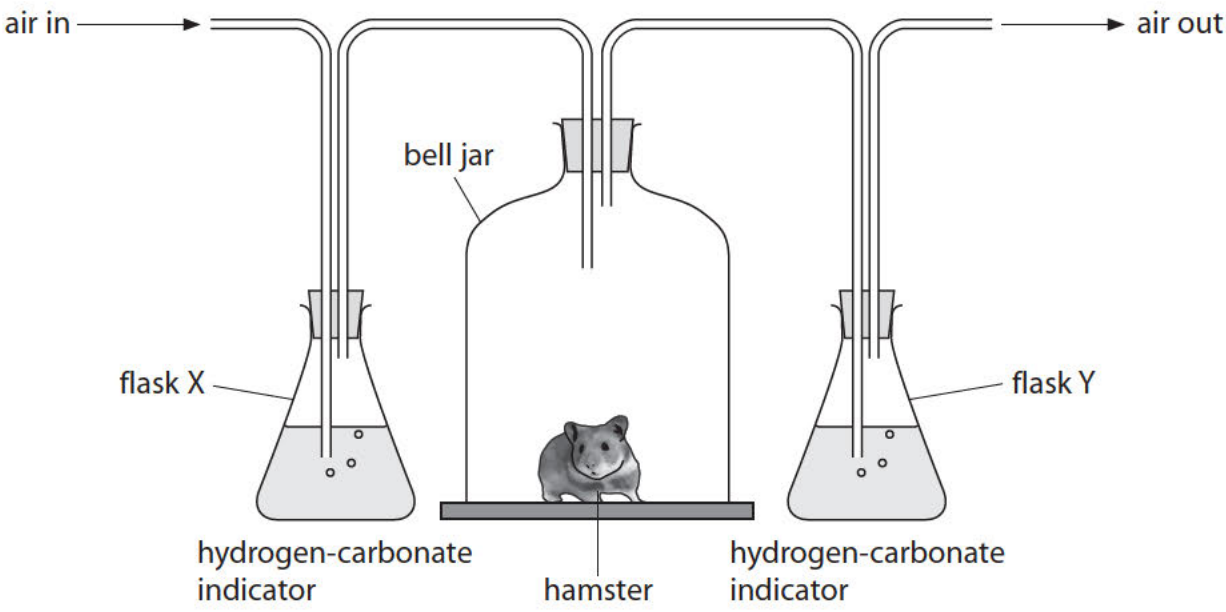
1 A scientist uses this apparatus to find out if body size affects the rate of respiration in hamsters, which are small mammals.



She puts a small hamster into a bell jar and measures the time taken for the hydrogen-carbonate indicator to change colour in flask Y.

She then repeats the experiment with a bigger hamster.

(a) (i) State the colour that the hydrogen-carbonate indicator would be in flask X and flask Y at the end of each experiment.

(2)

flask X .....

flask Y .....

(ii) Explain the colour change of the hydrogen-carbonate indicator in flask Y at the end of each experiment.

(1)

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(b) The table shows the scientist's results.

Time taken to change the colour of the hydrogen-carbonate indicator in flask Y in minutes	
Small hamster	**Big hamster**
6	8

(i) Hamsters need to maintain a constant body temperature.

Use this information and your knowledge to explain the difference in these results.

(2)

(ii) Explain why hamsters need to maintain a constant body temperature.

(2)

(c) The scientist's results are not reliable and might not be accurate.

(i) Explain why her results are not reliable.

(1)

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(ii) Explain why her method might not produce accurate results.

(1)

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(d) Give three variables that the scientist should control in her experiments.

(3)

1 .....

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2 .....

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3 .....

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(Total for Question = 12 marks)

2 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

COPD: chronic obstructive pulmonary disorder

Chronic obstructive pulmonary disorder (COPD) is the term used to describe several lung diseases including bronchitis and emphysema. People with COPD have trouble breathing because they have damaged their lungs, usually because of smoking. Eighty per cent of people who develop COPD are, or have been, smokers.

However, breathing in dust or fumes may also cause COPD. There is also a small genetic risk linked to COPD called alpha-1-antitrypsin deficiency. Alpha-1-antitrypsin is a molecule that protects your lungs from being digested by a protease enzyme released by white blood cells in the lungs. People who have an alpha-1-antitrypsin deficiency usually develop COPD at a younger age.

There are about 65 million people in the UK and 835 000 are known to have COPD. There are thought to be another 2 million who have COPD but have not been diagnosed because they have not asked for medical help. They seem content to put up with what they call smoker's cough. Sadly, there are about 25 000 deaths a year in the UK because of COPD.

The symptoms of COPD do not usually show until after the age of 35. They include breathlessness when exercising, persistent coughing of mucus and frequent chest infections, particularly in winter. The walls of the airways get thicker in response to inflammation, more mucus is made and the air sacs are damaged. Although any damage that has already happened to the lungs cannot be reversed, it is possible to prevent COPD from getting worse by making lifestyle changes.

Chest infections are common and can be caused by bacteria or viruses. People with COPD are advised to have two vaccinations. A yearly 'flu jab' each autumn protects against possible influenza and any chest infection that may develop due to this. Vaccination against *Pneumococcus*, a bacterium that can cause serious chest infections, involves a one-off injection.

Treatment for COPD usually involves relieving the symptoms, such as using an inhaler to make breathing easier. Other treatments such as steroids, antibiotics, breathing oxygen from a cylinder, and inhaling mucolytic (mucus-thinning) medicines are sometimes prescribed in more severe cases, or during a worsening of symptoms.

(a) COPD includes diseases such as emphysema (line 2).

Give two causes of emphysema.

(2)

1 .....

2 .....

(b) The white blood cells in the lungs release protease (a protein digesting enzyme) (line 9).

Suggest the function of this enzyme in the white blood cells in the lungs.

(2)

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(c) Calculate the number of people who may have COPD that are smokers (lines 4 and 5 and lines 11 and 12).

Show your working.

(2)

Answer .....

(d) (i) Name the air sacs in the lungs responsible for gas exchange (line 19).

(1)

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(ii) Suggest how damage to the air sacs can cause the symptom of breathlessness when exercising (line 17).

(2)

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(e) Explain how the vaccination against *Pneumococcus* provides protection from further infection (lines 24 to 27).

(2)

(f) (i) Suggest how mucolytic medicines help to treat the symptoms of COPD (lines 30 and 31).

(2)

(ii) Breathing in oxygen from a cylinder changes the concentration of oxygen in the air sacs.

How does the change in oxygen concentration help to reduce the symptoms of COPD?

(2)

(Total for Question = 15 marks)

3 Ian wanted to investigate how gas exchange in a flowering plant changed with light intensity.

He set up an experiment using four tubes. Each of the tubes contained orange hydrogencarbonate indicator solution and was sealed with a cork. Ian added a fresh leaf to tubes A, B and C. Tube D had no leaf.

The tubes were then left in the following conditions:

- Tube A was placed in direct sunlight.
- Tube B was covered with aluminium foil to prevent any light entering the tube.
- Tube C was covered with thin cloth which allowed some light to enter the tube.
- Tube D was also placed in direct sunlight.

He left the tubes in the laboratory for one hour and then returned to look at the colour of the indicator solution in the tubes.

(a) Suggest a hypothesis for Ian's investigation.

(2)

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(b) Give **two** variables that Ian should keep constant in his investigation.

(2)

1 .....

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2 .....

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(c) State the purpose of Tube D in the investigation.

(1)

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(d) Ian recorded his results in a table.

Tube	Colour of indicator at start	Colour of indicator after one hour
A	orange	purple
B	orange	yellow
C	orange	orange
D	orange	orange

(i) Explain the change in colour of the indicator in Tube A.

(2)

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(ii) Explain the change in colour of the indicator in Tube B.

(2)

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(e) Suggest why the indicator did not change colour in:

(i) Tube C

(1)

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(ii) Tube D

(1)

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(f) Limewater is an indicator that can be used to show an increase in the level of carbon dioxide.

Suggest why it would **not** be a suitable indicator for use in this investigation.

(1)

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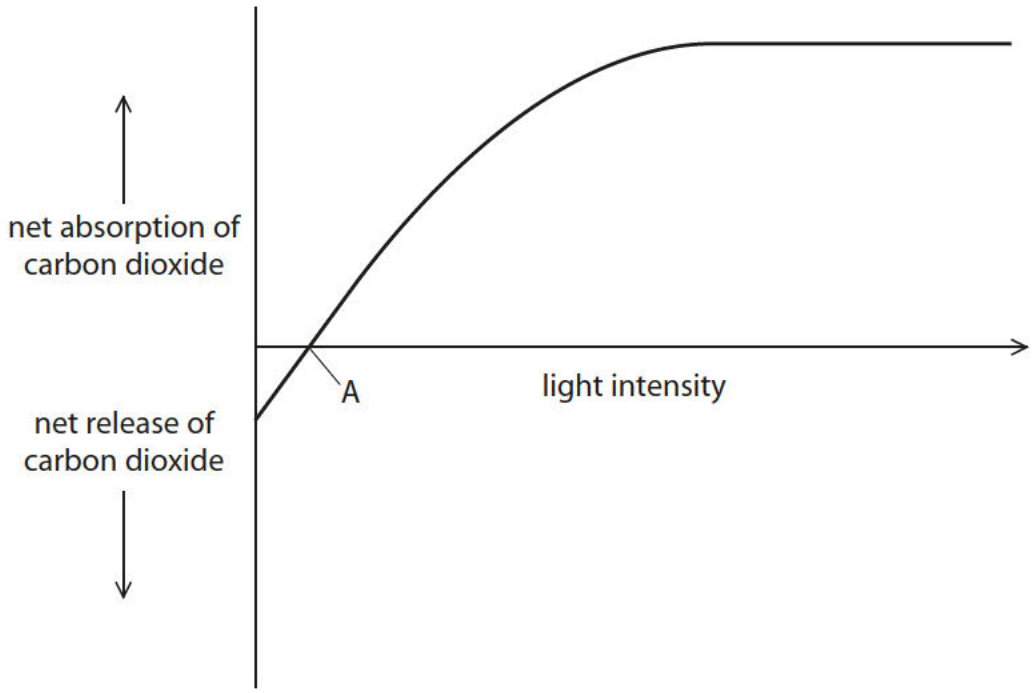
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(Total for Question = 12 marks)

4 The graph shows the effect of increasing light intensity on the exchange of carbon dioxide in a green plant.



(a) Describe the effect of increasing light intensity on the exchange of carbon dioxide.

(2)

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(b) Explain why there is no net exchange of carbon dioxide at point A.

(1)

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(c) Describe how you could use an indicator to show how the exchange of carbon dioxide by a leaf changes in the dark and in the light.

(2)

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(Total for Question = 5 marks)

5 Describe the biological consequences of cigarette smoking on the human lungs.

(5)

(Total for Question = 5 marks)