A-Level Biology

Edexcel A (Salters Nuffield)

2025 Predicted Paper

Paper 3

General and Practical Applications in Biology

Name:.....

Date:.....

NOTE: Question 8 is based on the pre-release material and the question will be added to the paper after paper 2 is sat on 13/6/25

2 hours allowed (for full paper inc Q8)

You may use a calculator

Rough Grade Boundaries

These do not guarantee you the same mark in the exam.

A* - 70%
A - 60%
B - 50%
C - 45%
D - 35%
E- 30%

Question	Possible Marks	Marks Gained
1	10	
2	10	
3	10	
4	10	
5	9	
6	8	
7	13	
8	30	
Total	**100**	

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- Easter Exam Prep Live tutorials with exam skills focus
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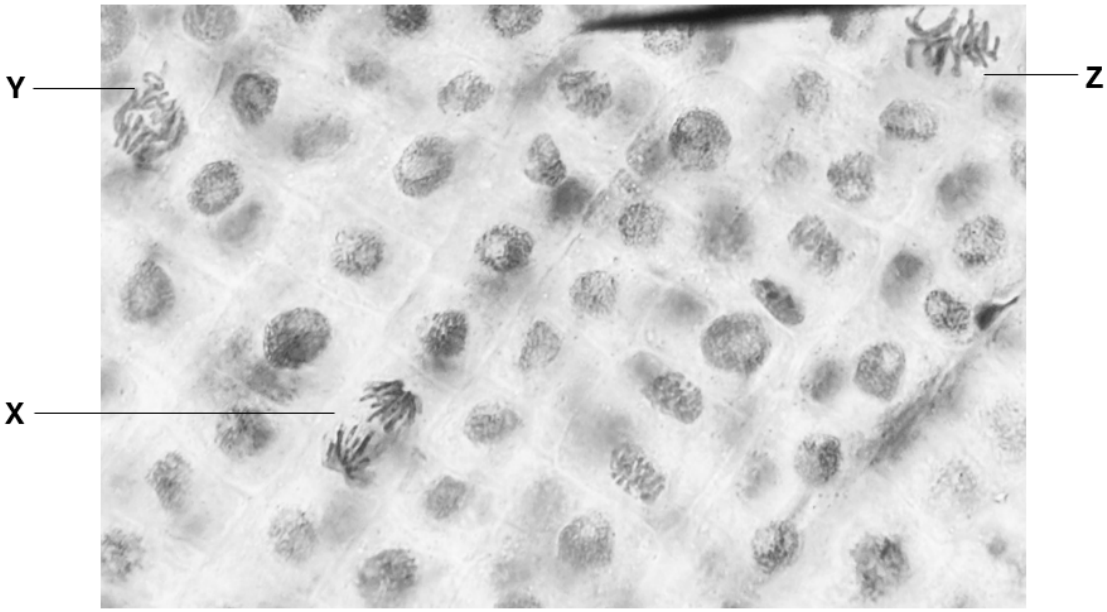
01 The image shows some cells from a garlic root viewed using a light microscope.



a) Answer the following questions using the image.

i) Identify which stage of cell division is occurring in cell X.

[1 mark]

- X **A** Prophase
- X **B** Anaphase
- X **C** Metaphase
- X **D** Cytokinesis

ii) Identify which stage of cell division is occurring in cell Z.

[1 mark]

- [X] **A** Telophase
- [X] **B** Anaphase
- [X] **C** Metaphase
- [X] **D** Prophase

iii) The chromosomes are visible in cell Y because the genetic material has:

[1 mark]

- [X] **A** Moved to the equator
- [X] **B** Replicated
- [X] **C** Attached to spindle fibres
- [X] **D** Condensed

b) Describe how a slide can be prepared from a root tip sample to produce this image.

[3 marks]

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c) There are 45 cells in the image.

Calculate the mitotic index for the cells in the image.

[2 marks]

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d) The mitotic index calculated for this tissue was different to the index calculated by another group, who had used a different type of garlic plant to carry out the same method a week earlier.

Describe **two** factors that could have caused this difference.

[2 marks]

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2:

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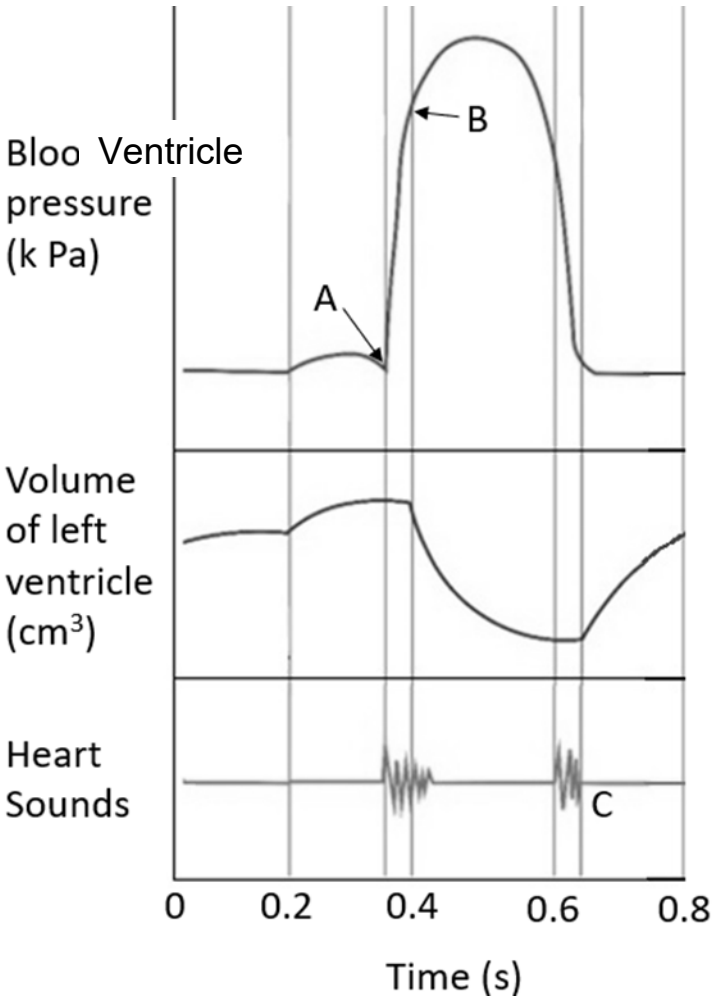
02 Before beginning training for a race, an athlete went through a medical examination.

The graph shows blood pressure and volume changes in the left ventricle and the heart sounds measured during one heartbeat.



a) The heart sounds were recorded using a phonocardiogram. The sound made between point A and B is caused by the closing of the AV valves.

Explain what causes the AV valves to shut.

[1 mark]

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b) Using evidence from the graph, explain what is happening between 0.4 and 0.6 seconds.

[2 marks]

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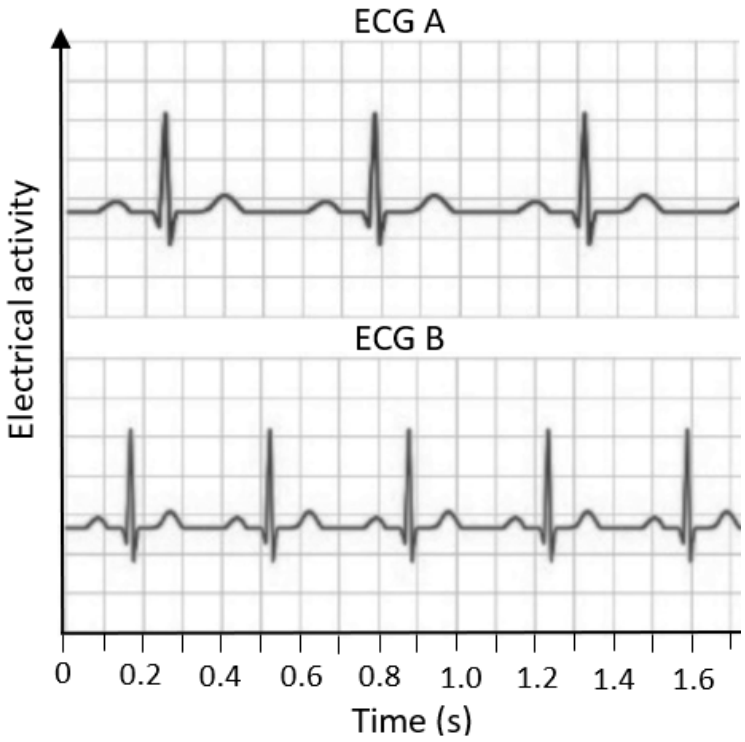
The athlete also underwent an ECG before the race. The figures below show a normal ECG, A, and the athletes ECG, B,:



c) Calculate the heart rate from ECG B. Show your working.

[2 marks]

..... beats per minute

d) ECG B was taken from the athlete at rest. They were advised not to take part in the race and to see a doctor.

i) Using the trace state what heart problem the athlete was diagnosed with by the doctor.

[1 mark]

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ii) The doctor prescribed beta-blockers to help the patient. Beta-blockers work by blocking the effects of the hormone adrenaline on the heart.

Explain how taking beta-blockers will help this patient.

[3 marks]

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iii) Give **one** disadvantage of taking anti-hypertensives such as beta-blockers.

[1 mark]

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03

a) Seeds contain a store of starch. When germination begins, amylase breaks down the starch.

Explain how the structure of starch is related to its function as an energy store in seeds.

[3 marks]

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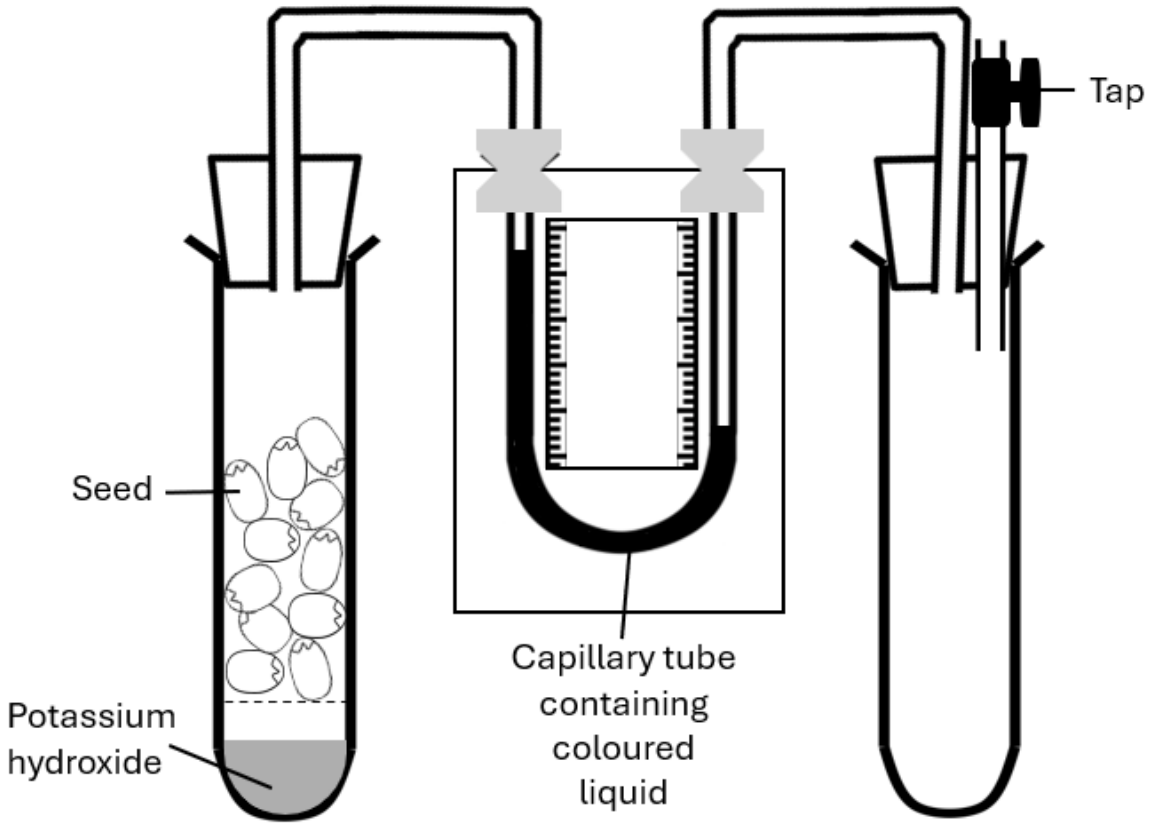
Students used a respirometer to investigate the rate of respiration in germinating seeds. A diagram of the set up can be seen below.



b) Describe the purpose of the potassium hydroxide solution in this respirometer.

[1 mark]

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c) The level of liquid in the right-hand side of the capillary tube moved down during the experiment. Explain why.

[2 marks]

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d) Devise an investigation using a respirometer to show the effect of temperature on the rate of respiration per gram of germinating seeds.

[4 marks]

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04 Peat bogs are unique wetland or bog ecosystems that are home to a diverse community of animals and plants. They are formed through the partial decay of layers of sphagnum mosses that build up over tens of thousands of years.

Peat has been extracted to be used as fuel for hundreds of years.

a) Proxy data is often used to estimate the previous climate conditions on Earth as historical data can be inaccurate and incomplete. One example of proxy data is pollen grain analysis.

i) Explain how analysis of preserved pollen grains extracted from peat can be used as evidence for climate change.

[3 marks]

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ii) Suggest **two** limitations of pollen grain analysis in estimating historical global climate changes.

[2 marks]

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b) Explain how the burning of peat and other fossil fuels contributes to global warming.

[3 marks]

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c) Explain why biofuels are a more sustainable alternative that could help to reduce reliance on peat as a fuel.

[2 marks]

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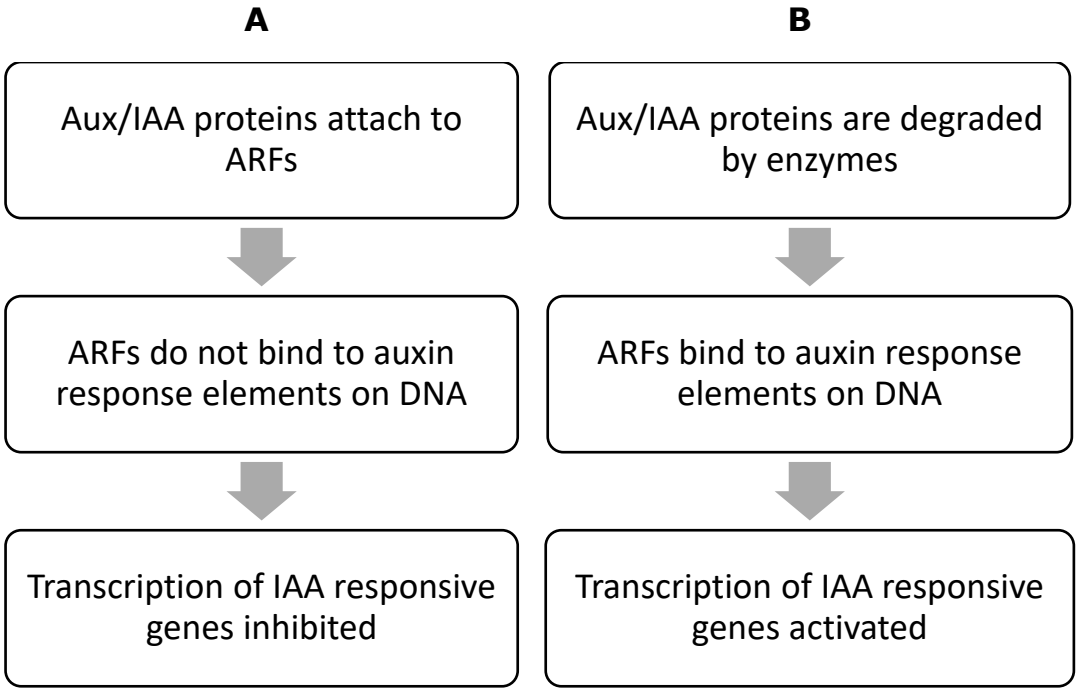
05 Plant cells respond rapidly to changes in IAA concentration which is responsible for controlling many developmental processes in plants.

There is a family of auxin-responsive genes that code for proteins that regulate gene expression. Aux/IAA and ARFs are two examples of proteins that interact with each other in the nucleus. Aux/IAA proteins inhibit the transcription of genes activated by ARFs.

The diagram shows two pathways involving Aux/IAA and ARFs that occur depending on the concentration of auxin in cells.



a) Give a reason why ARFs are classed as a transcription factor.

[2 marks]

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b) Explain how Aux/IAA proteins could inhibit the transcription of genes normally activated by ARFs.

[3 marks]

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c) Give the letter and explain which of the flow diagrams represents the response in shoot tip cells with high IAA concentration.

[2 marks]

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d) Plant growth factors like IAA were originally referred to as "plant hormones".

Give **two** similarities between IAA and hormones in humans.

[2 marks]

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06 Scientists investigated whether bees could learn to associate a certain flower colour with a specific type of nutritional reward: either nectar or pollen.

Initially the scientists trained 10 bees with a choice of either 10 blue or 10 yellow flowers. In the first training blue flowers contained pollen and yellow contained nectar, and in the second training this was switched around so that yellow flowers contained pollen and blue contained nectar.

All bees were deprived of pollen, and daily sucrose was given **after** training had taken place. The results of their choices are shown in the table.

Training 1	**Blue with pollen**	**Yellow with nectar**
Observed	7	3
Expected		
Training 2	**Blue with nectar**	**Yellow with pollen**
Observed	8	2
Expected		

a) State the null hypothesis for this investigation.

[1 mark]

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b) Calculate the chi squared (χ^2) value for the Training 2 group using the formula provided.

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

[3 marks]

χ^2 = ...

For bees, nectar is a source of carbohydrates and pollen a source of protein and lipids. Depending on their activity levels bees will need to consume different amounts of each food source.

The following measurements were taken from a sample of the bees tested.

Measurement	Low Activity	High Activity
O_2 absorbed (mm^3s^{-1})	10.4	150
CO_2 released (mm^3s^{-1})	10.0	120.6

c) Use all the information above to explain why it is important that bees can learn which flowers provide them with each food resource.

You should include respiratory quotient calculations in your answer.

[4 marks]

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07 Diabetic retinopathy is caused by persistent high blood sugar levels damaging blood vessels that feed the retina. The vessels can become weakened, and they can leak causing bleeding into the space just under the retina.

If this occurs near the fovea, a fibrous scar is formed that destroys the photoreceptor cells, reducing visual acuity and will eventually lead to blindness.

a) There are approximately 1.7 million rod cells in the fovea.

Name the two molecules that make up the photosensitive pigment found in rod cells.

[1 mark]

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b) One treatment for retinopathy is to inject medication directly into the eye. To do this eyedrops are used to keep pupils dilated. The eyedrops contain a synthetic form of atropine, a toxin extracted from plants. Atropine's effects include blocking acetylcholine receptors, preventing depolarisation of muscles in the iris.

i) State the term used to describe the relationship of circular and radial muscles in the iris which control the pupil diameter.

[1 mark]

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ii) Explain how preventing depolarisation stops the muscles in the iris contracting.

[2 marks]

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Many eye diseases that cause blindness, including diabetic retinopathy, are due to the over-production of a protein called vascular endothelial growth factor (VEGF).

VEGF is essential for the growth of blood vessels and normal growth and development.

Three main anti-VEGF drugs are currently available to treat retinopathy. Their costs and associated risks are outlined in the table below.

Drug	Cost per 100mg	Frequency of Stroke	Frequency of heart attack
Avastin	£242	1.8	2.8
Eylea	£816	0.7	2.6
Lucentis	£742	1.6	2.6

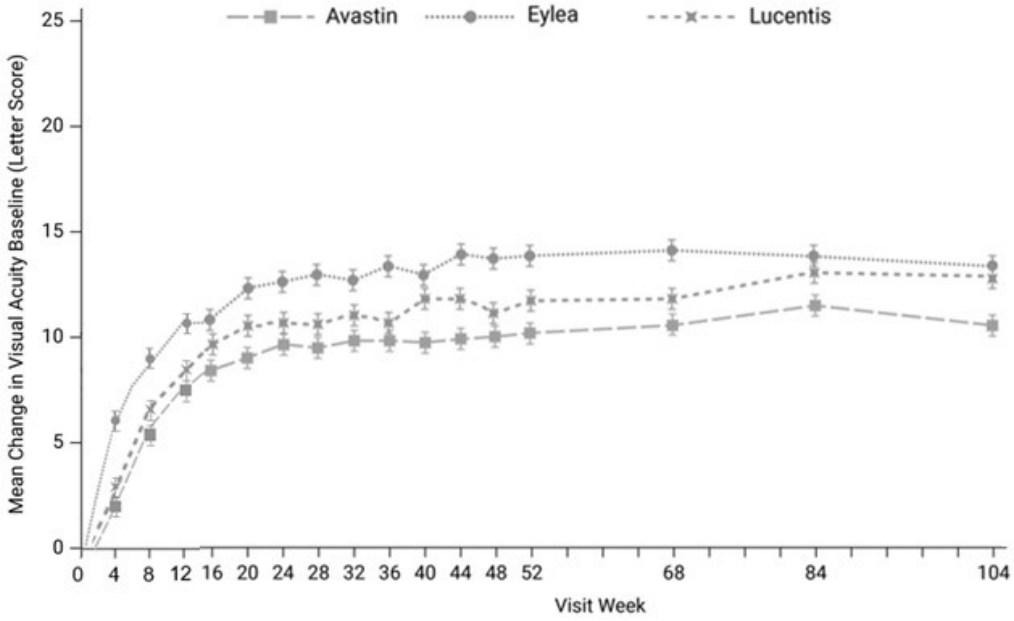
Scientists recently conducted a randomised, blind clinical trial of all three treatments. They compared their effectiveness at improving visual acuity in diabetic retinopathy patients with medium or high vision loss.

- 660 patients in total.
- Patients had to be over 18 years of age with type 1 or 2 diabetes.
- One eye of each participant was randomly assigned an anti-VEGF drug.

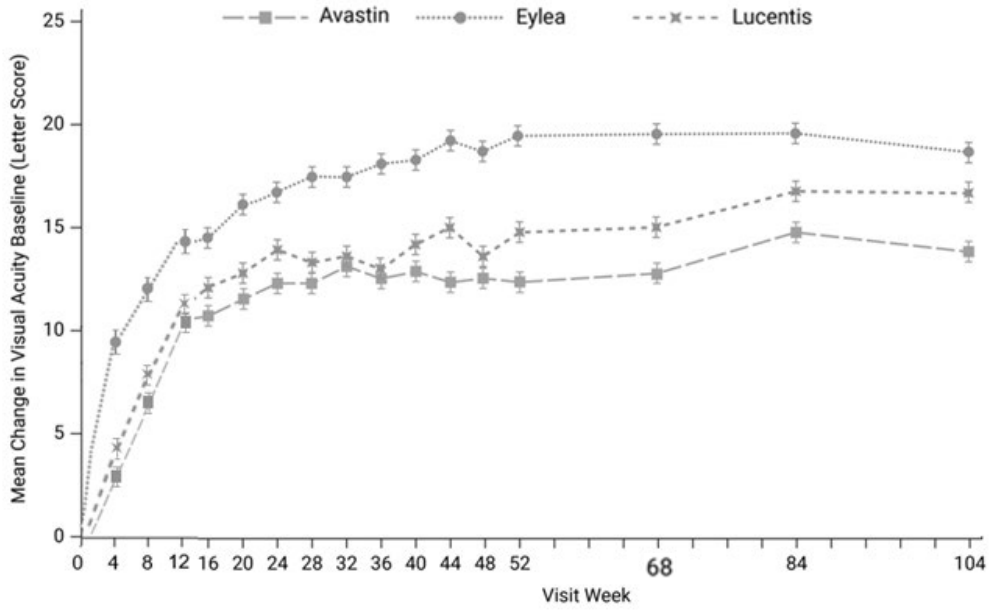
- Treatment occurred every 4 weeks with injections for a year and then for the second-year treatment continued in increasing increments 8,16 then 20 weeks.
- At each visit the patient's visual acuity was checked using a standard Snellen chart of letters held 6 metres away.

The following graphs show their results.

Graph 1 – Results for medium vision loss patient group



Graph 2 – Results for high vision loss patient group



c) A student analysed the data and concluded that Eylea was the most effective and should be offered on the NHS to treat the majority of retinopathy cases.

Evaluate the student's conclusion.

[9 marks]

Question 8 is based on the pre-release article.

This question will be released after Paper 2.

END OF QUESTIONS