

OCR A-LEVEL BIOLOGY B • H422

BIOLOGY



EXAM QUESTION PACK

3.3.2 RESPIRATORY DISEASES AND TREATMENT

SCORE

/56

PERCENTAGE

%

STEMUP

These questions belong to OCR, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by OCR. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with OCR and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. OCR has not endorsed, approved or been involved in the production of it. OCR and the qualification titles used here belong to their respective owners and appear for identification only.

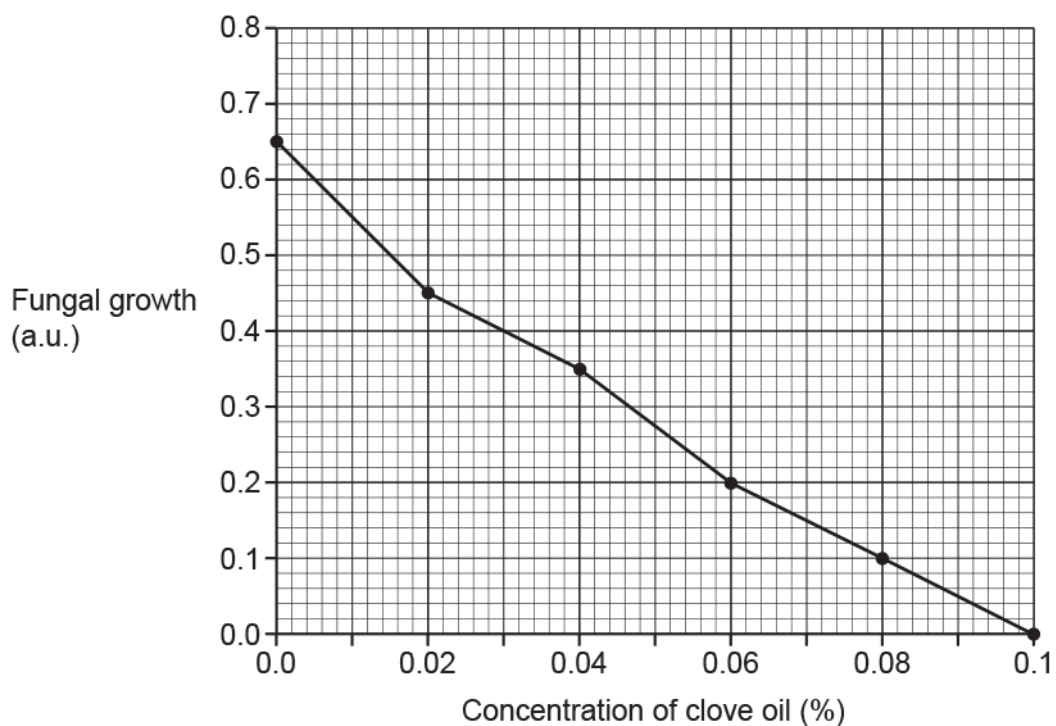
Where to find the originals

OCR publishes its past papers, mark schemes and examiner reports free of charge. Always check the current specification at ocr.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

- 1 Oils from the clove tree, *Syzygium aromaticum*, have been found to have antifungal properties and are a potential source of medicinal drugs.

The graph shows the results of a study into the effect of concentration of clove oil on the growth of fungi on cooked meat.



Which of the options, **A** to **D**, is the correctly calculated percentage decrease in growth of fungi as the concentration of clove oil increases from 0.02 to 0.04%?

- A 71%
- B 22%
- C 78%
- D 29%

Your answer

[1]

2 Respiratory diseases, such as asthma, can be acute or chronic.

A study was carried out into the effects of long-term exposure to air pollution on the risk of mortality from respiratory diseases.

- The study took place in the community involving a representative sample of a UK population.
- National surveys and questionnaires were used to gather data about individuals between 1971 and 2001.
- The concentration of pollutants in the air for each year of the study was obtained from a national database and used to estimate exposure for each individual over the 30-year period.

(i) Suggest what is meant by a **representative sample** in this study.

----- [1]

(ii) In 1971, the representative sample consisted of 511 670 individuals. However, 154 312 individuals were excluded from the results at the end of the study.

Calculate the percentage of individuals whose data were **included** in the results.

Give your answer to 2 significant figures.

Individuals included = ... % [2]

(iii) Suggest **one** reason why individuals may have been excluded from the results at the end of the study.

----- [1]

(iv) The study concluded that:

There was a positive correlation between the length of exposure to air pollution and the risk of mortality from respiratory diseases.

Discuss the limitations of the study that could affect the validity of this conclusion.

[3]

3(a)

Plant research is an important part of biology as plants are a potential source of medicinal drugs.

Describe how a scientist could investigate if a plant extract has antimicrobial properties.

[2]

- (b) The National Institute for Health and Care Excellence (NICE) is responsible for issuing guidance on the use of drugs such as those with antimicrobial properties.

The NHS in England and Wales has to provide the drugs that NICE recommends for the patients who need them.

Suggest **one** reason why NICE may **not** recommend a particular drug in their published guidance.

[1]

4(a) During an asthma attack, drugs known as bronchodilators can be used to increase the lumen diameter of the bronchus and therefore increase the oxygen consumption.

Fig. 1.2 shows the effect of saline and two different bronchodilators, Fenoterol and Salbutamol, on a patient following an asthma attack. The saline and the bronchodilators were breathed in using a device called a nebuliser which converts liquids into a fine mist.

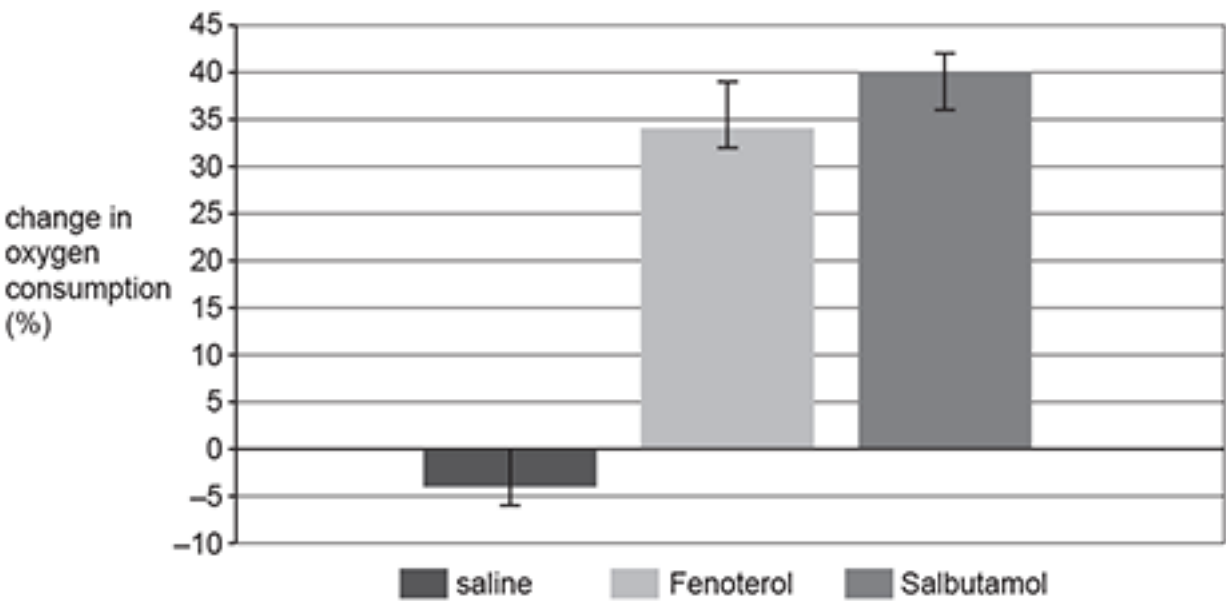


Fig. 1.2

A doctor concluded that:

‘Salbutamol is the best drug for the treatment of asthma.’

Evaluate the doctor’s claim.

----- [4]

(b) Saline is salt solution.

Using your knowledge of osmosis, explain how breathing in a fine mist of saline could reduce oxygen consumption.

----- [2]

5(a) This question is about the development of medicines.

(i) What are the features of a chronic disease?

-----[1]

(ii) Over half of commonly-used drugs are similar or identical to chemicals found in plants.

Name **one** such drug and state its medical use.

Drug -----

Medical use -----

[1]

- (b) Drugs must be evaluated for safety and effectiveness in clinical trials before they are licensed for the treatment of specific diseases.

A clinical trial was conducted to investigate the effect of a drug on blood glucose levels in patients with type 2 diabetes. Blood glucose levels can be monitored by measuring glycosylated (or glycated) haemoglobin ($\text{HbA}_{1\text{C}}$).

- Sixty patients with untreated type 2 diabetes were recruited.
- $\text{HbA}_{1\text{C}}$ levels were measured before the trial began.
- The patients were divided into two groups.
- One group received daily drug treatment and the other group received a daily placebo.
- After three months, $\text{HbA}_{1\text{C}}$ levels were measured and changes from pre-trial measurements were calculated.

Fig. 35 shows the results of the trial. The boxes show the mean change in $\text{HbA}_{1\text{C}}$ levels after three months and the error bars represent standard deviations.

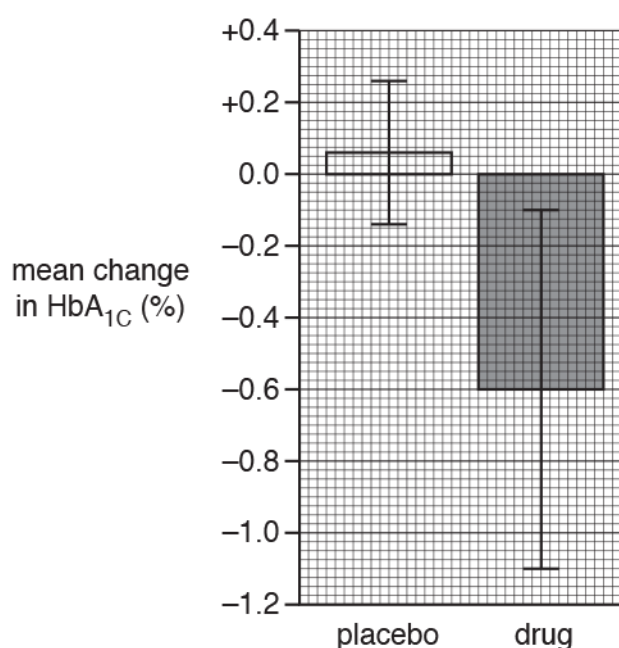


Fig. 35

- (i) State the **phase** of the clinical trial in which the data in Fig. 35 were obtained.

-----[1]

- (ii) Describe what a placebo is **and** explain why it was used.

----- [2]

(iii) Compare the results shown in Fig. 35 for the group receiving the placebo with the group receiving the drug.

----- [3]

(iv) Suggest **two** reasons why this trial does **not** support the use of the drug in the treatment of type 2 diabetes.

1 -----

2 -----

[2]

6 Researchers were studying the possible association between smoking and the respiratory tract infections, pneumonia and bronchitis.

The study included an analysis of the infection figures for **all** admissions to a hospital.

- Data from 5018 patients were collected.
- 4022 of these patients were **non-smokers**.
- Each patient had only **one** infection.

Some of the data from this study are shown in Table 5.1.

	Number of patients admitted with a respiratory tract infection		Number of patients admitted with other type of infection
	Pneumonia	Bronchitis	
Smokers	335	230	431
Non-smokers	1166	526	2330

Table 5.1

Fig. 5.1, (below and **on the insert**), is a photomicrograph showing tissues in the respiratory tract from one of the patients in the study.

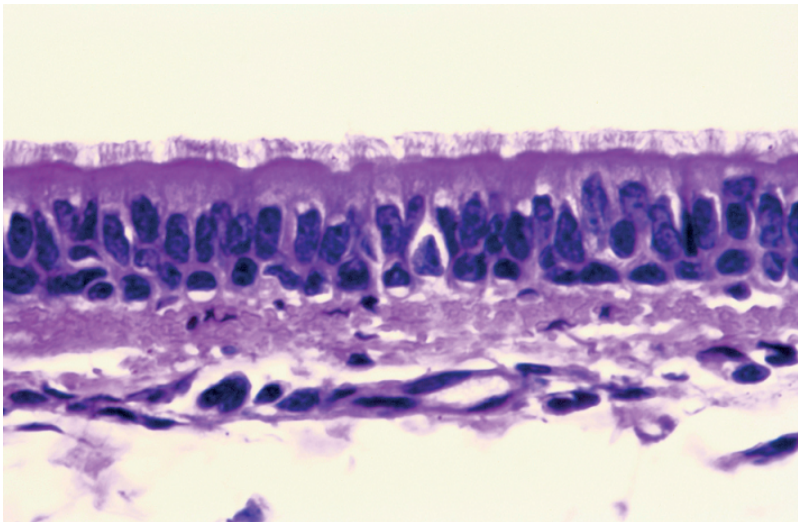


Fig. 5.1

Name **one** structure, visible in Fig. 5.1, involved in the primary defence system.

-----[1]

7 The statements below relate to the causes and effects of emphysema.

Which of the following statements is/are correct?

- 1 Ventilation is impaired due to the destruction of elastic lung tissue.
- 2 The partial pressure of oxygen in the blood is decreased.
- 3 Tissue destruction is mediated by monocytes.
- A 1, 2 and 3 are correct
- B Only 1 and 2 are correct
- C Only 2 and 3 are correct
- D Only 1 is correct

Your answer

[1]

8(a) Asthma and asbestosis are both chronic inflammatory diseases that affect the respiratory system.

(i) Name **two** cells other than macrophages that are responsible for the inflammatory response occurring in diseases such as asthma.

1

2

[2]

(ii) Explain why asthma could be considered an example of a specific immune response.

[1]

- (b) Diseases that involve chronic inflammation, such as asthma, are treated with steroids. Steroids reduce the transcription of the genes coding for molecules that produce an inflammatory response.

Steroids affect structural cells and cells involved in the inflammatory response. Structural cells form the tissues of the respiratory system.

- (i) Suggest what effect steroids have on histones such that gene transcription is reduced.

----- [1]

- (ii) Steroids can suppress the production of certain molecules by cells in the respiratory system.

Suggest one molecule released by a cell involved in an inflammatory response **and** one released by a structural cell for which production is suppressed by steroids.

molecule in inflammatory response -----

molecule released by structural cell -----

[2]

- (iii) Acute asthma attacks are treated using beta-agonists.

Name the tissue targeted by beta-agonists **and** state the location of this tissue in the airways.

tissue -----

location of tissue -----

[2]

- (c) Asbestosis occurs when asbestos fibres are engulfed by macrophages. Macrophages then stimulate an inflammatory response and the production of fibrous tissues in the region.

Other diseases associated with asbestos fibres are lung cancer and mesothelioma. Mesothelioma is a cancer of the tissue covering the surface of the lungs.

Table 5.1 shows the length of fibres in different types of asbestos.

Type of asbestos	Length of fibre (μm)
White	< 5
Blue	5–10
Brown	5–10

Table 5.1

Table 5.2 shows the relationship between the size of asbestos fibres and the disease caused.

Disease induced by asbestos	Length of fibre (μm)	Width of fibre (μm)
Asbestosis	> 2 μm	> 0.15 μm
Mesothelioma	> 5 μm	< 0.1 μm
Lung cancer	> 10 μm	< 0.15 μm

Table 5.2

White asbestos fibres can have diameters up to 1 μm and tend to be wider than blue or brown asbestos fibres.

What do you conclude about the relationship between the type of asbestos and the risk of an asbestos-induced disease? Justify your conclusion.

[2]

- 9 Alzheimer's is a neurological disorder. A potential new drug treatment for Alzheimer's has entered clinical trials. The drug has passed the phase 2 trial in which it was tested on 50 patients.

A brief summary of the plan for phase 3 of the trial is as follows:

- The new drug is compared to the best treatment currently available.
- 70 patients receive the new drug in total, 35 from hospital A and 35 from hospital B.
- A placebo is not used.
- Blind trials are used.

- (i) Discuss aspects of the planned phase 3 clinical trial and explain how each aspect is likely to affect the validity of the results.

[3]

- (ii) State **two** possible causes of Alzheimer's.

1

2

[2]

10 A research team planned to compare the genetic diversity of the populations of three towns.

An overview of their methodology is provided below.

- Genetic analysis will be conducted on 20 people from town A, 50 people from town B and 155 people from town C.
- 100 gene loci will be analysed.

What additional information would need to be considered to improve this methodology?

[3]

11 The following statement describes a clinical trial that reached completion in 2009.

The trial was a randomised, single-blind trial which aimed to compare a new drug, ustekinumab, with the standard-of-care drug, etanercept, for the treatment of a skin disease.

Which of the following statements is / are correct?

- Statement 1:** The doctors, but not the patients, knew which patient received which drug.
- Statement 2:** The trial was in phase 3.
- Statement 3:** Ustekinumab was given to patients over a range of doses in order to determine the safest dose.

- A 1, 2 and 3 are correct
- B Only 1 and 2 are correct
- C Only 2 and 3 are correct
- D Only 1 is correct

Your answer

☐

[1]

- 12 Several factors are known to affect fertility in men. One of these factors is Body Mass Index (BMI).

Table 35.1 shows measurements obtained for semen samples from two groups of men with different BMIs.

Group	Number in group	BMI	Mean semen volume (cm ³)	Mean total sperm count (10 ⁶)	Mean total progressively motile sperm (10 ⁶)
A	47	20–25	2.6	342.0	74.2
B	50	>25	3.0	413.1	110.4

Table 35.1

- (i) What can be concluded about the effect of BMI on the **concentration** and **quality** of semen samples in this study?

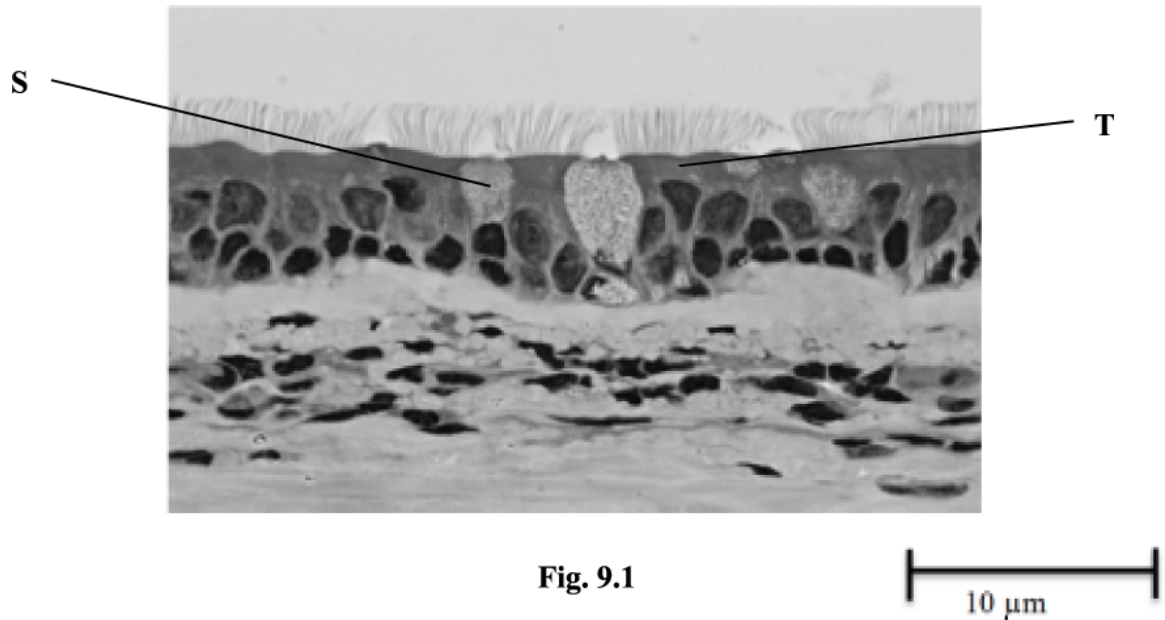
Analyse the information in Table 35.1 to support your conclusion.

[4]

- (ii) Suggest **two** ways in which the design of this study could be modified in order to improve the validity of a conclusion about the effect of BMI on fertility in men.

[2]

13 The statements below refer to the tissue shown in Fig. 9.1 and the magnification.



Which of the following statements is / are true?

- Statement 1:** The magnification of this image is $\times 300$.
Statement 2: The tissue shown is epithelial tissue.
Statement 3: Cells S and T will be replaced from stem cells.

- A 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

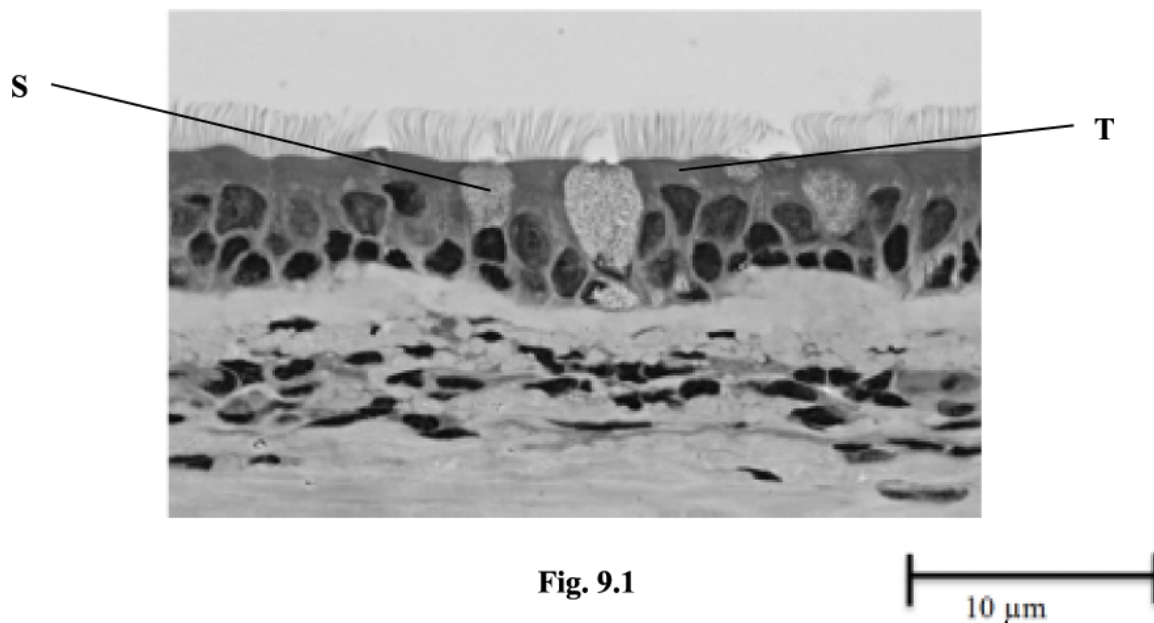
Your answer

☐

[1]

- 14 The statements below refer to the location of cells S and T and the effect of the pollutants in tobacco smoke on these cells.

Fig. 9.1 shows a photomicrograph of a tissue found in the human gas exchange system. This tissue will be exposed to any pollutants present in inhaled air.



Which of the following statements are correct?

- Statement 1:** Cell S is a goblet cell and is stimulated by pollutants.
Statement 2: Cell T is a ciliated cell and is damaged by pollutants.
Statement 3: Cell S and T are found in the bronchi, bronchioles and alveoli.

- A 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

Your answer ☐

[1]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			B	1(AO2.8)	
			Total	1	
2		i	(the people chosen) reflect the distribution of, characteristics of the whole population / AW ✓	1(AO2.4)	
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 70% ✓✓ $(357\ 358 \div 511\ 670) \times 100$ ✓	2(AO2.4)	ALLOW for one mark if calculated correctly but not recorded to 2sf 69.8% OR 69% OR 69.84%
		iii	(may have) died ✓ (may have) emigrated / not traceable (for follow up questionnaire) AW ✓ (may have) withdrawn consent / AW ✓	1max(AO 3.2)	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iv	a community setting more difficult to control variables than in laboratory / AW ✓ (individual exposure to pollutants was only estimated) so data collected was not accurate / AW ✓ people may have relocated so exposed to different levels of air pollutants / AW ✓ lifestyles may change due to length of study / thirty years is a long time for lifestyles to stay the same / AW ✓ people may not tell the truth on questionnaires / AW ✓ genetic predisposition to respiratory diseases will affect the data / AW ✓ other named / specified lifestyle factors, may be also raise risk (of respiratory disease) ✓	3max(AO 3.4)	e.g. smoking
			Total	7	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
3	a		add bacteria to agar plates ✓ add plant extract to agar plates, in wells / sterile filter paper discs ✓ incubate plates (for 24 hours) ✓ identify zone of inhibition ✓	max 2 (AO2.5)	
	b		not cost effective ✓ not as effective as a drug currently available ✓ not considered safe / reference to side effects ✓	max 1 (AO1.2)	
			Total	3	
4	a		<u>yes, because</u> salbutamol increased the oxygen consumption the most ✓ <u>no, because</u> the range bars overlap ✓ no statistical test carried out ✓ only two drugs tested ✓ may have more side effects (than Fenoterol) ✓	max 4 (3.2)	ALLOW corticosteroids have not been tested
	b		(saline) may cause water to move from cells (by osmosis) ✓ <i>idea that</i> (saline) may cause blockage of the bronchioles / alveoli ✓ reducing air supply to <u>alveoli</u> ✓	max 2 (AO2.1)	
			Total	6	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
5	a	i	long duration AND gradual development / worsening, of symptoms over time ✓	1	ALLOW slow onset
		ii	any 1 from: drug medical use theophylline (treat) COPD / asthma ✓ drug medical use topotecan (treat) (lung) cancer ✓ drug medical use (treat) cancer ✓ drug medical use reduce/relieve, fever / inflammation / pain / anti-thrombotic ✓ drug medical use (treat) malaria ✓	max 1	correct drug and correct medical use = 1 mark ALLOW other correct examples of drugs and medical uses e.g. morphine/opiates pain relief
	b	i	2 / two ✓	1	ALLOW II
		ii	drug with, same / similar, appearance to real drug but with no effect ✓ to compare with treatment group /to see effect of treatment ✓	2	IGNORE references to psychological effect

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iii	any 3 from: mean decrease in drug group and mean increase in placebo ✓ mean change (in HbA_{1c}) greater with drug than placebo ✓ 0.65% difference in means ✓ <u>more variable</u> changes (in HbA_{1c}) in treatment group ✓	2	needs to be comparative statement DO NOT ALLOW greater range Examiner's Comments Some candidates interpreted the boxes on the graph as the range of data rather than the mean change in glycosylated haemoglobin. Few candidates achieved the full three marks. Exemplar 10 The placebo had much narrower results than the actual drug with the ^{mean} average reading a positive change in HbA. The actual drug saw a decrease in HbA change with results being far more spread out than the placebo as shown by the much larger error bars. The decrease is by 0.6 in the drug and the placebo has less than a 0.1 increase. [3] A comparative answer including the scale and direction of differences and a statement about the more varied data in the treatment group.
		iv	any 2 from: error bars overlap ✓ no evidence of permanent drug effect / 3 months not long enough ✓ group size too small / need more participants ✓ disease severity may be different among patients / example of other variables to control ✓ idea that uncertainty as to whether reduction (in HbA_{1c}) in treatment group is great enough ✓	max 2	AW
			Total	10	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
6			cilia ✓	1	ALLOW ciliated epithelium ALLOW goblet cell Examiner's Comments Some candidates did not read Q5(c) carefully and cited primary defences that could not be seen in the photomicrograph e.g. skin, hydrochloric acid. Most candidates correctly identified cilia or goblet cells. Some candidates just referred to epithelium cells unqualified.
			Total	1	
7			B ✓	1	Examiner's Comments Candidates found this question very difficult with most students opting for response A.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
8	a	i	B lymphocyte / plasma cell ✓ Mast cell ✓ T-helper lymphocytes ✓	max 2	
		ii	<i>idea that</i> an antigen / allergen triggers the production of an antibody / IgE (antibody)	1	
	b	i	<i>idea that</i> histones are deacetylated / acetyl groups are removed	1	
		ii	<i>inflammatory cell</i> histamine / IgE / cytokine ✓ <i>structural cell</i> mucin / cytokine ✓	2	ALLOW cytokine once only for either type of cell ALLOW a named cytokine
		iii	<i>tissue</i> smooth muscle ✓ <i>location</i> wall of, bronchi / bronchioles ✓	2	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	c		<i>idea that</i> white asbestos less carcinogenic / blue and brown asbestos more carcinogenic ✓ <i>justification</i> fibre length is shorter in white asbestos / fibre length is longer in blue and brown asbestos / fibres are wider in white asbestos / fibres are narrower in blue and brown asbestos AND <i>idea that</i> longer / narrower, fibres are more carcinogenic ✓ <i>idea that</i> white asbestos linked more to asbestosis / blue and brown asbestos less likely to cause asbestosis ✓ OR shorter / thicker, fibres that cause asbestosis more likely in white asbestos AND data in support ✓	max 2	One mark for conclusion and one for justification Justification must be linked to the conclusion ALLOW white asbestos less likely to cause mesothelioma / lung cancer
			Total	10	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
9		i	Any 3 from: <i>idea that</i> 70 people is too low for a phase 3 trial (therefore reducing validity) / phase 3 trial should involve, hundreds / thousands, of people <i>idea that</i> (sample size of 70 people is) unlikely to differentiate new drug's performance from current drug (therefore reducing validity) blind trials (improve validity by), reducing / removing, bias (of patients) double blind trials (would be), improvement / AW, by removing bias of scientists <i>idea that</i> placebo cannot be used because it would be unethical in a phase 3 trial	3	
		ii	Any 2 from: genetics head injuries age smoking	2	
			Total	5	
10			Any 2 from: <i>idea that</i> ideally sample sizes from each town should be, the same / more similar <i>idea of</i> avoiding bias / random selection <i>idea of</i> using the same, sampling method / approach, for each town calculation method described or named what gene loci will be analysed	3	e.g. heterozygosity, proportion of polymorphic loci
			Total	3	
11			B	1	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance												
12		i	<i>conclusion</i> a higher BMI increases sperm concentration and quality <i>data in support</i> concentrations correctly calculated correct unit given data used with units to support statement on quality	4	ALLOW comments referring to a small difference BMI 20 – 25 $342 \div 2.6 = 131.5$ AND BMI > 25 $413.1 \div 3 = 137.7$ 10^6 cm^{-3} OR $10^6 / \text{cm}^3$ <table><tr><td>Group</td><td>BMI</td><td>Total progressively motile sperm (10^6)</td><td>Concentration 10^6 cm^{-3}</td></tr><tr><td>A</td><td>20–25</td><td>74.2</td><td>131.5</td></tr><tr><td>B</td><td>>25</td><td>110.4</td><td>137.7</td></tr></table>	Group	BMI	Total progressively motile sperm (10^6)	Concentration 10^6 cm^{-3}	A	20–25	74.2	131.5	B	>25	110.4	137.7
Group	BMI	Total progressively motile sperm (10^6)	Concentration 10^6 cm^{-3}														
A	20–25	74.2	131.5														
B	>25	110.4	137.7														
		ii	Any 2 from: <i>Idea that</i> BMI >25 needs to be subdivided age in both groups should be same larger sample size carry out study over more generations of men / time span of study named factor should be controlled	2	e.g. smoking, fitness level, exposure to STDs or traumatic damage												
			Total	6													
13			C	1													
			Total	1													
14			B	1													
			Total	1													