OXFORD
INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL A-LEVEL BIOLOGY

(BL05)

Unit 5: Synoptic paper

Example responses with commentary

For teaching from September 2016 onwards
For A-level exams in May/June 2018 onwards

This guide includes some examples of student responses to a selection of questions from the summer 2018 BL05 unit.

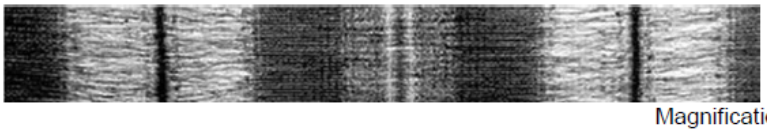
The question parts are reproduced, along with the final mark scheme, student responses and a commentary from the Lead Examiner on each of the students' answers.

QUESTION

01.2, 01.3 AND 01.4

0 1 **Figure 1** is an electron micrograph of part of a myofibril from a relaxed skeletal muscle.

Figure 1



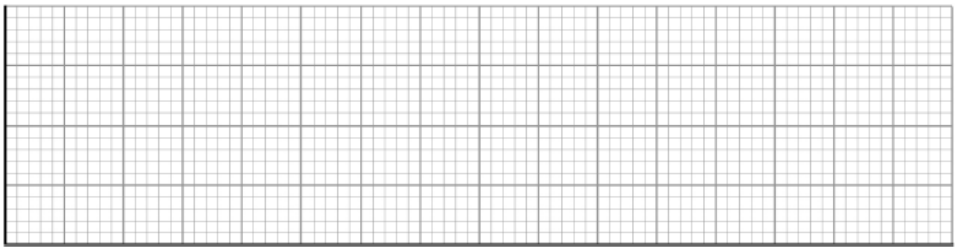
Magnification × 40 000

0 1 . 2 Draw an **unlabelled** diagram of **one** complete sarcomere from **Figure 1**.

Do your drawing to scale on the graph paper in **Figure 2**.
Draw the sarcomere 100 mm in length.

[3 marks]

Figure 2



0 1 . 3 The magnification of the myofibril in **Figure 1** is × 40 000

Calculate the magnification of your drawing in **Figure 2**.

[2 marks]

The electron micrograph in **Figure 1**, on page 2, was produced using a transmission electron microscope.

The resolution of a microscope is proportional to the wavelength of the radiation used for producing the image and is given by the following formula:

$$\text{resolution} = \frac{\text{wavelength}}{2}$$

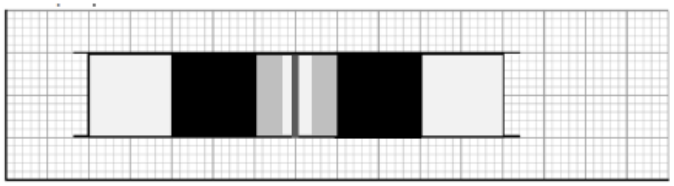
The wavelength of visible light is approximately 500 nm

0 1 . 4 Would it be possible to see the pattern of light and dark bands shown in **Figure 1** using an optical microscope?

Justify your answer using suitable calculations.

[3 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
01.2	1. One sarcomere drawn ; 2. Length = 100 mm ; 3. Banding correct and in correct proportions ± 4 mm ;	3	Example  Accept pattern shown by filaments
01.3	1. $\frac{\text{Length in } \mathbf{Fig\ 2} \times 40\,000}{\text{Length in } \mathbf{Fig\ 1}}$; 2. 50 000 / correct for candidate's measurements ;	2	eg $\frac{100 \times 40\,000}{80}$ Allow figures from corresponding parts of **Figure 1** and candidate's drawing Correct answer = 2 marks (Ignore working) Allow answer correct for candidate's drawing for 2 marks
01.4	Yes because: 1. Resolution = $\frac{500 \times 10^{-3}}{2}$ = 0.25 μm / 250 nm 2. Calculation of suitable distance, eg I-band = 32mm ≡ $\frac{32\,000}{40\,000}$ ≡ 0.8μm / 800 nm; 3. So it is possible as separation > 0.25 μm / 250 nm ;	3	Units must be included Allow alternatives, eg A-band = 48 mm ≡ $\frac{48\,000}{40\,000}$ ≡ 1.2 μm /1200 nm **or** sarcomere = 80 mm ≡ $\frac{80\,000}{40\,000}$ = 2 μm / 2000 nm

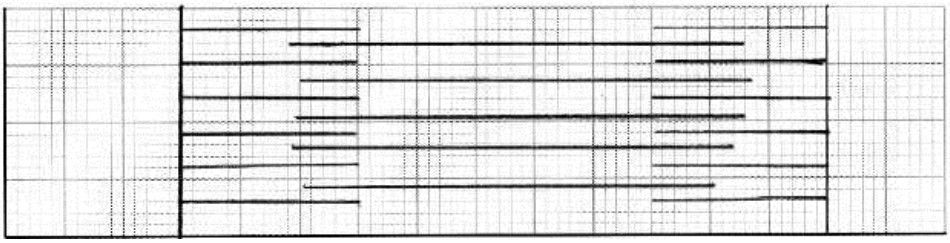
STUDENT A

0 1 . 2 Draw an **unlabelled** diagram of **one** complete sarcomere from **Figure 1**.

Do your drawing to scale on the graph paper in **Figure 2**.
Draw the sarcomere 100 mm in length.

[3 marks]

Figure 2



0 1 . 3 The magnification of the myofibril in **Figure 1** is × 40 000

Calculate the magnification of your drawing in **Figure 2**.

[2 marks]

$\frac{82}{100} \times \frac{40,000}{x}$

$x = 48780$ .48

Magnification of drawing in **Figure 2** = × 48780

0 1 . 4 Would it be possible to see the pattern of light and dark bands shown in **Figure 1** using an optical microscope?

Justify your answer using suitable calculations.

[3 marks]

resolution = $\frac{500 \times 10^{-9}}{2} = 2.5 \times 10^{-7}$

~~No since the value of the resolution obtained is too small and an~~ Yes since the value of the resolution obtained is ~~greater than~~ less than the wavelength of visible light so the light and dark bands will be visible

EXAMINER COMMENTARY

In 01.2, one complete sarcomere was drawn but it was not the correct size or in the correct proportions. Therefore, only 1 mark was awarded.

In 01.3, the original sarcomere was approximately 82mm long so the calculation is correct and worth 2 marks.

In 01.4, the resolution is calculated but no units are included. There is no reference to the size of the light or dark bands so no marks are awarded.

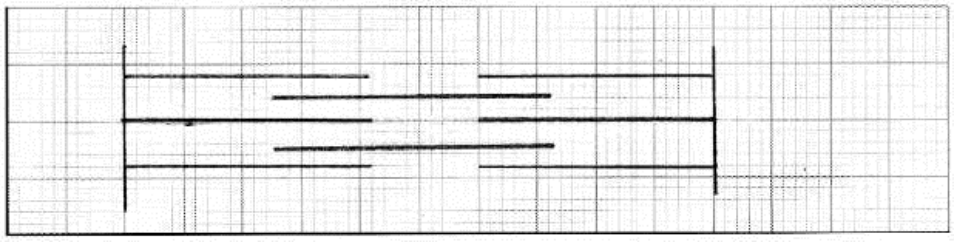
STUDENT B

0 1 . 2 Draw an **unlabelled** diagram of **one** complete sarcomere from **Figure 1**.

Do your drawing to scale on the graph paper in **Figure 2**.
Draw the sarcomere 100 mm in length.

[3 marks]

Figure 2



0 1 . 3 The magnification of the myofibril in **Figure 1** is × 40 000

Calculate the magnification of your drawing in **Figure 2**.

[2 marks]

$m = \frac{1}{a} = \frac{100}{0.00205} = 48780$

$a = \frac{1}{m} = \frac{82}{40,000} = 0.00205$

Magnification of drawing in **Figure 2** = x 48780

0 1 . 4 Would it be possible to see the pattern of light and dark bands shown in **Figure 1** using an optical microscope?

Justify your answer using suitable calculations.

[3 marks]

resolution = $\frac{500}{2}$ = 250?

→ no as the resolution is too small so the high optical microscope will not be able to distinguish the pattern.

→ It will not be able to ~~produce~~ justify one point from another.

EXAMINER COMMENTARY

In 01.2, one complete sarcomere was drawn and it is 100mm in length. However, the proportions of the A to I banks is incorrect so 2 marks were ignored.

In 01.3 again the calculation is correct and is awarded 2 marks.

In 01.4 again, the resolution is calculated but no units are included and there is no reference to the size of the light or dark bands so 0 marks are awarded.

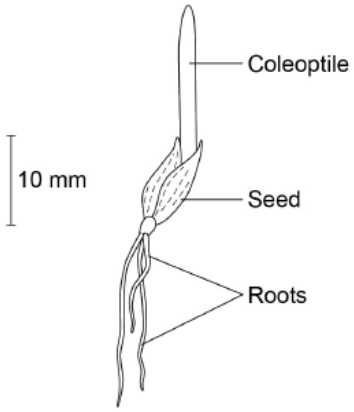
QUESTION

02.1

0 2 Plants produce growth substances called auxins.

Figure 3 shows a 4-day-old oat seedling.

Figure 3



The oat seedling produces an auxin called indoleacetic acid (IAA).

The concentration of IAA in different parts of the seedling varies but is never more than a few parts per million (ppm).

You are provided with:

- 100 oat seedlings, all 4 days old
- some IAA solution with a concentration of 100 mg dm^{-3} (100 ppm)
- any other laboratory apparatus you may need.

0 2 . 1 Plan an investigation to find the effect of six different concentrations of IAA, between 10^{-3} ppm and 100 ppm, on the growth of the oat coleoptiles.

You should include:

- how you would change the independent variable
- steps you would take to make sure any other variables are kept constant
- details of a control you would set up
- how you would measure the dependent variable.

[6 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
02.1	1. Prepare correct range of IAA concentrations from 10^{-3} to 100 ppm ; 2. Extra detail of how serial dilution is performed ; 3. Cut portions of coleoptiles all the same length from same region ; 4. In batches of, say, 10 coleoptiles for each IAA concentration ; 5. Add same volume / excess of IAA solution to each batch **or** Keep at same temperature in an incubator **or** Leave for same length of time **or** Sterile conditions **or** Constant light / no light ; 6. Control with just water / no IAA ; 7. Length with a ruler **or** Mass with a balance after blotting dry ; 8. Calculate % change ;	6 max	eg 100, 10, 1, 10^{-1}, 10^{-2}, 10^{-3} eg 10 mm Allow control of any suitable variable If a temperature suggested, in range 20 – 30 °C Time = 1 – 4 days

STUDENT A

0 2 . 1 Plan an investigation to find the effect of six different concentrations of IAA, between 10^{-3} ppm and 100 ppm, on the growth of the oat coleoptiles.

You should include:

- how you would change the independent variable
- steps you would take to make sure any other variables are kept constant
- details of a control you would set up
- how you would measure the dependent variable.

[6 marks]

(1) ~~By using serial dilution~~ In 6 different test tubes make ~~the~~ different concentration of IAA by using serial dilution ~~using the~~ 0, 0·2, 0·4, 0·6, 0·8 and 1 ppm ~~(2) in a test tube~~

concentration	0 ppm	0·2 ppm	0·4 ppm	0·6 ppm	0·8 ppm	1 ppm
volume of IAA	0	20 cm^3	40 cm^3	60 cm^3	80 cm^3	100 cm^3
volume of water	100 cm^3	80 cm^3	60 cm^3	40 cm^3	20 cm^3	0

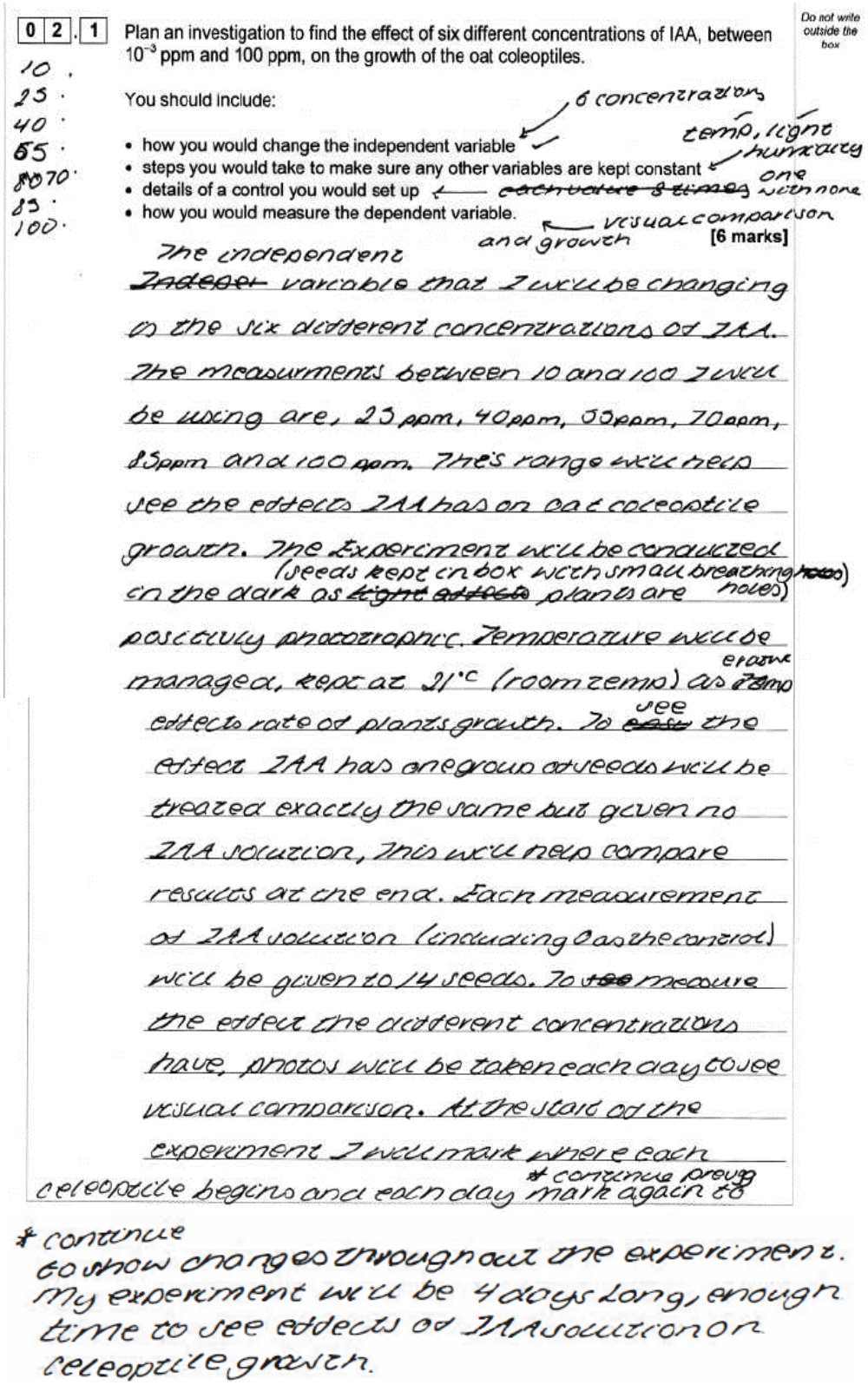
(2) Place ~~the seedlings~~ seedlings in each tube ~~and~~ make sure that other variables are not a limiting factor such as light, CO_2 and temperature. So these must be constant and seedlings are in same environmental conditions

(3) Measure the length of the coleoptile of the seedling after 10 days using a mm ruler

EXAMINER COMMENTARY

In planning this investigation, the candidate referred to controlling variables and measuring the length with a ruler. Therefore, 2 marks were scored. The range of concentrations did not tally with the question and so were not given credit.

STUDENT B



0 2 . 1 Plan an investigation to find the effect of six different concentrations of IAA, between 10^{-3} ppm and 100 ppm, on the growth of the oat coleoptiles.

Do not write outside the box

10 .
25 .
40 .
55 .
70 .
85 .
100.

You should include:

- how you would change the independent variable
- steps you would take to make sure any other variables are kept constant
- details of a control you would set up
- how you would measure the dependent variable.

[6 marks]

6 concentrations
temp, light intensity
one with none
visual comparison and growth

The independent ~~Indepen~~ variable that I will be changing is the six different concentrations of IAA. The measurments between 10 and 100 I will be using are, 25 ppm, 40 ppm, 55 ppm, 70 ppm, 85 ppm and 100 ppm. This's range will help see the effects IAA has on oat coleoptile growth. The experiment will be conducted in the dark as ~~light effects~~ plants are positively phototrophic. Temperature will be managed, kept at 21°C (room temp) as temp effects rate of plants growth. To see the effect IAA has one group of seeds will be treated exactly the same but given no IAA solution, this will help compare results at the end. Each measurement of IAA solution (including 0 as the control) will be given to 14 seeds. To measure the effect the different concentrations have, photos will be taken each day to see visual comparison. At the start of the experiment I will mark where each coleoptile begins and each day * continue prevg mark again to * continue to show changes throughout the experiment. My experiment will be 4 days long, enough time to see effects of IAA solution on coleoptile growth.

(seeds kept in box with small breathing holes)
epidermal

EXAMINER COMMENTARY

The script gains a mark for keeping the light consistent ie 'in the dark.' Also the use of a control with water gains credit. Therefore, despite the length of the response, only 2 marks are awarded. Candidates did find this planning question quite challenging.

QUESTION

02.2

You could use a graph and a statistical test to analyse your results.

0 2 . 2 Describe how you would present your results in a graph. Give a reason for your choice.

[4 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
02.2	1. Plot line graph of length change / mass change against concentration; 2. Reference to mean values; 3. And error bars to represent standard deviation / standard error; 4. Line graph plotted because the two variables are continuous;	4	Allow scatter graph Allow growth Allow change minus any change in control with water Allow average Allow range bars

STUDENT A

You could use a graph and a statistical test to analyse your results.

ICA DMY

0 2 . 2 Describe how you would present your results in a graph. Give a reason for your choice.

[4 marks]

On the x axis label the concentrations of IAA and on the y axis labell the length in mm. The graph ~~should~~ labels should ~~be~~ have ~~regular~~ equal spaces at regular intervals. Plot the graph with the values of the length colleted. The independant variable is on x axis and dependant variable is on the y axis

EXAMINER COMMENTARY

The type of graph plotted is not stated or justified so no marks are awarded.

STUDENT B

You could use a graph and a statistical test to analyse your results.

0 2 . 2 Describe how you would present your results in a graph. Give a reason for your choice.

[4 marks]

measure difference between original coleoptile position and end of experiment position. Take average height. of all the seeds per IAA concentration group.
Plot averages on scatter graph the Y axis being change in position / growth, X axis being concentration of IAA. Then do line of best fit to show relationship.
Reason being show relationship and plot average result to eliminate effects of anomalous data

EXAMINER COMMENTARY

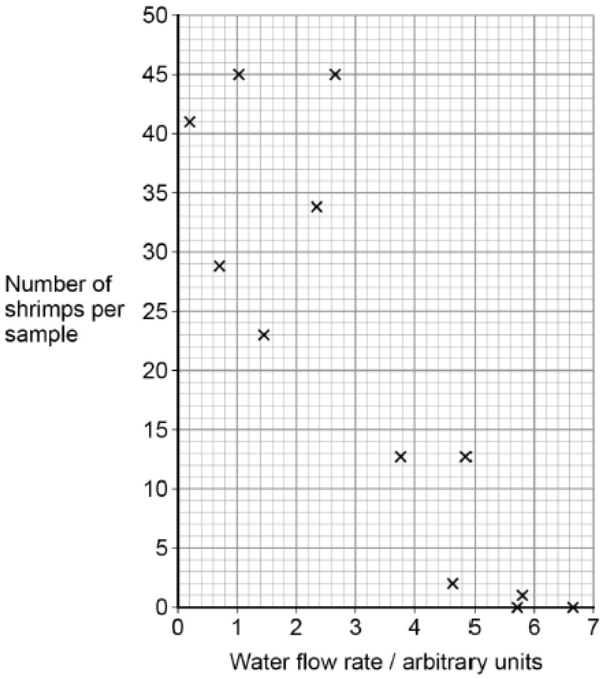
In this script there is a reference to plotting averages and to a scatter graph so 2 marks are awarded.

QUESTION

03.3

Figure 4 shows the students' results.

Figure 4



The students use the data to calculate a Spearman rank coefficient, **r** = –0.87

0 3 . 3 The students conclude that freshwater shrimps prefer slow-flowing water. Evaluate this conclusion.

[3 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
03.3	Pro: 1. As flow rate increases, number of shrimps decreases **or** There is a negative correlation between flow rate and number of shrimps ; 2. **r** = (-)0.87 shows very good correlation **or r** is close to (-)1 Con: 3. Correlation does not necessarily indicate causal relationship ; 4. Other environmental factor(s) could be involved / named eg - eg food availability / predators / O_2 concentration;	3 max	For full marks answer must include at least one pro + one con Allow the value of **r** shows there is a significantly higher number of shrimps at low flow rates Allow converse Allow wide variation at low flow rates Allow only 12 results / small sample size

STUDENT A

The students use the data to calculate a Spearman rank coefficient, r = –0.87

0 3 . 3 The students conclude that freshwater shrimps prefer slow-flowing water. Evaluate this conclusion.

[3 marks]

⇒ the coefficient indicates a negative correlation between the water flow and distribution.

⇒ the graph indicates that at slower water flow the number of shrimps is significantly higher so this supports the statement.

⇒ however, there could be another reason to support this. Correlation ≠ causation.

EXAMINER COMMENTARY

This answer gives one statement supporting the conclusion ie, that there is a negative correlation between the variables. The point is also made that a correlation does not always mean a cause, so 2 marks are scored.

STUDENT B

The students use the data to calculate a Spearman rank coefficient, **r** = –0.87

0 3 . 3 The students conclude that freshwater shrimps prefer slow-flowing water. Evaluate this conclusion.

[3 marks]

Shows a ~~medium~~ strong negative correlation between water flow and number of shrimps. However cannot conclude they always prefer slower water because not many experiments were taken, not many repeats. Spearmans rank coefficient of -0.87 backs up strong negative relationship. Conclusion would be stronger if repeats were taken and more accurate.

EXAMINER COMMENTARY

Again, the negative correlation is commented on and also the fact that the rank coefficient shows a good correlation. Against this, there is a comment about the small sample size so 3 marks were awarded.

QUESTION

04.3 AND 04.4

0 4 Beta-thalassaemia is an inherited condition in which the body makes an abnormal form of haemoglobin. The abnormal haemoglobin affects the osmotic properties of the red blood cells.

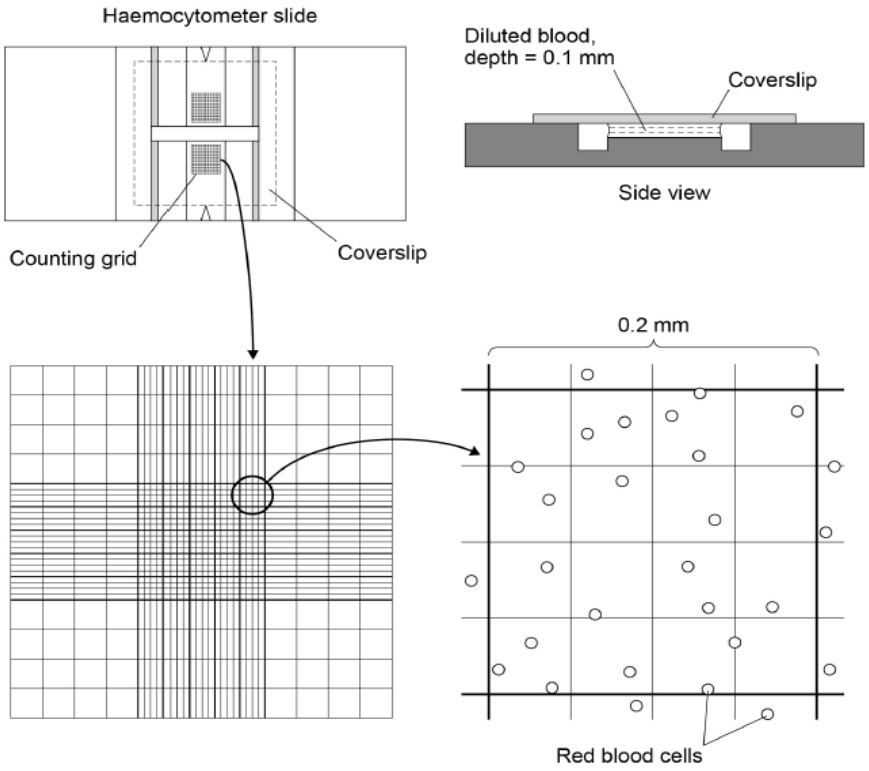
A scientist tests the effect of different concentrations of sodium chloride solution on the red blood cells in samples of blood taken from two people:

- a healthy person
- a person with beta-thalassaemia.

The scientist:

- dilutes 0.1 cm^3 blood to a volume of 100 cm^3 with 0.60% sodium chloride solution
- places a drop of the diluted blood on the counting grid of a haemocytometer slide, as shown in **Figure 5**
- places a special, thick coverslip over the diluted blood to give a depth of 0.1 mm of diluted blood
- places the haemocytometer slide on the stage of a microscope
- counts the number of red blood cells in a 0.2 mm × 0.2 mm square on the slide.

Figure 5



0 4 . 3 Use the following procedure to count the number of red blood cells in the 0.2 mm × 0.2 mm square in **Figure 5**:

- count all cells that are completely within the 0.2 mm × 0.2 mm square
- count cells that are touching the left side and the lower side of the square
- do not count cells that are touching the right side or the upper side of the square.

[1 mark]

0 4 . 4 Estimate the number of red blood cells in 1.0 mm^3 of undiluted blood.

Use your answer from question **04.3**
Give your answer in standard form.

[3 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
04.3	20;	1	
04.4	1. (Allow for dilution) 20 × 1000; 2. (Allow for volume) ÷ 0.004 **or** $\frac{20 \times 1000}{0.004}$ **or** $\frac{20 \times 1000 \times 1000}{4}$; 3. (Correct answer) 5×10^6;	3	Allow ecf from 04.3 Allow 2 marks for 5 000 000 **or** 5 million

STUDENT A

0 4 . 3 Use the following procedure to count the number of red blood cells in the 0.2 mm × 0.2 mm square in **Figure 5**:

- count all cells that are completely within the 0.2 mm × 0.2 mm square
- count cells that are touching the left side and the lower side of the square
- do not count cells that are touching the right side or the upper side of the square.

[1 mark]

Number of red blood cells in the 0.2 mm × 0.2 mm square = 20

0 4 . 4 Estimate the number of red blood cells in 1.0 mm^3 of undiluted blood.

Use your answer from question **04.3**
Give your answer in standard form.

[3 marks]

$1.mm^3 \xrightarrow{\times 10} 10mm^3 \longrightarrow$

$1mm^3 \xrightarrow{\div 10} 20$

Number of red blood cells in 1.0 mm^3 of undiluted blood = 2

EXAMINER COMMENTARY

In 04.3, the number of cells is counted correctly.

In 04.4, 0 marks are awarded.

STUDENT B

0 4 . 3 Use the following procedure to count the number of red blood cells in the 0.2 mm × 0.2 mm square in **Figure 5**:

- count all cells that are completely within the 0.2 mm × 0.2 mm square
- count cells that are touching the left side and the lower side of the square
- do not count cells that are touching the right side or the upper side of the square.

[1 mark]

Number of red blood cells in the 0.2 mm × 0.2 mm square = 20

0 4 . 4 Estimate the number of red blood cells in 1.0 mm^3 of undiluted blood.

Use your answer from question **04.3**
Give your answer in standard form.

[3 marks]

0·2 x 0·2 = 20
0·1 x 0·1 = 10 · 0·1 x 0·2 x 0·2 = 0·004

0·004 = 20
1·00 = 5000

Number of red blood cells in 1.0 mm^3 of undiluted blood = ~~200~~ 5000

EXAMINER COMMENTARY

In 04.3, again the cells are counted correctly.

In 04.4, the volume seems to be taken into account correctly but there is no reference to the dilution factor. Therefore, the answer is a thousand times too small. It is also not given in standard form. Therefore only 1 mark was awarded.

QUESTIONS

04.5 AND 04.7

0 4 . 5 The scientist uses a special, thick coverslip over the sample of diluted blood. A normal, thinner coverslip would have been pulled down slightly by the surface tension of the liquid beneath it.

Explain what effect the use of a normal, thinner coverslip would have had on your answer to question **04.4**

[2 marks]

The scientist then investigates the effect of other concentrations of sodium chloride solution on the red blood cells. The scientist uses the same method as described previously in **Figure 5** on page 12.

The red cells burst at certain concentrations of sodium chloride.
When red cells burst they release haemoglobin into the surrounding solution.
This process is called haemolysis. The scientist calculates the percentage of cells haemolysed at each concentration of sodium chloride.

0 4 . 7 Burst red blood cells are no longer visible in the microscope.

Suggest how the scientist could determine the percentages of cells that are haemolysed.

[2 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
04.5	Would give too low an estimate; Because volume reduced slightly (and reduction amplified x 250 000);	2	
04.7	1. Count cells at new % of NaCl ; 2. Calculate $100 - \frac{100\mathbf{n}}{\mathbf{N}}$ **or** $\frac{(\mathbf{N} - \mathbf{n})}{\mathbf{N}} \times 100$;	2	Where **N** = cell count in 0.60% NaCl and **n** = cell count in new % NaCl

STUDENT A

0 4 . 5 The scientist uses a special, thick coverslip over the sample of diluted blood. A normal, thinner coverslip would have been pulled down slightly by the surface tension of the liquid beneath it.

Explain what effect the use of a normal, thinner coverslip would have had on your answer to question **04.4**

[2 marks]

Push down on the blood would cause red blood cells to be pushed out of the 0.2mm x 0.2mm square decreasing red number of blood cells counted.

0 4 . 7 Burst red blood cells are no longer visible in the microscope.

Suggest how the scientist could determine the percentages of cells that are haemolysed.

[2 marks]

count how many are left take average amount in 1mm³ of blood decide how many left by average & times by 100, take this % add of 100 and your left with a percentage of cells that disappeared/were haemolysed.

EXAMINER COMMENTARY

In 04.5, 2 marks are awarded as the effect is stated with valid reason.

In 04.7, both marks are awarded for counting the red blood cells left and a correct method.

STUDENT B

0 4 . 5 The scientist uses a special, thick coverslip over the sample of diluted blood. A normal, thinner coverslip would have been pulled down slightly by the surface tension of the liquid beneath it.

Explain what effect the use of a normal, thinner coverslip would have had on your answer to question **04.4**

[2 marks]

⇒ the thinner coverslip would reduce the depth of the diluted blood.

⇒ there would be less red blood cells.

0 4 . 7 Burst red blood cells are no longer visible in the microscope.

Suggest how the scientist could determine the percentages of cells that are haemolysed.

[2 marks]

⇒ count the number of cells before the sodium chloride is added.

⇒ count the number after and find the difference to get cells that are haemolysed, and use equation.

⇒ $\frac{\text{total no. before} - \text{total no. after}}{\text{total no. of cells before NaCl added.}} \times 100$

EXAMINER COMMENTARY

In 04.5 the effect is given but the reason is incomplete so only 1 mark is scored.

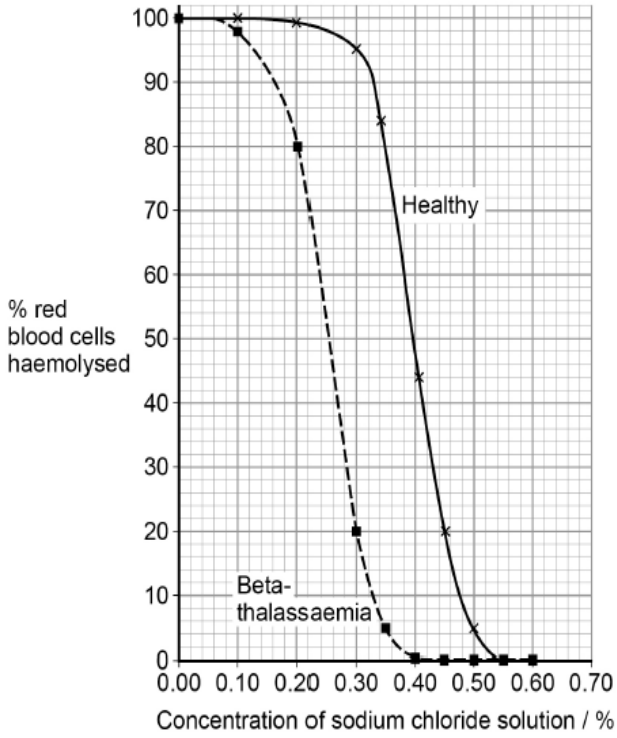
In 04.7, again 2 marks are awarded.

QUESTION

04.8

Figure 6 shows the scientist's results using blood from the healthy person and from the person with beta-thalassaemia.

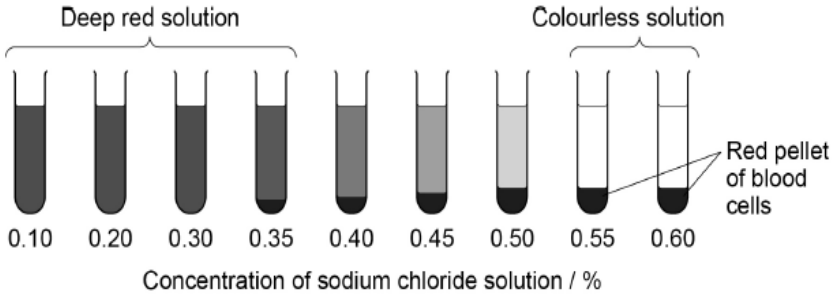
Figure 6



After counting cells in samples of blood in the different concentrations of sodium chloride, the scientist centrifuges each sample.

Figure 7 shows the results, after centrifugation, for the healthy person.

Figure 7



0 4 . 8 Explain how the results for the person with beta-thalassaemia would be different from those in **Figure 7**.

Use information from **Figure 6**.

[2 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
04.8	Deep red solution in 0.10 and 0.20; Because (most) cells haemolyse only at these concentrations; **or** Pellet seen only at 0.20 and above; Because (most) cells are intact at these concentrations; **or** Colourless solution seen at 0.40 and above; Because (most) cells are intact at these concentrations;	2	If no concentrations are given, allow 1 mark for a described shift to lower concentrations

STUDENT A

0 4 . 8 Explain how the results for the person with beta-thalassaemia would be different from those in **Figure 7**.

Use information from **Figure 6**.

[2 marks]

less red blood cells, more deoxy red solutions.

EXAMINER COMMENTARY

No suitable explanation is made here so no marks are awarded.

STUDENT B

0 4 . 8 Explain how the results for the person with beta-thalassaemia would be different from those in **Figure 7**.

Use information from **Figure 6**.

[2 marks]

→ the colour of the solution would be less visible at lower concentrations.

→ red pellet is more visible at a greater range of ~~dcon~~ ~~bigh~~ concentrations.

EXAMINER COMMENTARY

1 mark is awarded here for reference to the shift in colour observation to the lower concentrations.

QUESTION

05.1

0 5 Electrophoresis is a technique that can be used for separating molecules of different substances.

A scientist separates amino acids and peptides in a solution as follows.

The scientist:

- places a drop of the solution in the middle of a large sheet of filter paper
- makes the filter paper moist with a buffer solution at pH 7.0
- places the paper into a tank with the ends of the paper dipping into more buffer solution at pH 7.0
- connects an electrode to each end of the paper
- applies a potential difference of 3 kV (kilovolts) across the paper for 30 minutes.

Figure 8 shows the apparatus.

Figure 8

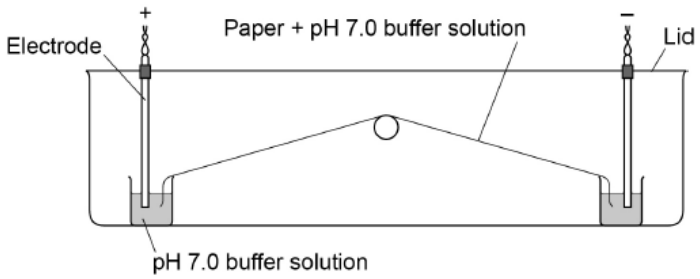


Table 1 gives information about three substances the scientist separated.

Table 1

Substance	Structure	Molecular mass, M	Electric charge, e
Aspartate	$^{+}H_3N$ — Asp — COO^- (with COO^- on the side chain)	132	–1
Peptide **A**	$^{+}H_3N$ — Ala — Met — Lys — COO^- (with NH_3^+ on Lys)	349	
Peptide **B**	$^{+}H_3N$ — Gly — Asp — Glu — Phe — COO^- (with COO^- on Asp and Glu)	464	

0 5 . 1 Complete **Table 1** to show the electric charge on peptide **A** and on peptide **B**.
[2 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
05.1	(In Table) Peptide A: +1; Peptide B: – 2;	2	

STUDENT A

Table 1 gives information about three substances the scientist separated.

Table 1

Substance	Structure	Molecular mass, M	Electric charge, e
Aspartate	$^{+}H_3N$ — Asp — COO^- (with COO^- on the R group)	132	–1
Peptide **A**	$^{+}H_3N$ — Ala — Met — Lys — COO^- (with NH_3^+ on the R group of Lys)	349	+ 1
Peptide **B**	$^{+}H_3N$ — Gly — Asp — Glu — Phe — COO^- (with COO^- on the R groups of Asp and Glu)	464	– 1

0 5 . 1 Complete **Table 1** to show the electric charge on peptide **A** and on peptide **B**.

[2 marks]

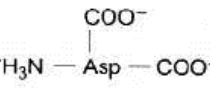
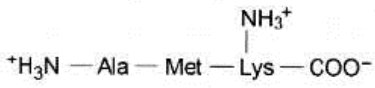
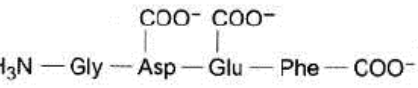
EXAMINER COMMENTARY

The correct charge on peptide A is given but not on peptide B. 1 mark awarded.

STUDENT B

Table 1 gives information about three substances the scientist separated.

Table 1

Substance	Structure	Molecular mass, M	Electric charge, e
Aspartate		132	–1
Peptide **A**		349	1
Peptide **B**		464	– 2

0 5 . 1 Complete **Table 1** to show the electric charge on peptide **A** and on peptide **B**.

[2 marks]

EXAMINER COMMENTARY

Both charges are correct so 2 marks are scored.

QUESTION

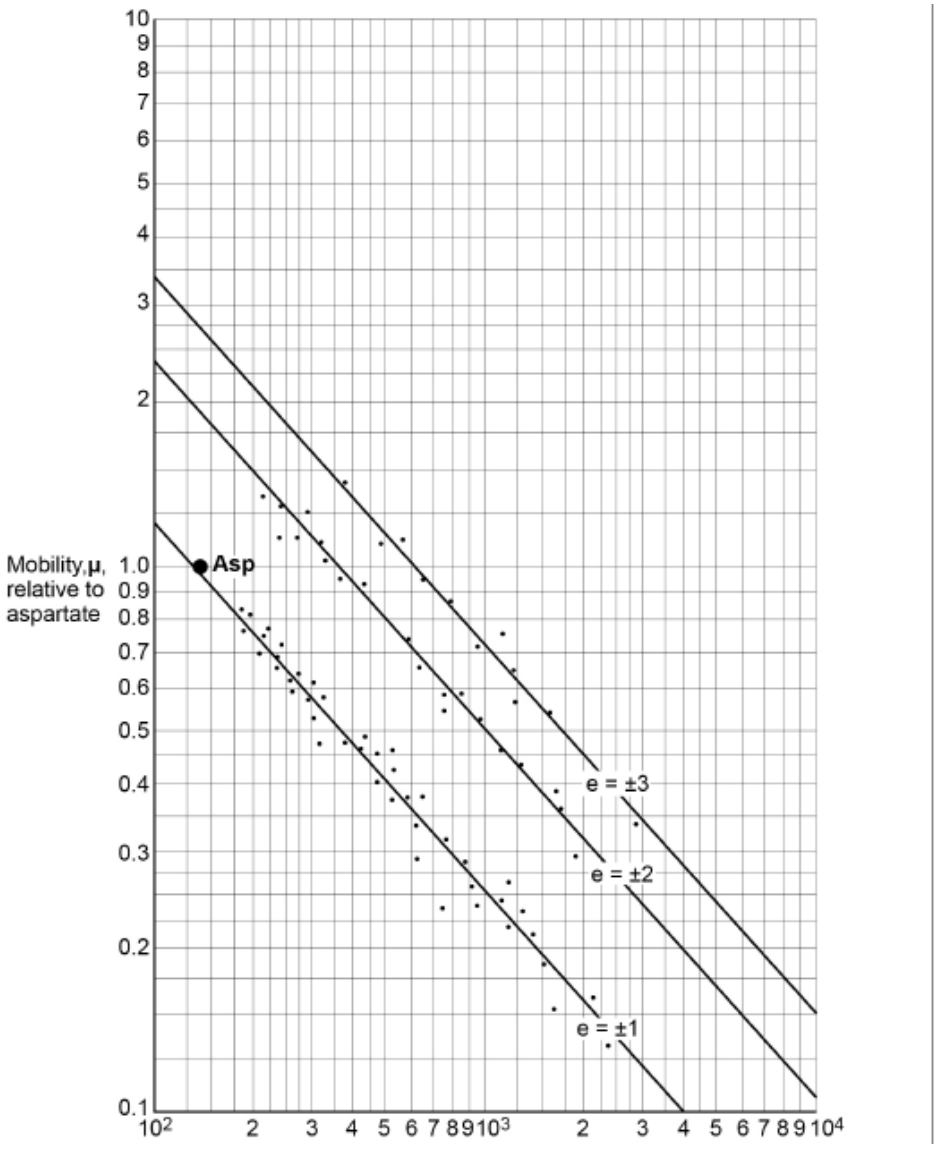
05.3

The scientist:

- measures the distance moved along the paper by each substance
- repeats the process for many more peptides of different mass and charge
- calculates the 'mobility', **μ**, of each peptide as the distance moved by the peptide relative to the distance moved by aspartate (Asp).

Figure 9 shows the scientist's results plotted on logarithmic graph paper.

Figure 9



0 5 . 3 The mobility of Asp is shown on the graph in **Figure 9**.

Plot the mobility of peptide **A** and the mobility of peptide **B** on **Figure 9**.

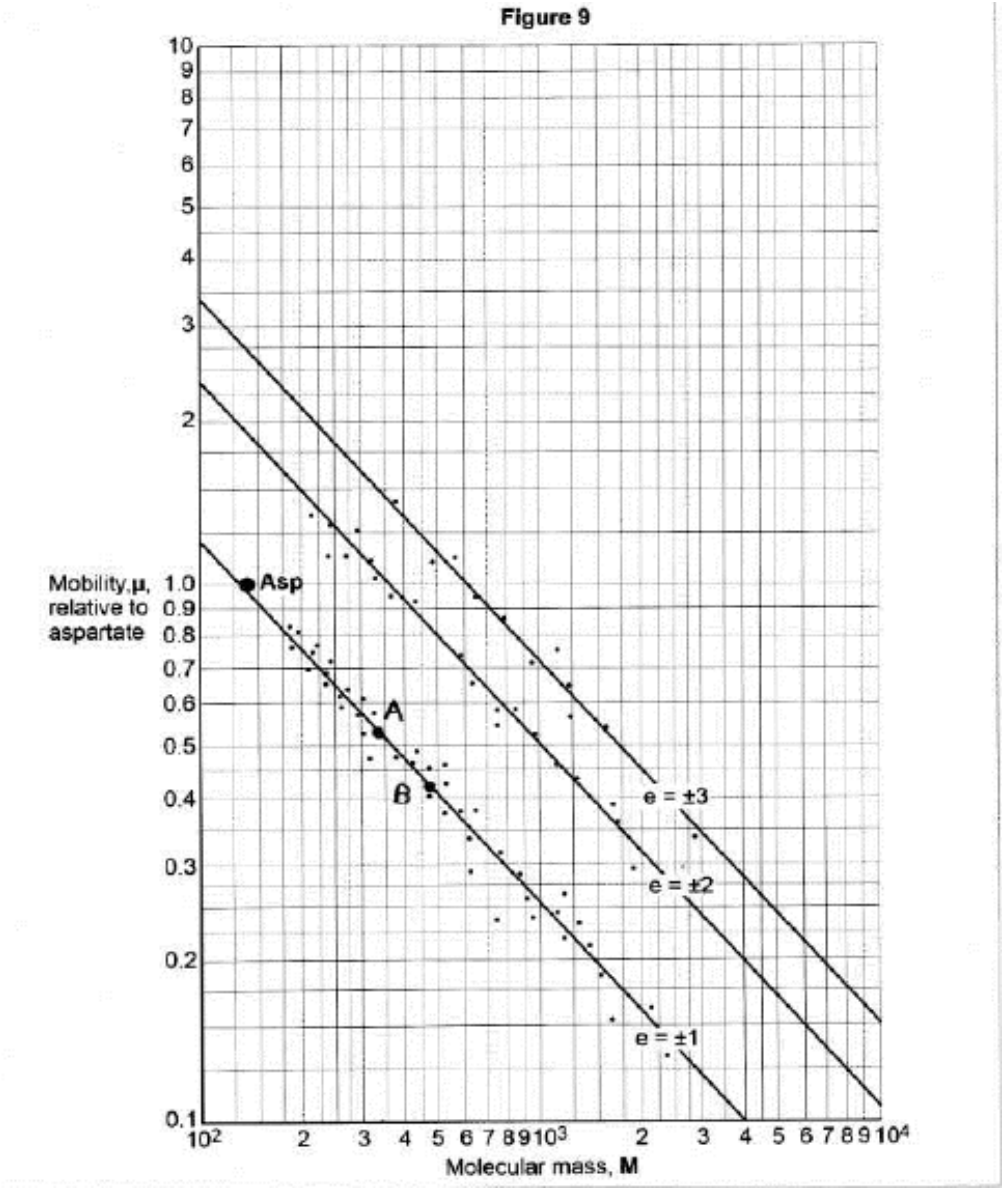
Use data from **Table 1** on page 19.

[2 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
05.3	Correctly plotted on graph: Peptide A at (349,0.52) on line e = ± 1; Peptide B at (464,0.84) on line e = ±2;	2	 Allow ecf for incorrect charge from 05.1

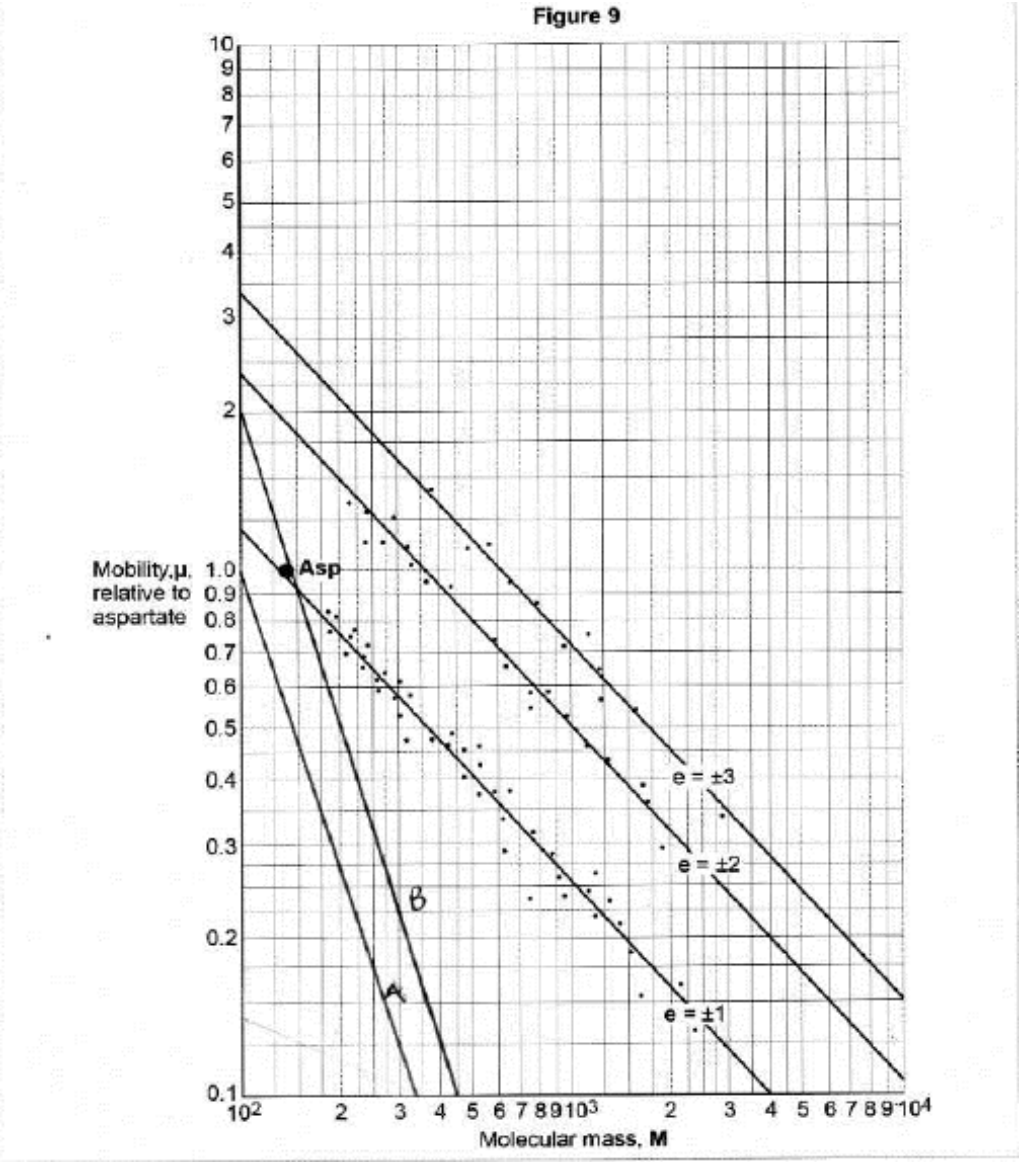
STUDENT A



EXAMINER COMMENTARY

An error carried forward was allowed from 05.1, both plots are made on the correct e lines and also in the correct position.

STUDENT B



EXAMINER COMMENTARY

Both plots are made on the incorrect e lines so no marks are scored.

QUESTION

05.5

0 5 . 5 Paper chromatography is another method for separating amino acids and peptides.

Describe how you could use paper chromatography to separate aspartate, peptide **A** and peptide **B** from a solution containing all three substances.

[4 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
05.5	1. Mark origin in pencil; 2. Spot solution onto origin and allow solvent to evaporate between applications **or** keep spot of solution as small as possible; 3. Place one edge of paper in solvent with meniscus below origin; 4. In container with lid (to prevent evaporation); 5. Allow solvent to run up paper, remove paper and mark solvent front with pencil / measure distance solvent front moved;	4 max	Allow turn though 90° and use 2nd solvent Allow staining to visualise substances

STUDENT A

0 5 . 5 Paper chromatography is another method for separating amino acids and peptides.

Describe how you could use paper chromatography to separate aspartate, peptide **A** and peptide **B** from a solution containing all three substances.

[4 marks]

(1) Place solvent in a testtube and mark a line on a filter paper 2cm above this is the origin.
(2) Place a spot of the peptide solution on the origin.
(3) Pace the filter paper in the testtube and make sure the solvent does not touch the line of origin.
(4) Allow the mixture to separate and remove the filter paper and mark the distant moved by the solvent. this is the solvent front line
(5) Allow the paper to dry and calculate the Rf values of the [redacted] and compare with known samples to identify the peptide

EXAMINER COMMENTARY

2 marks are awarded. One for making sure the solvent does not touch the line and one for marking the distance moved by the solvent.

STUDENT B

0 5 . 5 Paper chromatography is another method for separating amino acids and peptides.

Describe how you could use paper chromatography to separate aspartate, peptide **A** and peptide **B** from a solution containing all three substances.

[4 marks]

⇒ on the paper, draw a line using pencil and place even droplets of the solution along the line.
⇒ place the paper into a solvent below the baseline and stand the paper upwards.
⇒ after the solvent has travelled up the length of the paper, use ninhydrin to locate the peptides.
⇒ calculate the Rf value of each mark and compare with theoretical values to indicate ~~with~~ which peptide is which.

EXAMINER COMMENTARY

This time a mark is awarded for drawing the origin line as a pencil is specified. Marks are also scored for making sure the solvent is below the baseline and for the use of a technique to visualise the substance.

QUESTION

06.1

0 6 Transport of substances is important to plants and animals.

0 6 . 1 Describe the different methods of transporting organic substances in and out of cells. Give examples in your answer.

[7 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
06.1	Diffusion – defined re. high to low concentration; Examples – glucose / amino acids into epithelium of small intestine / into body cells; Facilitated diffusion – defined re. channel proteins; Examples – glucose into epithelium co-transport with Na^+ ions / glucose into liver cells via GLUT4 channel protein; Active transport – (Specific) carrier protein; Against concentration gradient; Use of energy; Examples – amino acids into epithelium of small intestine; Phagocytosis / pinocytosis / endocytosis / exocytosis Examples – microbes by wbc / chylomicrons re. fat absorption from small intestine / secretion of acetylcholine at presynaptic membrane of synapse / secretion of digestive enzymes by pancreas / etc;	7 max	Allow other correct examples throughout

STUDENT A

0 6 . 1 Describe the different methods of transporting organic substances in and out of cells. Give examples in your answer.

[7 marks]

Osmosis, is an example of movement in and out of cells. Where substances move from a place of lower water potential to a place of high water potential. An example of this is in the small intestines in digestion where water from food is transported into the blood plasma. Active transport is another example. where energy added causes substance to leave, An example of this is during glycolysis in ~~respiration~~ photosynthesis where light energy causes electrons to get excited and cause them to actively leave the cells cytoplasm. Or

Diffusion is where a substance moves from a place of ~~low~~ high concentration to a place of low concentration. Occurs when nutrients from the soil diffuses into the roots of plant cells.

EXAMINER COMMENTARY

Osmosis is irrelevant in this question because it asks for the movement of organic substances.1 mark is awarded for the use of active transport requiring energy. The definition of diffusion is credited with a mark so 2 marks are scored in total.

STUDENT B

0 6 . 1 Describe the different methods of transporting organic substances in and out of cells. Give examples in your answer.

[7 marks]

There are two main types of transport in and out of cells - diffusion and active transport. For small lipid-soluble substances, simple diffusion can take place as they are able to enter and exit a cell through the phospholipid bilayer. Examples of small, lipid soluble substances include fats and lipids. For larger, polar substances such as Na^+ and Ca^+, they must enter a cell via facilitated diffusion using protein channels. Protein channels span through the membrane and are specific for each substance. Molecules such as glucose must enter and exit using a co-transport protein, or carrier proteins. These proteins use active transport as they require energy from ATP to move substances.

EXAMINER COMMENTARY

A mark is awarded for an example of a substance that moves by diffusion. Facilitated diffusion requiring protein channels is also credited. Active transport and energy is awarded as is carrier proteins so 4 marks in total.

QUESTION

06.2

0 6 . 2 Explain the importance of mass transport systems to large organisms.

[5 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
06.2	1. Transport over long distances; 2. Diffusion only efficient over distances < 1 or 2 mm; 3. Larger organism has smaller SA/Vol for exchange; 4. Needs transport system to maintain concentration gradient for adequate diffusion (at exchange surface); 5. Large animals are active re. movement; 6. High demand for energy – so need to supply O_2 and glucose and remove CO_2 at high rate;	5 max	Allow mass transport system helps maintain temperature

STUDENT A

0 6 . 2 Explain the importance of mass transport systems to large organisms. **[5 marks]**

Mass transport is movement of substances around large organism. One importance of this is to ~~ensure~~ keep ensure bodily functions can continue. ~~O_2 is needed~~

Mass transport of blood ~~ATP to ensure body can~~ keeps body temperature ~~the~~ steady and ensures not too hot, enzymes denature or not to cold, reactions too slow.

An example of mass transports in plants is water and nutrients moving in through the roots by osmosis and up the xylem onto leaves. Leaves contain cytoplasm and ~~or~~ are the site of photosynthesis due to there pigment picking up the light. ~~Plants~~ Mass transport ensures H_2O and ATP are from the soil can reach these photosynthetic sites so that the plants can grow.

EXAMINER COMMENTARY

Most students found this question challenging. The only creditworthy statement here is regarding the use of mass transport in keeping body temperature constant. So 1 mark is awarded.

STUDENT B

0 6 . 2 Explain the importance of mass transport systems to large organisms. **[5 marks]**

=> The main mass transport system in large organisms is the circulatory system. Large organisms transport oxygen, useful substances and even waste through the blood. In the lungs, oxygen diffuses into the blood to be carried to respiring muscles around the body for producing ATP. The heart produces a pulse so that the blood may travel long distances. In the digestive system, nutrients such as glucose are actively transported into the blood for respiration aswell. Finally, in the kidneys, waste products are filtered out of the blood so to prevent them from damaging the body.

<- blood

EXAMINER COMMENTARY

Again, only 1 mark is scored, this time for movement over long distances.

QUESTION

06.3

0 6 . 3 What are the similarities **and** differences between the mass transport systems of plants and animals?

[6 marks]

MARK SCHEME

Question	Marking guidance	Mark	Comments
06.3	Similarities: Substances carried in solution; Mass flow of fluid; Vascular system / system of tubes; Differences: Animals: Blood or blood vessels transport organic / inorganic substances; Contractile pump – eg heart; Variable output re demand; O_2 (often) combined with a pigment / eg haemoglobin; Other substances dissolved in plasma; Insects: tracheal system for gas transport; Plants: Xylem – main force is transpiration pull = passive; Control by opening / closing stomata + leaf wilting ; Water and mineral ions; Phloem – main force is active transport / pressure flow due to osmosis; Small organic molecules – eg sucrose + amino acids;	6 max	For full marks, must include at least 2 similarities Allow examples of substances transported by both animals and plants – eg mineral ions / simple sugars / amino acids / water Allow named examples

STUDENT A

0 6 . 3 What are the similarities **and** differences between the mass transport systems of plants and animals?

[6 marks]

A similarity of the mass transport systems is that they are both necessary for survival. Plants need nutrients from soil distributed around to ensure the whole plant grows, they also needs water distributed to the leaves so they are more photosynthesis site. In the same way, animals need nutrients distributed around. The cytoplasm in the leaves is the

EXAMINER COMMENTARY

Any comparisons here are too vague so no marks are scored.

QWC: 1 mark was awarded as some scientific terms were used directly and the accounts were reasonably clear.

STUDENT B

0 6 . 3 What are the similarities **and** differences between the mass transport systems of plants and animals?

[6 marks]

=) the differences are that plants transport substances via the xylem and phloem whilst animals transport using the blood. Plants have two types of systems (xylem) and (phloem) to seperate the transport of water and organic substances, where as animals transport water and substances together in the blood. Plants and animals both use diffusion and active transport to move substances, however animals excrete waste whilst plants don't.

=) the similarities is that plants and animals both transport the same substances and from source to sink e.g leaf to shoot and lungs to muscles. carbon dioxide is the waste product of plants and animals from respiration and ATP is used.

EXAMINER COMMENTARY

Marks were awarded for comparisons of the substances transported in blood and in xylem and phloem. 1 for the similarities and 2 for the substances transported in xylem and in phloem.

QWC: 2 marks were awarded as scientific terms were used correctly and the accounts were clear.

FURTHER GUIDANCE AND CONTACTS

You can contact the subject team directly at science@oxfordaqaexams.org.uk

Please note: We aim to respond to all email enquiries within two working days.

Our UK office hours are Monday to Friday, 8am – 5pm local time.

OXFORD INTERNATIONAL AQA EXAMINATIONS
GREAT CLARENDON STREET, OXFORD, OX2 6DP
UNITED KINGDOM

enquiries@oxfordaqaexams.org.uk
oxfordaqaexams.org.uk