Name:

Biology Class:

Teacher: Mrs Masters

A-Level Biology AO3 Evaluation Question Practice

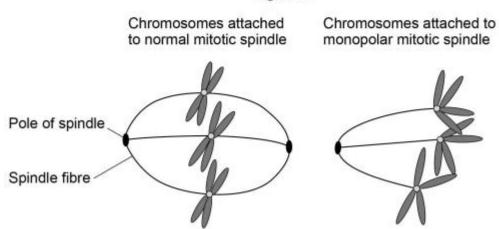


Question 1: AS Paper 1 2016 Q8

Scientists looking for treatments for cancer are investigating the use of substances called kinesin inhibitors (KI). These inhibitors prevent successful mitosis. Some kinesin inhibitors cause the development of a monopolar spindle in mitosis.

Figure 6 shows chromosomes attached to a normal mitotic spindle and to a monopolar mitotic spindle.

Figure 6



Scientists investigated the effect of different concentrations of a kinesin inhibitor (KI) on mitosis of human bone-cancer cells grown in a culture.

Table 3 shows the scientists' results.

Table 3

Concentration of kinesin inhibitor / nmol dm ⁻³	Percentage of dividing human bone-cancer cells showing a monopolar mitotic spindle
0	0
1	0
10	8
100	93
1000	100
10 000	100

A student who saw these results concluded that in any future trials of this kinesin inhibitor with people, a concentration of 100 nmol dm⁻³ would be most appropriate to use.

Do these data support the student's conclusion?	Give reasons for your answer. [4 marks]

Question 2: A-Level Paper 3 2017 Q2.5

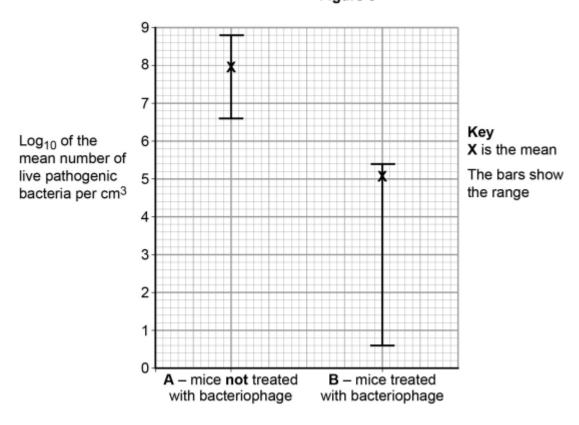
Scientists investigated the use of bacteriophages to treat lung infections caused by bacteria. They infected the lungs of mice with a pathogenic species of bacterium. The mice were then divided into two groups, **A** and **B**.

- The mice in group A were not treated with bacteriophage.
- The mice in group B were treated by breathing in a spray containing bacteriophage particles.

After 3 days, the scientists killed the mice and removed their lungs. They washed out each set of lungs with a set volume of liquid. The scientists determined the number of live bacteria in the liquid.

Figure 3 shows the scientists' results. **Figure 3** shows the mean and the range of the data about the mean for each group. Standard deviations of the means are **not** shown.

Figure 3



Using only **Figure 3**, what can you conclude from these data about the effectiveness of the bacteriophage in treating this lung infection in mice?

Do not consider statistical analyses in your answer.	[3 marks]

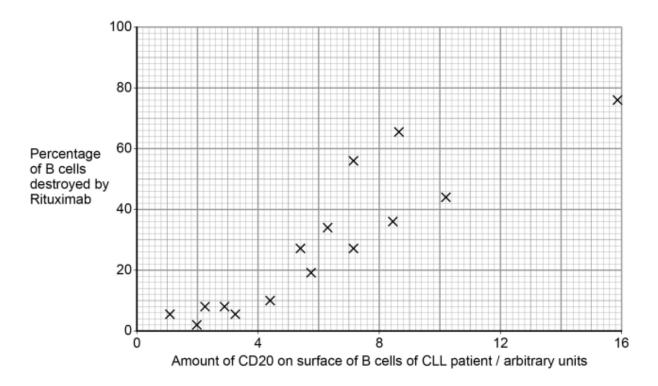
Question 3: A-Level Paper 3 2018 Q2.2

Chronic lymphocytic leukaemia (CLL) is a cancer that affects some B cells of a person's immune system.

Rituximab is a drug used to treat CLL. It binds to a protein called CD20 on the surface of B cells. If enough Rituximab binds to a B cell, it can kill the cell. Rituximab kills **both** healthy **and** cancerous B cells. The body then produces new B cells.

The amount of CD20 on the surface of B cells varies from one person to another. Doctors investigated the relationship between the amount of CD20 on the B cells of a patient and the percentage of B cells destroyed by Rituximab.

Figure 2 shows the doctors' results. Each cross is the result for one patient.



0 2 . 2 From these data, what can you conclude about the effectiveness of Rituximab in treating patients with CLL?

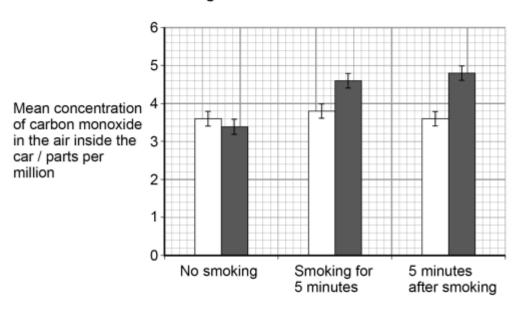
Do not include considerations of statistical analyses in your answer.	[3 marks]

Question 4: AS Paper 1 2018 Q9.3

Carbon monoxide is a poisonous gas that is present in cigarette smoke. This carbon monoxide can be absorbed into the blood where it binds with haemoglobin.

Scientists investigated the concentration of carbon monoxide in cars in which people were smoking or not smoking. They measured the concentration with the car windows open and closed. **Figure 7** shows the scientists' results as they presented them. A value of \pm 2 standard deviations from the mean includes over 95% of the data.

Figure 7



Closed window

± 2 SD

0 9 . 3	In England, in October 2015, a law was introduced making it illegal to smoke in a car carrying someone who is under the age of 18.
	Following the introduction of the law, a politician stated:
	'It is dangerous to smoke when a child is in the car. Higher levels of deadly toxins can build up, even on short journeys, and children breathe faster than adults, meaning they inhale more of the deadly toxins.'
	Use the information provided and the data in Figure 7 to evaluate the politician's statements.
	[4 marks]

Question 5: A-level Paper 1 2019 Q2

Cell walls make up much of the fibre that people eat.

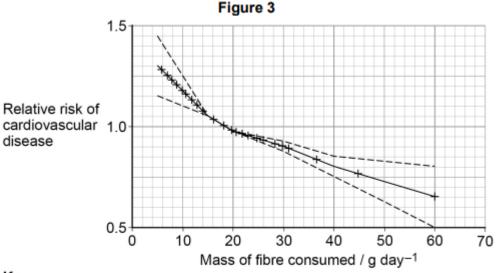
Scientists investigated the relationship between the mass of fibre people ate each day and their risk of cardiovascular disease (CVD).

They gathered data from a large sample of people and used this to calculate a relative risk.

- A relative risk of 1 means there is no difference in risk between the sample and the whole population.
- A relative risk of < 1 means CVD is less likely to occur in the sample than in the whole population.
- A relative risk of > 1 means CVD is more likely to occur in the sample than in the whole population.

Their results are shown in **Figure 3**. A value of \pm 2 standard deviations from the mean includes over 95% of the data.

Their results are shown in **Figure 3**. A value of \pm 2 standard deviations from the mean includes over 95% of the data.



Key

- Mean relative risk
- --- Line of best fit showing ± 2 standard deviations from the mean Each '+' plotted point represents 1000 people
- 0 2 2 A student concluded from **Figure 3** that eating an extra 10 g of fibre per day would significantly lower his risk of cardiovascular disease.

Evaluate his conclusion.

[4 marks]

0 2 . 3	The scientists estimated the mean mass of fibre eaten per day using a food frequency questionnaire (FFQ).
	The FFQ asks each person how often they have eaten many types of food over the past year.
	An alternative method to calculate fibre eaten is for a nurse to ask each person detailed questions about what they have eaten in the last 24 hours.
	Suggest one advantage of using the FFQ method and one disadvantage of using the FFQ method compared with the alternative method.
	[2 marks]
	Advantage
	Disadvantage

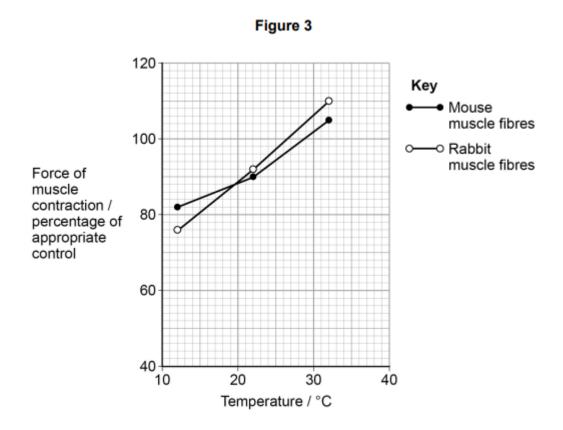
Question 6: A-Level Paper 2 2019 Q4

Scientists investigated the effect of a decrease in pH on muscle contraction. The scientists did the investigation with four different preparations of isolated muscle tissue: **A**, **B**, **C** and **D**.

- A mouse muscle fibres at typical pH of mouse muscle tissue (control 1).
- B mouse muscle fibres at 0.5 pH units below typical pH.
- C rabbit muscle fibres at typical pH of rabbit muscle tissue (control 2).
- D rabbit muscle fibres at 0.5 pH units below typical pH.

They measured the force of muscle contraction of the muscle fibres at 12 $^{\circ}\text{C},\,22\,^{\circ}\text{C}$ and 32 $^{\circ}\text{C}$

Figure 3 shows the results the scientists obtained for **B** and **D** compared with the appropriate control.



Use Figure 3 to evaluate this conclusion.	ı
	ı

1 A student looked at the results and concluded that a decrease in pH does cause a

Question 7 A-level Paper 3 2019 Q5

The crown-of-thorns starfish (COTS) is one of the main causes of the decline of the world's coral reefs.

Marine biologists used a choice chamber to investigate the effects of flashing and constant light on the behaviour of COTS.

Table 1 shows their results as they presented them. The P values show results from a statistical test.

Table 1

Behaviour of COTS	Type of light used in choice chamb	
Donaviour of GO 10	Flashing	Constant
COTS moving towards the stimulus	22	12
COTS moving away from the stimulus	28	38
P value	0.69	0.02

0 5 . 1	State a null hypothesis the marine biologists tested in this investigation. [1 mark]
0 5.2	The natural habitat of COTS is coral reefs of tropical oceans.
	Suggest two factors that should be kept constant in the choice chambers so that COTS display normal behaviour.
	[1 mark]
	2
0 5.3	A journalist studying Table 1 suggested that either type of light could be used to cause COTS to move away from coral reefs.
	Evaluate the journalist's suggestion. [3 marks]

Question 8: Alevel 2019 Paper 3

Trexall is a drug that can be used to slow the development of various forms of cancer.

Trexall slows cell division by interacting with an enzyme called dihydrofolate reductase (DR).

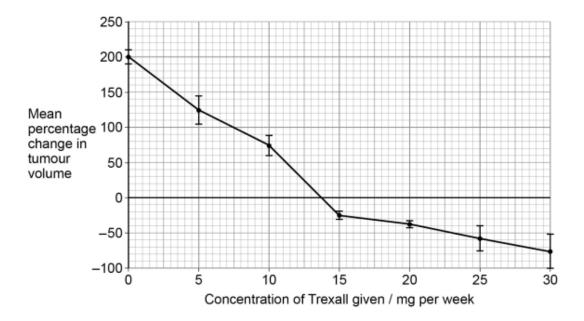
DR is involved in making nucleotides; the substrate for DR is folic acid.

Figure 8 shows the chemical structure of Trexall.

Figure 9 shows the chemical structure of folic acid.

Doctors investigated how the concentration of Trexall given to patients affected the growth of lung tumours. The doctors measured the volume of tumours at the beginning of the study and after 8 months.

Figure 10 shows the results of this investigation. The bars represent \pm 2 standard deviations. A value of \pm 2 standard deviations from the mean includes over 95% of the data.



Trexall can also be used to slow the development of rheumatoid arthritis (a pain-causing joint disease).

Scientists investigated the effectiveness of Trexall as a pain relief treatment in 12 rheumatoid arthritis patients. All of the patients were female. They randomly divided the patients into two groups:

- . Group R received Trexall tablets for 35 days
- · Group S was a control group.

They asked both groups to rate their pain on a scale of 0–10 (0 being no pain and 10 being the worst pain possible) at the start and then every 7 days for 35 days. They calculated mean scores for each group.

Their results can be seen in **Table 3**.

Table 3

Number of days of	Mean score for severity of pain (scale 0–10)	
treatment	Group R	Group S
0	9.7	9.8
7	8.2	9.1
14	8.4	8.6
21	7.6	7.2
28	6.3	7.5
35	5.1	7.8

0 6 . 8	A student analysed Table 3 and concluded that Trexall was effective in reducing pain in arthritis patients.
	Evaluate the student's conclusion. [3 marks

Question 9 AS 2019 Paper 1 Q9

on stomach	tests, scientists investigated the effects of a new drug called ABZ tumour cells. They found ABZ stopped mitosis by preventing the spindle fibres. They also found that ABZ affected some healthy	
It regulates to concentration. The scientist	controlled process. Cyclin B is a protein found in a cell's nucleus. he timing of mitosis during the cell cycle. Mitosis starts when the n of Cyclin B in the nucleus rises sharply and ends when it falls. It is found that ABZ increased, and maintained, a high concentration in stomach tumour cells.	5
Bax, are inversation of Bcl-2 scientists for	d cell death is called apoptosis. Two nuclear proteins, Bcl-2 and olved in controlling apoptosis. Apoptosis is prevented when the to Bax is high and is promoted when this ratio is low. The and that ABZ decreased the concentration of Bcl-2 and increased ation of Bax in stomach tumour cells.	10
	esults the scientists claimed that ABZ could be used for the eatment of stomach cancer.	15
Use informa questions.	tion from the passage and your own understanding to answer the	
0 9 . 4	Evaluate the scientists' suggestion that ABZ could be used for the s	successful
	treatment of stomach cancer.	[3 marks]
	treatment of stomach cancer.	[3 marks]
	treatment of stomach cancer.	[3 marks]
	treatment of stomach cancer.	[3 marks]
	treatment of stomach cancer.	[3 marks]
	treatment of stomach cancer.	[3 marks]
	treatment of stomach cancer.	[3 marks]

Question 10 Alevel Paper 1 2020 Q9

Scientists investigated stomatal density on leaves of one species of tree.

Figure 9 shows three examples of the square fields of view the scientists used to calculate a mean stomatal density.

Figure 9

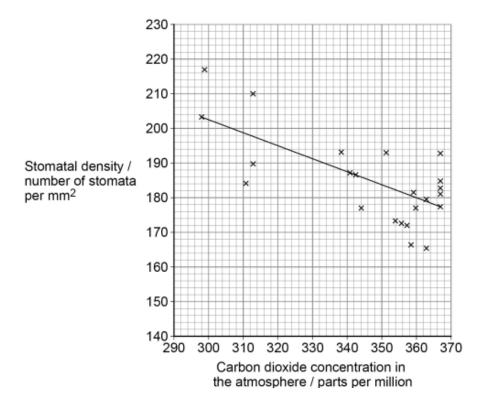
Key

Stomata

White lines show the counting field for stomata (each edge of white square = 250 μm)

The scientists used leaves from individual trees that had grown in different areas of the world in different years. Each tree had grown in an area and year with known carbon dioxide concentration.

Their results are shown in Figure 10.



Key

Each plotted point represents mean stomatal density from 10 leaves from one tree

Line shows line of best fit, which shows a statistically significant change

0 9.2	Give a null hypothesis for this investigation and name a statistical test that would be appropriate to test your null hypothesis. [2 marks]
	Null hypothesis
	Statistical test
0 9 . 3	From 1910 to 2000, the carbon dioxide concentration in the atmosphere increased from 300 parts per million to 365 parts per million.
	Use Figure 10 to calculate the mean rate of change in stomatal density from 1910 to 2000.
	Give your answer as number of stomata per mm² per 10-year period.
	Show your working. [2 marks]
	Number of stomata per mm² per 10-year period

0 9 . 4	A journalist saw Figure 10 and suggested that future increases in atmospheric carbon dioxide concentration could result in less transpiration.					
	Evaluate his suggestion.	[4 marks]				

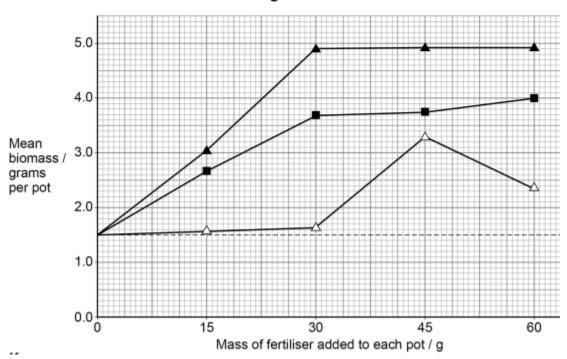
Question 11 A-Level Paper 2 2020 Q7

A scientist investigated the effects of different fertilisers on the growth of spinach plants. The scientist:

- · set up a large sample of identical pots of soil
- · added different masses of different fertilisers to selected pots
- did not add fertiliser to the control pots
- · planted the same number of young spinach plants in each pot
- after 20 days, determined the biomass of spinach plants in each pot.

The results the scientist obtained after 20 days are shown in Figure 4.

Figure 4



Key

▲ Potassium nitrate

■ Ammonium sulfate

△ △ Chicken manure

----- Control – no fertiliser added

O 7. 1 Calculate how many times greater the mean growth rate per day was using 37.5 g potassium nitrate than using 37.5 g ammonium sulfate.

Assume the mean biomass of the spinach plants at the start of the investigation was 0.5 g per pot.

[1 mark]

J	Answei	r		

0 7.2	Using all the information, evaluate the effect on plant growth of adding the d fertilisers to the soil.					

Question 12: Alevel Paper 2 2020 Q8

Alport syndrome (AS) is an inherited disorder that affects kidney glomeruli of both men and women. Affected individuals have proteinuria (high quantities of protein in their urine).

Scientists investigated the use of transplanted stem cells to treat AS in mice.

The scientists set up four experimental groups.

Group A - 40 wild type* mice

Group B - 40 AS mice

Group C - 40 AS mice that received stem cells from AS mice

Group **D** – 40 AS mice that received stem cells from wild type mice

After 20 weeks, the scientists measured the quantity of protein in the urine using a scale from 0 (lowest quantity) to +++++ (highest quantity).

The results the scientists obtained are shown in Table 2.

Table 2

Group	Maximum quantity of protein in urine at 20 weeks	Percentage of mice with this quantity of protein	
A	0	100	
В	++++	97.5	
С	++++	100	
D	++	68	

0 8 . 3	Using all the information, evaluate the use of stem cells to treat AS in humans. [4 mag)					

^{*}Wild type mice are mice not affected by AS.

Question 13: AS Paper 1 2020 Q5

- - 0 5 . 4 Scientists investigated the link between the lung disease asthma and three risk factors. They studied a large number of people. They recorded if the people had asthma and if they:
 - · were obese
 - · burned wood indoors as a fuel
 - · lived in a house with a cat or dog.

The scientists used a statistical test to calculate the probability of the link between asthma and each risk factor being due to chance.

Table 2 shows their results.

Table 2

Risk Factor	Probability (P value)		
Obese	< 0.001		
Burned wood indoors	= 0.06		
Lived with a cat or dog	< 0.05		

with asthma. Evaluate this conclusion. [3 marks]

A student who looked at these results concluded that all three risk factors are linked

Question 14 Alevel Paper 3 2021 Q2.2

HIV-1 is the most common type of HIV. HIV-1 binds to a receptor on T_H cells called CCR5.

Current treatment for HIV-1 involves the use of daily antiretroviral therapy (ART) to stop the virus being replicated. Only 59% of HIV-positive individuals have access to ART.

Scientists have found that two HIV-1-positive patients (**P** and **Q**) have gone into remission (have no detectable HIV-1). This happened after a blood stem cell transplant (BSCT).

- Patient P was given two BSCTs, and patient Q was given one BSCT.
- All BSCTs came from a donor with T_H cells without the CCR5 receptor.
- In addition, patient P had radiotherapy, and patient Q had chemotherapy. Both of these treatments are toxic.
- Both patients (P and Q) stopped receiving ART 16 months after BSCT.

18 months after stopping ART, **both** patients had **no** HIV-1 RNA in their plasma, **no** HIV-1 DNA in their T_H cells and **no** CCR5 on their T_H cells.

Use the information given to evaluate the use of BSCT to treat HIV infection	s. [5 marks]