**1.** Which of the following are greenhouse gases?

I. Oxides of nitrogen

II. Carbon dioxide

III. Methane

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

(Total 1 mark)

**2.** During aerobic cell respiration, oxygen is consumed and carbon dioxide is produced inside cells. This generates concentration gradients between respiring cells and the environment, which cause diffusion of oxygen and carbon dioxide. Both oxygen and carbon dioxide are soluble in water. As the temperature rises, water becomes saturated at a lower concentration of the gas.

*Laternula elliptica* is a mollusc that lives on the sea bed in Antarctica. Its body temperature is always similar to that of the environment around it. To investigate the effect of temperature on *Laternula elliptica*, specimens were kept in temperature-controlled aquaria. The oxygen concentrations of water near the gills and in the body fluids were measured, at a range of temperatures from 0°C to 9°C. The graph below shows the mean results.



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(a) (i) Outline the relationship between temperature and oxygen concentration in the body fluids in *Laternula elliptica*.

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(2)

(ii) Suggest **two** reasons for the relationship.

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(2)

(b) In its natural environment, *Laternula elliptica* buries itself in the mud on the sea bed.  
In this investigation, it was found that above 6°C it is unable to bury itself. Suggest a reason for this.

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(1)

The world’s oceans can absorb large amounts of carbon dioxide. This process has been studied in the Pacific Ocean near Hawaii, by measuring carbon dioxide concentrations in the atmosphere and in surface water every month, from October 1988 onwards. The graph below shows the carbon dioxide concentration expressed as partial pressures (Pco2).



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(c) (i) Describe the trends in atmospheric carbon dioxide concentration, shown in the graph.

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(2)

(ii) Suggest **two** reasons for the trends that you have described.

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(2)

(d) (i) Diffusion of carbon dioxide only occurs when there is a concentration gradient.  
Deduce the pattern of carbon dioxide diffusion, between water and atmosphere, from 1988 to 2002.

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(2)

(ii) The graph provides evidence for the hypothesis that there will be no net diffusion of carbon dioxide between water and atmosphere by 2020. Explain this evidence.

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(1)

The concentration of carbon dioxide in the atmosphere is currently 385 ppm (parts per million).  
Variations in the concentration of carbon dioxide in the atmosphere can be studied using ice-cores. An ice-core record covering the last 400 000 years has been obtained from Vostok in the Antarctic. The graph below shows the carbon dioxide concentrations that were measured at different depths in the ice. Atmospheric temperatures are also shown on the graph. These were deduced from ratios of oxygen isotopes. The upper line on the graph shows CO2 concentrations and the lower line shows temperature.



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(e) (i) State the highest carbon dioxide concentration shown on the graph.

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(1)

(ii) State the highest temperature shown on the graph.

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(1)

(f) Using the data in the graph, deduce the relationship between atmospheric carbon dioxide concentration and temperature.

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(1)

(g) Using the data in this question, explain reasons for concern about the long-term survival of Antarctic species, such as *Laternula elliptica*.

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(3)

(Total 18 marks)