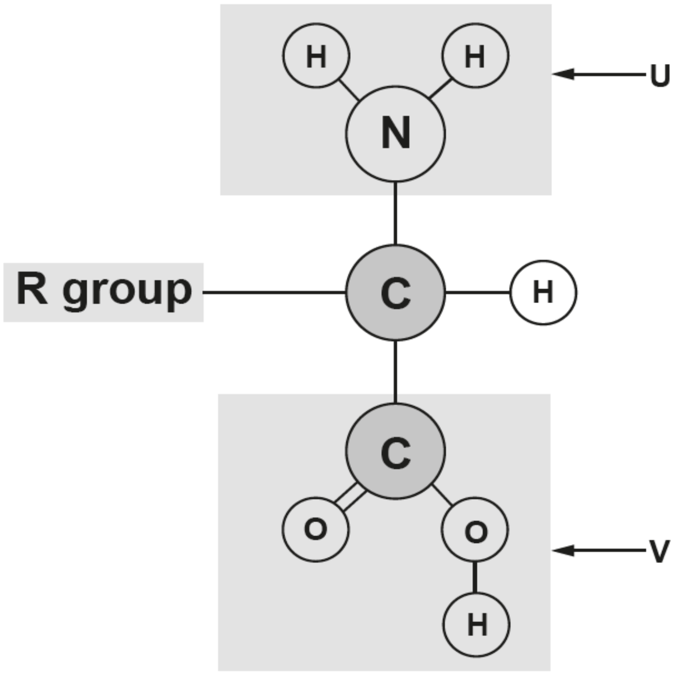

Fig. 1.1

(i) State the names of the groups labelled **U** and **V**.

U ....

V ....
[1]

This recall task was generally well-done but wrong answers included nitrogenous for **U**.

Question 1(a)(ii)

(ii) Fig. 1.2 shows a representation of a short polypeptide chain made from three amino acids.

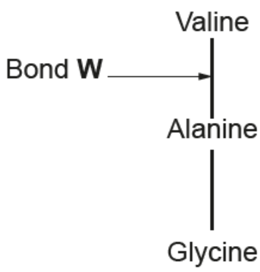

Fig. 1.2

Name bond **W and** state what type of reaction takes place to form this bond.

Name of bond **W** ....

Type of reaction ....
[1]

© OCR 2018

Most candidates were successful in naming the peptide bond and the type of reaction (condensation). Some candidates confused condensation and hydrolysis.

Question 1(b)(i)

(b) Pepsin is a protease enzyme with a polypeptide chain containing 327 amino acids.

Titin is the largest known protein. It has a polypeptide chain containing at least 92 times more amino acids than pepsin.

(i) DNA sequences in genes code for polypeptide molecules such as pepsin and titin.

Explain why a process known as transcription is necessary for polypeptide synthesis.

....

....

....

.... **[2]**

As a recall question this was done well, particularly with respect to the sizes of molecules being able or unable to leave the nucleus via nuclear pores, and ribosome being the site of translation. Some candidates confused translation with transcription.

Misconception Some candidates misuse language in describing transcription.

Correct:

- DNA is transcribed into mRNA. *(Note passive tense)*
- mRNA is a transcript of the DNA.
- mRNA is a copy of the DNA.

Incorrect:

- mRNA transcribes the DNA. *(Active tense)*
- mRNA copies the DNA. *(RNA polymerase does this).*
- DNA is converted into mRNA.

© OCR 2018

Question 1(b)(ii)

(ii) Calculate the minimum length of the DNA base sequence required to code for titin.

Show your working.

Answer .... **[2]**

Most candidates multiplied the number of amino acids in pepsin (327) by the number of times bigger that titin is compared to pepsin (92). These candidates gained 1 mark for arriving at the figure 30 084. Only a minority of candidates understood that the question information was about the number of *amino acids* in a polypeptide while the question was asking for the number of *bases* in the equivalent DNA. Some of those who realised the distinction divided by the number of bases that code for one amino acid in error. The correct process was multiplying by 3 due to the logic that every amino acid in a polypeptide is coded for by 3 bases on DNA. Candidates who followed a different route could calculate the number of bases in DNA coding for pepsin and then multiply by 92, or could add 3 or 6 bases to their final answer for a stop and/or start codon.

Question 1(b)(iii)

(iii)* Titin is a fibrous protein. Pepsin is a globular protein.

Compare the properties and functions of fibrous proteins and globular proteins in the human body.

....

....

....

....

.... **[6]**

....

Candidates generally had plenty to say and almost all attempted to fulfil the command word **compare** by making reference to **both** fibrous and globular proteins. Level 3 answers fully answered the question brief by providing science content covering at least one property of a fibrous protein and one property of a globular protein and at least one function of each type of protein. The word 'property' was confused by some candidates with structure and this resulted in irrelevant material about levels of protein structure and bonding within proteins. Properties may be physical or chemical and relate to aspects like the solubility, strength, flexibility, shape and stability (for example at different temperatures) of molecules.

© OCR 2018

Exemplar 1

fibrous proteins usually form strands. They are usually insoluble in water, not very metabolically active and have a structural role within the body. For example, keratin which makes up things like skin, hair and nails. Globular proteins have more of a spherical shape. They are usually soluble in water and are more metabolically active than fibrous proteins. Globular proteins have a more metabolic role within the body. For example, haemoglobin and insulin are both examples of globular proteins and are involved in chemical reactions in the body. [6]

L3

Exemplar 1 is a level 3 answer that is contained within the line space, answers all aspects of the question and contains an appropriate level of science content. There is a well-developed line of reasoning, a clear and logical structure and all the material is relevant and substantiated by fact, so the communication statement for 6 marks is met.

© OCR 2018

Question 1(b)(iv)

(iv) Another protease enzyme is HIV1 protease, which is essential for the life cycle of the human immunodeficiency virus (HIV). Inhibition of this protease prevents HIV from maturing.

In 1995, saquinavir was the first HIV1 protease inhibitor drug to be approved by the US Food and Drug Administration (FDA).

The data in Fig. 1.3 show the number of acquired immune deficiency syndrome (AIDS) diagnoses and deaths between 1981 and 2007 in the US.

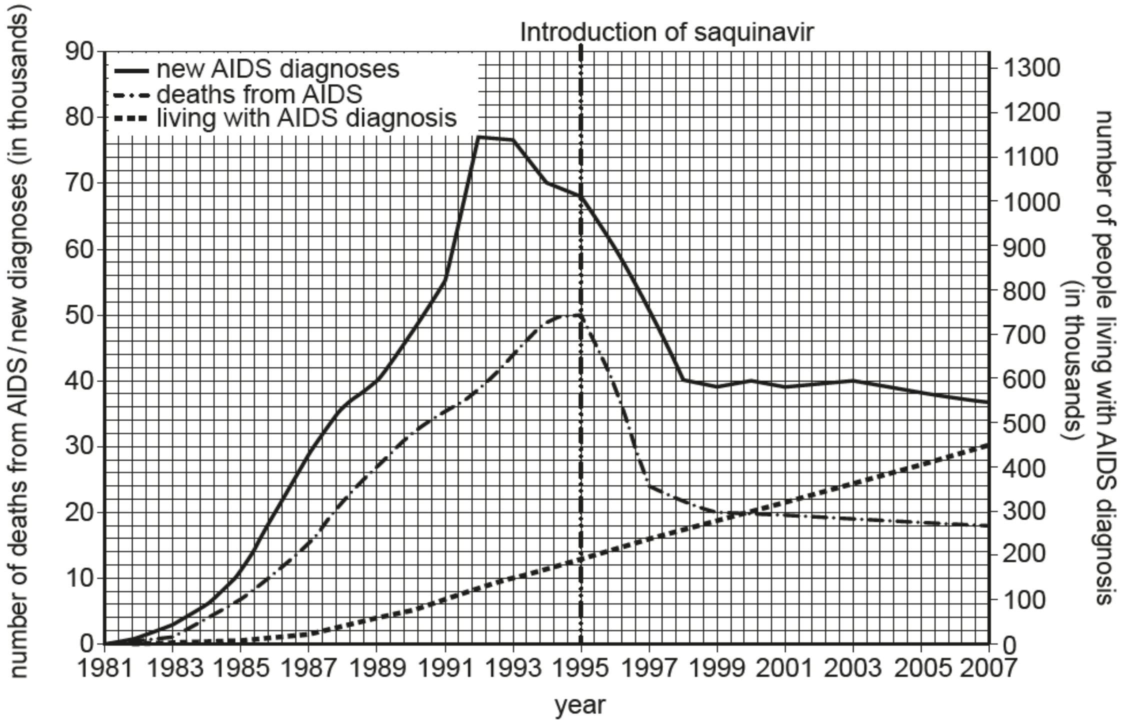

Fig. 1.3

Calculate the rate of decrease in deaths from AIDS between 1995 and 1998.

Give your answer to **two significant figures**.

Show your working.

Answer .... Units .... **[2]**

Candidates often achieved one of the two marks available but few successfully worked through all the processes involved in arriving at an answer with appropriate units for the rate of decrease over three years. One error was for candidates to calculate not a rate (over time) but a percentage decrease. A breakdown of how to tackle this question is listed in the 'Assessment for Learning' box. This, together with sections from the three tutorial sheets listed under OCR support, could form the basis of a step-by-step worksheet on solving the problem set in this question. Additional questions could be devised using this graph to calculate rates of increase or decrease in the numbers of new diagnoses or those living with an AIDS diagnosis for different time periods.

AfL

1. Select the dash-dot line for deaths and read to the nearest half-square of the grid where values for 1995 and 1998 intercept the *y* axis.
2. Check the left-hand *y* axis label to see that these figures represent thousands.
3. Subtract one away from the other to find the difference.
4. Divide this answer by the time between the two values on the *x* axis, 3 years.
5. Give the answer to two significant figures.
6. Determine the units.

OCR support

Tutorial sheets and quizzes are available to support the teaching of the skills listed in the specification for Maths for Biology. Three areas cover key skills needed to successfully answer this question:

http://www.ocr.org.uk/qualifications/by-subject/biology-related/maths-for-biology/m3-graphs/ (calculating a rate from a graph with time on the *x* axis)

http://www.ocr.org.uk/qualifications/by-subject/biology-related/maths-for-biology/m0-arithmetic-and-numerical-computation/ (introduction to significant figures)

http://www.ocr.org.uk/qualifications/by-subject/biology-related/maths-for-biology/m0-arithmetic-and-numerical-computation/ (using and choosing units)

© OCR 2018

Question 1(b)(v)

(v) A student looking at the data in Fig. 1.3 made the following conclusion:

> "The decrease in deaths from AIDS after 1995 is because of the use of saquinavir by HIV patients."

Suggest why this conclusion may be invalid based on the data in Fig. 1.3.

....

....

....

....

.... **[2]**

As specified in the question, candidates had to make use of data from the graph in their answer. Ideas from their own knowledge like improved education or increased precautions against transmission of HIV did not therefore score. Strong responses did not just look at 1995 to judge whether the introduction of a drug had an effect (pre-supposing that a change would begin from this point), but instead drew conclusions from ongoing trends that pre-dated 1995. These showed that new diagnoses were already falling, deaths had already peaked and the number living with AIDS experienced no change in its rate of increase.

© OCR 2018

Question 1(c)(i)

(c) A group of students wanted to use thin layer chromatography to identify four amino acids.

To produce the chromatogram, the students:

- drew a pencil line 1 cm from the bottom of the chromatography plate and put solvent into the beaker to a height of approximately 0.9 cm
- held the chromatography plate firmly in the middle with their hands and lowered it into the beaker
- left the apparatus to stand as shown in Fig. 1.4.

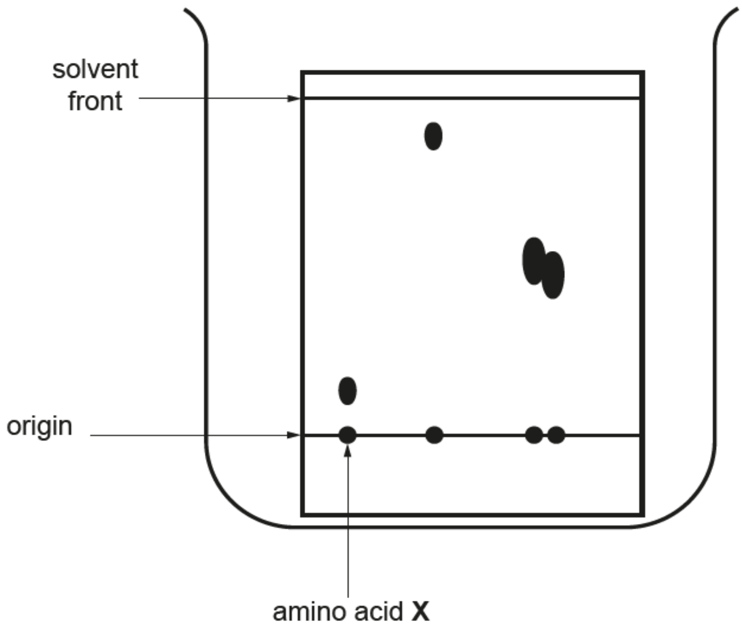

Fig. 1.4

(i) Describe **four** ways you would refine the method used by the students. For each change you suggest, give a reason why this would improve the results of the experiment.

....

....

....

....

....

....

....

.... **[4]**

Candidates mostly made two sensible suggestions for refining the chromatography experiment procedure, but few managed three and very few four. The question clearly asked not just for a suggested change but also for an associated reason so answers needed to follow the plan 'do x because of y'. Eight key ideas for improvement are provided on the mark scheme. AfL ideas are given below.

AfL

Making four suggestions relies upon:

(i) plenty of practice in using chromatography

(ii) the ability to clearly visualise the experimental set-up and to consider the steps in setting it up and running the procedure.

A cheap way of teaching the principles of chromatography is to use strips of filter paper held by a paper clip inserted into a cork and to suspend these in boiling tubes containing a low toxicity solvent. Felt tip pens or food dyes can be used as samples and the results are instantly visible and can be measured for Rf value calculations. Chromatograms can be left to run while other teaching continues. Once the principles, including the derivation of the name 'chromatography' are understood, chlorophyll extracts from different leaves can be provided, or other sources of natural colour (anthocyanins from flowers of berries). The need to stain colourless compounds such as amino acids can then be introduced. The principles of thin layer chromatography (and to some extent, gel electrophoresis) are the same as in paper chromatography but the paper version is cheap and easy enough to be able to give candidates more than one opportunity to practice the technique.

© OCR 2018

Question 1(c)(ii)

(ii) Table 1 shows the R_f values of some amino acids.

Name of amino acid	R_f value
Alanine	0.31
Cysteine	0.40
Glutamine	0.13
Phenylalanine	0.59

Table 1

Using the information in Table 1 and Fig. 1.4, identify amino acid **X** by calculating its R_f value.

Show your working.

R_f value of amino acid **X** ....

Name of amino acid **X** ....

[2]

Most candidates correctly selected glutamine but not all provided an Rf value calculated from Fig. 1.4 to justify this. Some attempts to divide the distance travelled by amino acid X by the distance travelled by the solvent front used measurements that were so inaccurate that the answer fell outside of the generous range provided for by the mark scheme.

© OCR 2018

Question 2 (a)(i)

2 **(a)** A patient was admitted to a hospital ward suffering from a heart rhythm abnormality.

Fig. 2.1(a) shows an ECG trace of the patient upon arrival at the hospital.

Fig. 2.1(b) shows an ECG trace of the patient when their heart rhythm had settled down to that of a normally functioning heart.

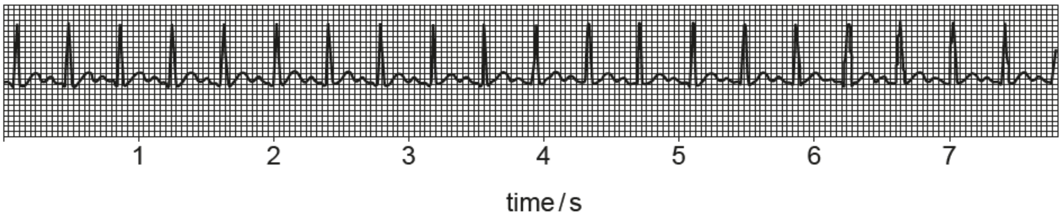

Fig. 2.1(a)

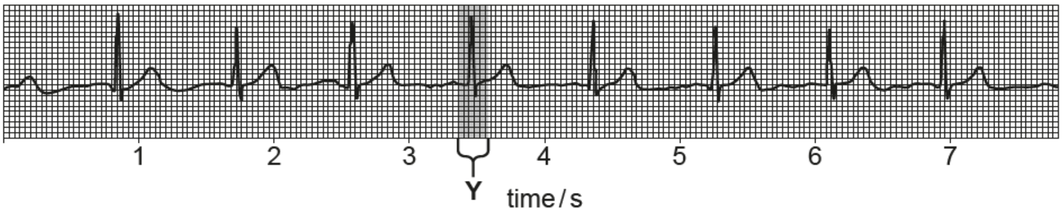

Fig. 2.1(b)

(i) Using the traces shown in Fig. 2.1, name the heart rhythm abnormality that the patient is suffering from.

.... **[1]**

Of those who attempted to name the abnormally fast heart rhythm, around half got the correct answer. Most of the rest provided a spelling that was unacceptably far from the correct one, tachycardia, though a few opted for other heart abnormalities like atrial fibrillation or bradycardia.

© OCR 2018

Question 2(a)(ii)

(ii) The equation for working out cardiac output is:

cardiac output = stroke volume × heart rate

Stroke volume is the volume of blood pumped per heart beat.

The stroke volume of the patient is 80 cm^3.

Calculate the cardiac output of the patient using **Fig. 2.1(b)**. Give your answer in standard form.

Answer .... Units .... **[3]**

This was another problem requiring several steps of mathematical processing to solve. Just under half of candidates gained one or more marks. A stepwise approach to dealing with this question is detailed in the AfL box, and some support materials are listed below this. The error carried forward rule meant that candidates who only got part way through the calculation were credited if they gave their calculated figure in standard form. Similarly if a wrong answer was given with a correct unit, a mark was credited.

AfL

1. Use the ECG in Fig. 2.1 (b) to measure the time in seconds for a set number of heart beats to occur. Ideally a larger number (wider sample) should be chosen, e.g. all nine beats occurring in 8 seconds, though the mark scheme made allowance for a smaller section of the ECG trace being used.

3. Convert the number of heart beats in this number of seconds to a heart rate in beats per minute. E.g. 9/8 x 60 = 67.5 bpm.

4. Substitute into the equation for cardiac output the stroke volume of 80cm^3 and the calculated figure for heart rate. E.g. 80 x 67.5 = 5480.

5. Give the answer in standard form.

6. Determine the units as a measure of volume per unit time.

OCR support

Tutorial sheets and quizzes are available to support the teaching of the skills listed in the specification for Maths for Biology. Two in particular cover key skills needed to successfully answer this question:

http://www.ocr.org.uk/qualifications/by-subject/biology-related/maths-for-biology/m2-algebra/ (using algebraic equations)

http://www.ocr.org.uk/qualifications/by-subject/biology-related/maths-for-biology/m0-arithmetic-and-numerical-computation/ (using standard form)

© OCR 2018

Question 2(a)(iii)

(iii) Explain how the heart is controlling the electrical activity at **Y** on Fig. 2.1(b).

....

....

....

....

.... **[2]**

This was well answered with most candidates mentioning the atrioventricular node (AVN) and referring correctly to a wave of excitation of electrical impulses (rather than signals or messages).

Question 2(b)(i)

(b) Fig. 2.2, **on the insert**, shows photographs of sheep's hearts that were considered for use in a school dissection.

(i) Looking at the two hearts in Fig. 2.2, a student decided that **Heart 2** was a better choice for the dissection because it had more structures present.

What evidence from the two hearts in Fig. 2.2 supports the student's decision?

....

.... **[1]**

Most candidates referred to the visible blood vessels or a named vessel on heart 2.

Question 2(b)(ii)

(ii) Name the structure labelled **Z** on Fig. 2.2.

.... **[1]**

Most candidates identified the left ventricle. Some wrote cardiac muscle which is a tissue rather than a structure.

© OCR 2018

Question 2(c)*

(c)* Fig. 2.3 shows the heart at different stages of the cardiac cycle.

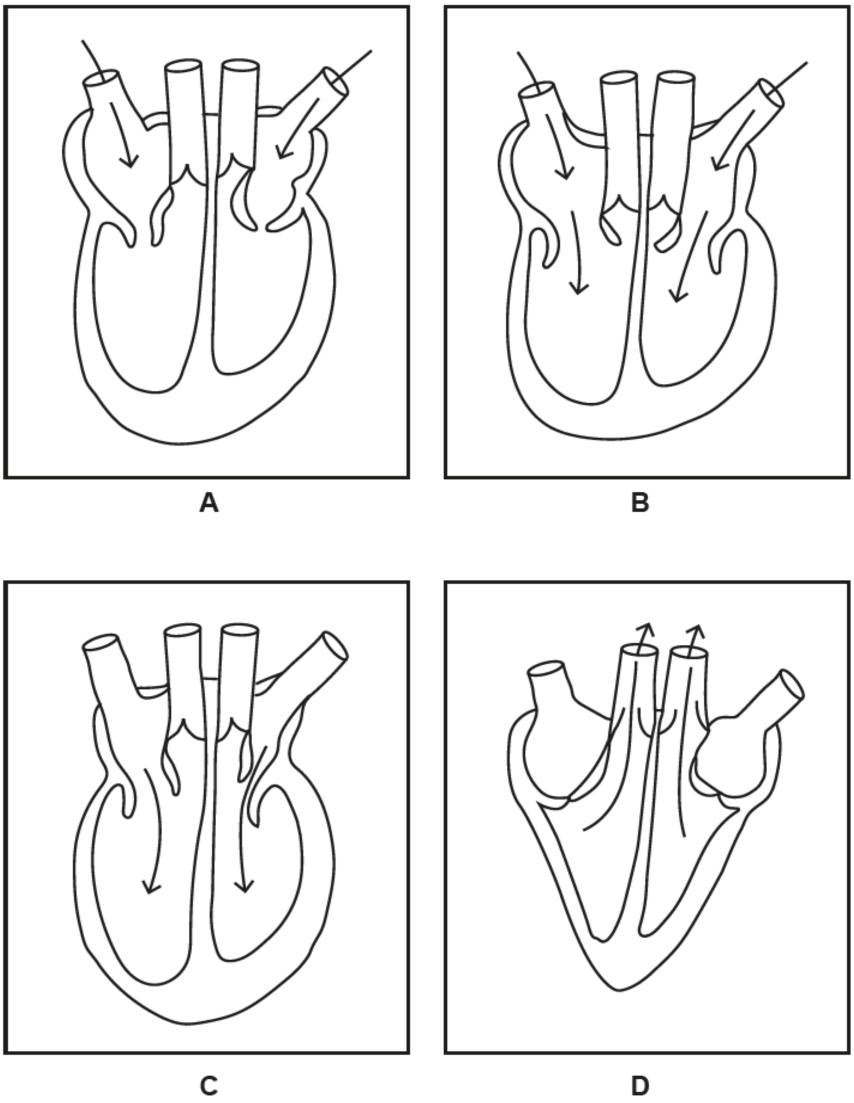

Fig. 2.3

Box A shows atrial diastole. Blood is entering the atria, which are relaxed.

Outline the remaining stages of the cardiac cycle, with reference to boxes B, C and D in Fig. 2.3.

....

....

....

....

.... **[6]**

© OCR 2018

In order to be successful on this level of response question, candidates had to apply their recalled knowledge of the cardiac cycle to the sequence of stages shown on Fig. 2.3. Most candidates tried to do this and made clear references, as instructed, to stages **B**, **C** and **D**. A correct and clearly communicated account with a reasonable level of detail scored 6 marks, but the next commonest mark was a level 2 mark of 3 for the type of answer shown in the exemplar. A common error for stage **C** was to say that the atrioventricular valves were being forced closed when the diagram does not show this. Some candidates confused the names of the atrioventricular valves and the semi-lunar valves which muddled the clarity of their communication. Many thought that the AV valves closed automatically to prevent backflow at the beginning of ventricular systole and do not realise that this occurs due to the build-up of pressure in the ventricles created by the contraction of the muscular wall.

Exemplar 2

Box B shows atrial systole where pressure builds up in the atria which contract and force open the atrioventricular valves, and blood begins to enter the ventricles.

Box C shows ventricular diastole; this is where blood is entering the ventricles and they are relaxed.

Box D shows the ventricles contracting ~~which~~ due to a build up of pressure causing the semi-lunar valves to open and blood leaving the heart. This is ventricular systole. L2 ^

This candidate scores 3/6 for an answer that gets one stage completely wrong (B incorrectly described as atrial systole), one stage right with an appropriate level of detail (D described as ventricular systole) and one stage not wrong but lacking the main correct descriptive points (C, should be recognised from the diagram as atrial systole). This exemplifies a common pattern of wrong answer that which may have been due to candidates relying too much on memorised accounts and not enough on studying the diagrams provided.

Question 3(a)

3 **(a)** A cytoskeleton is present in all eukaryotic cells. One of its functions is to control the movement of organelles.

State how the cytoskeleton moves organelles around the cell.

....

.... **[1]**

Just under half of candidates associated movement of organelles in a cell with microtubules or motor proteins.

© OCR 2018

Question 3(b)

(b) Epithelial cells in the airways of mammals play an essential role in defences against pathogens.

Explain the function of epithelial cells in the airways of mammals in the defence against pathogens **and** suggest the importance of the cytoskeleton in carrying out this function.

....

....

....

....

....

....

....

.... **[4]**

Most candidates scored one or more marks. High ability responses showed correct and precise use of biological terms such as goblet cells, mucus, cilia and pathogens. Lower ability responses did not distinguish between the roles of two sorts of epithelial cells, goblet cells and ciliated cells. The commonest error was to say that cilia trap pathogens.

© OCR 2018

Question 3(c)(i)

(c) **(i)** Phagocytes defend the body by engulfing and destroying pathogens in a process called phagocytosis.

A student produced a summary of the stages of phagocytosis, which is shown in Fig. 3.1.

The student made two errors in their summary. Describe what **two** corrections the student should make.

Stage 1 Phagocytes are attracted by chemicals produced by pathogens.

↓

Stage 2 Phagocytes recognise pathogen as self.

↓

Stage 3 Phagocyte engulfs the pathogen and encloses it in a vacuole called a phagosome.

↓

Stage 4 Enzymes from lysosomes digest and destroy the pathogen.

↓

Stage 5 Phagosome combines with a lysosome to form a phagolysosome.

Fig. 3.1

Correction 1 ....

....

....

Correction 2 ....

....

.... **[2]**

Most candidates recognised the problem with stage 2 (which should have said non-self or equivalent) but fewer recognised that stages 4 and 5 were in the wrong order.

© OCR 2018

Question 3(c)(ii)

(ii) Antibodies are defensive proteins carried in the bloodstream. Fig. 3.2 shows the simplified, incomplete structure of an antibody.

Complete Fig. 3.2 by **drawing and labelling** the missing part(s) of the antibody.

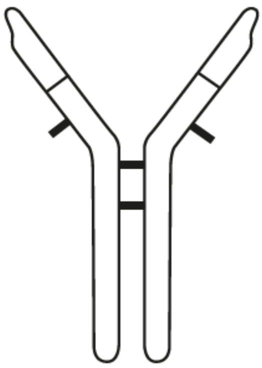

Fig. 3.2

[Answer on Fig. 3.2] **[1]**

Many candidates missed this out. Candidates who attempted it often drew light chains that were too long, in the wrong place or unrecognisable. Where at least one light chain was drawn correctly there was usually one correct label such as 'variable region' or 'light chain'.

Question 4(a)(i)

4 (a) (i) Ions have a number of important roles in living organisms.

Complete the table below by identifying the ion that plays each of the roles. Choose from the following list.

NH_4^+ Cl^- H^+ OH^- PO_4^{3-} Ca^{2+}

Important role	Ion
Production of nitrate ions by bacteria	NH_4^+
Loading of phloem	
DNA structure	
Cofactor for amylase	

[2]

Most candidates could identify one or two ions associated with the roles. The least-known ion was chloride ion as a cofactor for amylase.

© OCR 2018

Question 4(a)(ii)

(ii) Dissolved ions diffuse between blood plasma and tissue fluid.

Pressure differences at the arterial and venous ends of capillaries are responsible for the formation of tissue fluid. The following measurements were made in one capillary:

- Net hydrostatic pressure at the arterial end was 4.6 KPa
- Net oncotic pressure was −3.0 KPa
- Net hydrostatic pressure at the venous end was 2.3 KPa.

Use this information to explain the movement of fluid in and out of a capillary.

....

....

....

....

....

....

.... **[2]**

This question targeted a quantitative understanding of a theoretical process. Candidates needed to present an analysis of the figures in the question to explain why fluid moves out of the capillary at the arterial end and back in at the venous end. Memorised answers that not fully explain the net effect of the two opposing pressures did not score. Lower scoring answers ignored oncotic pressure and just discussed the difference between hydrostatic pressure at both ends of capillary.

Question 4(b)(i)

(b) Copper (II) ions act as irreversible non-competitive inhibitors of the enzyme catalase.

(i) Describe how a non-competitive inhibitor works to inhibit the activity of an enzyme.

....

....

....

....

.... **[2]**

This question was well answered with most candidates naming or describing an allosteric site, and giving an appropriate level of detail about the effect of inhibitor binding on the enzyme's tertiary structure or on enzyme-substrate bonding.

© OCR 2018

Question 4(b)(ii)

(ii) Catalase is found in all living things that are exposed to oxygen. It protects cells from oxidative damage by breaking down hydrogen peroxide to water and oxygen.

Catalase is a useful biomarker of oxidative stress in fish exposed to water contaminated with copper ions.

A group of students carried out an experiment to explore the effects of copper sulfate on the action of catalase. They measured the activity of catalase exposed to different concentrations of copper sulfate.

The results of their experiment are shown in Table 4.

Concentration of copper sulfate (moles dm^{-3})	**Volume of oxygen gas produced (cm^3)**
0.00	14.50
0.05	10.50
0.10	7.55
0.15	5.80
0.20	4.20

Table 4

In the space provided below, **sketch** a graph of the results in Table 4.

[2]

Most candidates gained one or two marks. See the AfL box for advice on training candidates in this skill.

AfL

1. Identify the independent variable in the table and label the *x* axis with the full column heading description plus the full units.
2. Identify the dependent variable in the table and label the *y* axis with the full column heading description plus the full units.
3. Plot the points roughly by eye.
4. Join them with a clear, single line of best fit, in this case a curve.

© OCR 2018

Question 4(b)(iii)

(iii) What can the students conclude from their results?

....

....

....

....

.... **[2]**

Most candidates showed they are able to describe a relationship between two variables using data from a table or graph. Higher ability candidates went on from this to explain the relationship in terms of copper ions inhibiting the activity of catalase.

Question 4(b)(iv)

(iv) Three rivers in the Himalayan foothills were polluted with copper, which affected the aquatic wildlife. Scientists were provided with one dead Indian Barb fish, *Esomus danricus*, from each of the rivers.

Scientists were unable to take a direct measurement of the copper ion concentration in the fish.

Using the information provided in 4(b)(ii), suggest how the scientists could use the fish tissue to compare the copper ion pollution in the three rivers.

....

....

....

....

....

....

.... **[3]**

While a generous mark scheme enabled candidates to score one or two marks, very few candidates were able to fully integrate the information gained from Q.4 (a) parts (i) to (iii) to understand how to tackle this question. The correct line of thinking underpinning an experiment to use the three fish to compare the copper ion pollution in the rivers they came from is given in the AfL box. Errors in thinking included adding catalase to the fish (instead of realising the fish are a source of catalase and adding hydrogen peroxide) or thinking that the relative oxygen content of each fish could be measured. The main marking point that was credited was re-stating the relationship that more copper ions means less oxygen produced or catalase activity. Higher scoring answers mentioned a way of controlling a variable in their experimental design, such as cutting equal-sized samples of each fish, or referring to the table or graph to read off a concentration of copper ions. The higher order skills being tested here were firstly, to interpret and evaluate the information given, and secondly, to creatively develop a practical procedure based on these facts.

© OCR 2018

AfL

Steps in thinking required to design an experiment to use the three fish to compare the copper ion pollution in the rivers they came from:

1. Copper ions bind irreversibly to catalase enzyme (information from the first line of (b)).

2. Catalase is found in all living things (information from (b) (ii)), including fish.

3. A fish from a more polluted river will have less working catalase.

4. Catalase activity can be measured by adding hydrogen peroxide and measuring oxygen production (information from (b) (ii)).

5. Refinement of procedure with consideration to controlling variables and interpreting results.

Candidates could be asked to consider each step 1-5 and whether the skill needed in each case is interpretation or evaluation of information given, or creative design with the ability to visualise an experimental procedure.

Question 5(a)(i)

5 **(a)** Elephants are protected by the treaty known as the Convention on International Trade in Endangered Species (CITES).

(i) Give **one** aim of CITES.

....

....

.... **[1]**

Many candidates recognised that CITES is linked to protecting endangered species but wrote vaguely about conservation without specifying the restriction on trade.

Question 5(a)(ii)

(ii) Between 1913 and 2013 the approximate worldwide population of living elephants dropped from 10 000 000 to 500 000.

Calculate how many orders of magnitude smaller the elephant population is likely to be in 2213 compared to 1913.

Assume that the elephant population continues to decline at the same rate each 100 years.

Show your working.

Answer .... **[2]**

Candidates found this question very challenging and only very high ability candidates achieved a final answer of 4 orders of magnitude. See the AfL box for a step-by-step approach to solving this problem, and the OCR support box for links to useful resources.

AfL

Since the initial number of elephants was very large and the challenge was to find the difference in order of magnitude between a starting and final figure, it may be helpful to re-state the figures in standard form as follows:

1. In 1913 there were 1×10^7 elephants.

2. In 2013 there were 5×10^5 elephants.

3. The percentage remaining after 100 years is calculated as the final number divided by the starting number multiplied by 100 (= 5%) OR

The percentage decrease after 100 years is calculated as the difference divided by the starting number multiplied by 100 (= 95%).

4. Assuming the same rate of decline every 100 years,

in 2113 there will be 5% left of 5×10^5

so 5/100 x 500 000 = 25 000 (2.5×10^4)

5. Again assuming the same rate of decline,

in 2213 there will be 5% left of 2.5×10^4

so 5/100 x 25 000 = 1250 (1.25×10^3).

6. To find the difference in order of magnitude between the elephant population in 1913 and 2213, compare 1×10^7 with 1.25×10^3. The difference in the exponential is 7 – 3 = 4 orders of magnitude.

© OCR 2018

OCR support http://www.ocr.org.uk/qualifications/by-subject/biology-related/maths-for-biology/m0-arithmetic-and-numerical-computation/ (using standard form)

http://www.ocr.org.uk/qualifications/by-subject/biology-related/maths-for-biology/m1-handling-data/ (orders of magnitude)

Question 5(b)

(b) Fig. 5 shows the approximate percentages of elephants that were killed illegally in three different regions of Africa.

Item removed due to third party copyright restrictions

John Scanlon, the Secretary-General of CITES in 2015, made the following statement:

Item removed due to third party copyright restrictions

Give two pieces of evidence to show how the data in Fig. 5 support the statement made by John Scanlon.

Evidence 1 ....

....

....

....

Evidence 2 ....

....

....

....

[2]

Candidates generally picked out at least one piece of evidence but needed to include detailed description, i.e. the number of illegally killed elephants in a named place. Single figure comparisons were acceptable, as were descriptions of increase or decreasing trends and figures quotes to support these.

© OCR 2018

Question 6(a)(i)

6 **(a)** A group of students were studying a local field, Upper End Meadow. The students sampled plants from this field.

The students' results are given in Table 6.

Species	*n*
Meadow buttercup	6
Common daisy	7
Red clover	3
Ribwort plantain	8

Table 6

(i) Calculate the Simpson's Index of Diversity for Upper End Meadow.

Use the information in Table 6 and the formula:

$$D = 1 - \left(\sum\left(\frac{n}{N}\right)^2\right)$$

n = number of organisms of this species
N = total number of organisms

Show your working. Give your answer to **two significant figures**.

Answer .... **[3]**

Candidates seemed well-prepared for this task. Many sensibly added two extra columns to Table 6 to calculate n/N and then $(n/N)^2$. Where a slip was made in calculating the sum of these, error carried forward was applied, so that the subtraction of this figure from 1 was credited, as was giving the answer to two significant figures. This illustrates the general principle for maths questions on Biology papers; that it is the process in each step is important for credit to be given, and not the absolute value of the number obtained.

For further practice in calculating Simpson's Index of Diversity see the OCR support box.

Intermediate working may be given as fractions or decimals. If using decimals candidates should be trained to present their working to show the steps in the process to the same number of decimal places throughout (2 or 3 would be suitable here) while conducting calculator working to the maximum number of decimal places shown on the display.

© OCR 2018

OCR support http://www.ocr.org.uk/qualifications/by-subject/biology-related/maths-for-biology/m1-handling-data/ (see learner activity)

Question 6(a)(ii)

(ii) Name a piece of equipment that you could use for the random sampling of the plants shown in Table 6.

.... **[1]**

This was an easy question with most candidates naming a 'quadrat'. A random number generator is not a single piece of equipment, though as a useful tool on a computer, this was ignored if given as an additional answer. The spelling 'quadrant' is not acceptable.

Question 6(b)

(b) The group of students attempted to extract and purify DNA from a plant in Upper End Meadow.

The students used the following steps:

1. Mix the plant sample with detergent.
2. Add salt.
3. Add protease enzyme.
4. Spool the DNA precipitate onto a glass rod.

Suggest whether this method would successfully extract and purify DNA. Justify your conclusion.

....

....

....

....

....

....

.... **[3]**

Knowledge of the reasons for each step in a procedure to purify DNA was poor. Candidates may have been put off by the commands to suggest and justify. Essentially candidates needed to argue yes for the correct steps listed which they could explain the point of, and no for the extra steps that they realised had been omitted.

Misconception Many candidates thought that a crushing stage would be needed to break cell membranes instead of cell walls. Conversely, many candidates thought the detergent would break cell walls instead of cell membranes.

Many candidates thought that protease would break down DNA instead of its associated proteins such as histones.

There was misunderstanding of the roles of salt and ethanol to precipitate the DNA (separate it from the aqueous solution).

© OCR 2018

Question 6(c)

(c) The students found 50 animals in a soil sample collected from Upper End Meadow and identified them as follows:

- 2 click beetles
- 24 leatherjackets
- 23 meadow ants
- 1 wireworm

What can you conclude about the species evenness shown in the soil sample? Justify your answer.

Conclusion ....

Justification ....

....

....

[1]

Most candidates stated that the sample showed species unevenness and compared the figures to explain why. An answer that only restated figures from the question such as: 'There were 24 leatherjackets and 2 click beetles' did not score. Some evidence of candidate evaluation was required, like: 'There were a large number of leatherjackets but only 2 click beetles'.

Copyright acknowledgements

Q1c(ii), Table 1

Adapted from A Fullick, J Locke, P Bircher, 'A Level Biology for OCR', p61, Oxford University Press, 2015. Reproduced by kind permission of Oxford University Press.

Q5a(i)

Adapted from A Fullick, J Locke, P Bircher, 'A Level Biology for OCR', p261, Oxford University Press, 2015.

Q5b

J E Scanlon, 'African Elephants Still In Decline due to High Level of Poaching', 3 March 2016, www.cites.org, CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora. Reproduced by kind permission of CITES.

Q5b, Fig. 5

African Elephants Still In Decline due to High Level of Poaching', 3 March 2016, www.cites.org, CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora. Reproduced by kind permission of CITES.

© OCR 2018

Supporting you

For further details of this qualification please visit the subject webpage.

Review of results

If any of your students' results are not as expected, you may wish to consider one of our review of results services. For full information about the options available visit the OCR website. If university places are at stake you may wish to consider priority service 2 reviews of marking which have an earlier deadline to ensure your reviews are processed in time for university applications.

activeresults

Active Results offers a unique perspective on results data and greater opportunities to understand students' performance.

It allows you to:

- Review reports on the **performance of individual candidates**, cohorts of students and whole centres
- **Analyse results** at question and/or topic level
- **Compare your centre** with OCR national averages or similar OCR centres.
- Identify areas of the curriculum where students excel or struggle and help **pinpoint strengths and weaknesses** of students and teaching departments.

http://www.ocr.org.uk/administration/support-and-tools/active-results/

CPD Hub
Your route to OCR's teacher training

Attend one of our popular CPD courses to hear exam feedback directly from a senior assessor or drop in to an online Q&A session.

https://www.cpdhub.ocr.org.uk

The small print

We'd like to know your view on the resources we produce. By clicking on the 'Like' or 'Dislike' button you can help us to ensure that our resources work for you. When the email template pops up please add additional comments if you wish and then just click 'Send'. Thank you.

Whether you already offer OCR qualifications, are new to OCR, or are considering switching from your current provider/awarding organisation, you can request more information by completing the Expression of Interest form which can be found here: www.ocr.org.uk/expression-of-interest

OCR Resources: *the small print*
OCR's resources are provided to support the delivery of OCR qualifications, but in no way constitute an endorsed teaching method that is required by OCR. Whilst every effort is made to ensure the accuracy of the content, OCR cannot be held responsible for any errors or omissions within these resources. We update our resources on a regular basis, so please check the OCR website to ensure you have the most up to date version.

This resource may be freely copied and distributed, as long as the OCR logo and this small print remain intact and OCR is acknowledged as the originator of this work.

Our documents are updated over time. Whilst every effort is made to check all documents, there may be contradictions between published support and the specification, therefore please use the information on the latest specification at all times. Where changes are made to specifications these will be indicated within the document, there will be a new version number indicated, and a summary of the changes. If you do notice a discrepancy between the specification and a resource please contact us at: resources.feedback@ocr.org.uk.

OCR acknowledges the use of the following content:
Square down and Square up: alexwhite/Shutterstock.com

Please get in touch if you want to discuss the accessibility of resources we offer to support delivery of our qualifications: resources.feedback@ocr.org.uk

Looking for a resource?

There is now a quick and easy search tool to help find **free** resources for your qualification:

www.ocr.org.uk/i-want-to/find-resources/

www.ocr.org.uk

OCR Customer Contact Centre

General qualifications

Telephone 01223 553998
Facsimile 01223 552627
Email general.qualifications@ocr.org.uk

OCR is part of Cambridge Assessment, a department of the University of Cambridge. *For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored.*

© **OCR 2018** Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee. Registered in England. Registered office The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA. Registered company number 3484466. OCR is an exempt charity.

Cambridge Assessment

CERTIFIED ISO 9001

UKAS MANAGEMENT SYSTEMS 001