

Name of the Student: _____

Max. Marks : 20 Marks

Time : 20 Minutes

Q1.

Scientists investigated the effect of a mycorrhizal fungus on the growth of pea plants with a nitrate fertiliser or an ammonium fertiliser. The fertilisers were identical, except for nitrate or ammonium.

The scientists took pea seeds and sterilised their surfaces. They planted the seeds in soil that had been heated to 85 °C for 2 days before use. The soil was sand that contained no mineral ions useful to the plants.

- (a) Explain why the scientists sterilised the surfaces of the seeds and grew them in soil that had been heated to 85 °C for 2 days.

(2)

- (b) Explain why it was important that the soil contained no mineral ions useful to the plants.

(1)

The pea plants were divided into four groups, **A**, **B**, **C** and **D**.

- **Group A** – heat-treated mycorrhizal fungus added, nitrate fertiliser
- **Group B** – mycorrhizal fungus added, nitrate fertiliser
- **Group C** – heat-treated mycorrhizal fungus added, ammonium fertiliser
- **Group D** – mycorrhizal fungus added, ammonium fertiliser

The heat-treated fungus had been heated to 120 °C for 1 hour.

- (c) Explain how groups **A** and **C** act as controls.

(2)

After 6 weeks, the scientists removed the plants from the soil and cut the roots from the shoots. They dried the plant material in an oven at 90 °C for 3 days. They then determined the mean dry masses of the roots and shoots of each group of pea plants.

- (d) Suggest what the scientists should have done during the drying process to be sure that all of the water had been removed from the plant samples.

(2)

The scientists' results are shown in the table below.

Treatment	Mean dry mass / g per plant (standard deviation)	
	Root	Shoot
A – heat-treated fungus and nitrate fertiliser	0.40 (±0.05)	1.01 (±0.12)
B – fungus and nitrate fertiliser	1.61 (±0.28)	9.81 (±0.33)
C – heat-treated fungus and ammonium fertiliser	0.34 (±0.03)	0.96 (±0.26)
D – fungus and ammonium fertiliser	0.96 (±0.18)	4.01 (±0.47)

- (e) What conclusions can be drawn from the data in the table about the following?

The effects of the fungus on growth of the pea plants.

The effects of nitrate fertiliser and ammonium fertiliser on growth of the pea plants.

(4)

The scientists determined the dry mass of the roots and shoots separately. The reason for this was they were interested in the ratio of shoot to root growth of pea plants. It is the shoot of the pea plant that is harvested for commercial purposes.

- (f) Explain why determination of dry mass was an appropriate method to use in this investigation.

(2)

- (g) Which treatment gave the best result in commercial terms? Justify your answer.

(2)

(Total 15 marks)

Q2.

(a) In respiration in cells,

(i) where does glycolysis take place

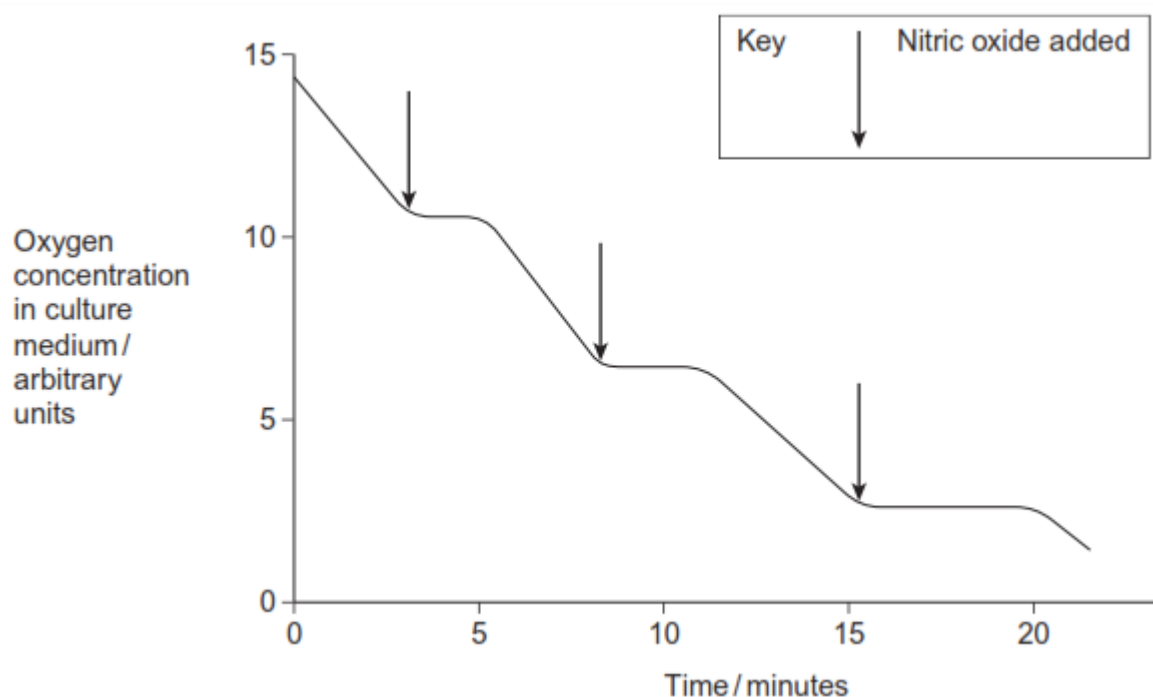
(1)

(ii) where, exactly, is the electron transfer chain found?

(1)

(b) Scientists kept kidney cells in a liquid culture. They investigated the effect of the gas nitric oxide on oxygen consumption by these cells. They recorded the oxygen concentration in the culture medium over a period of time. At intervals they added a small volume of nitric oxide to the culture medium. Nitric oxide affects the functioning of a protein in the electron transport chain.

The graph shows their results.



Explain the effect of nitric oxide.

(Extra space) _____

(3)
(Total 5 marks)