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BIOLOGY

ENERGY TRANSFERS IN & BETWEEN ORGANISMS

Level & Board	AQA (A-LEVEL)
TOPIC:	NUTRIENT CYCLES
PAPER TYPE:	QUESTION PAPER - 2
TOTAL QUESTIONS	6
TOTAL MARKS	24

Nutrient Cycles - 2

1.

Artificial fertilizers are used by farmers to preserve or boost grain-producing crop plants like wheat.

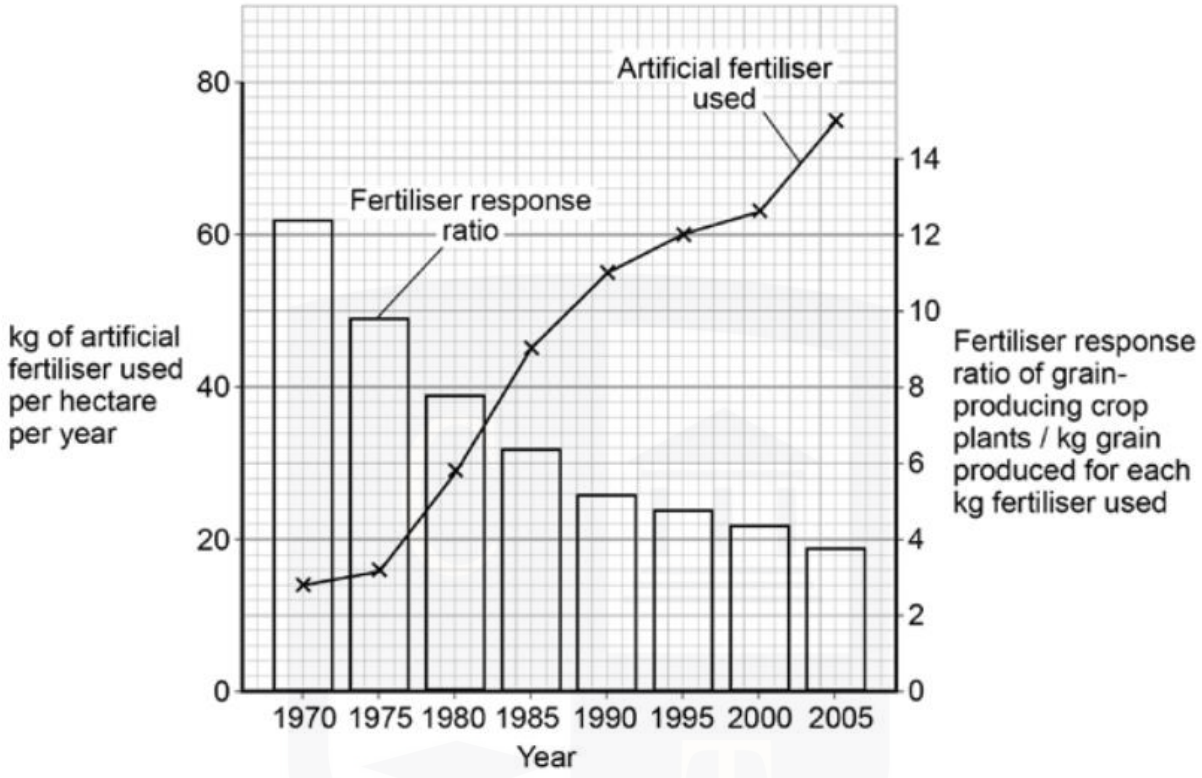
(a) When crops are harvested, the mineral ions that were taken from the soil are replaced with artificial fertilizer. Nitrate is one of the mineral ions.

Give two instances of nitrogen-containing biological substances that would be eliminated during crop harvesting. **(2)**

2.

(a) Researchers looked into how India's usage of artificial fertilizer changed between 1970 and 2005. Additionally, they looked into variations in the fertilizer response ratio. This ratio displays the number of kilograms of grain produced per kilogram of fertilizer applied.

The results are displayed on the graph as the scientists intended. (A hectare is a typical agricultural unit of measurement.)



Determine the difference between the mass of grain produced per hectare in 1970 and 2005 using these statistics.

Display your work. **(2)**

(b) Assess the application of artificial fertilizers on grain-producing crops in India using the information in the graph above. **(2)**

3.

Researchers looked into how a mycorrhizal fungus affected pea plant growth when it was fertilized with either nitrate or ammonium. All the fertilizers were the same, with the exception of ammonium or nitrate.

The researchers sanitized the surfaces of pea seeds. Two days prior to use, the soil was heated to 85 °C, where the seeds were placed. There were no beneficial mineral ions for the plants in the sand that made up the soil.

(a) Justify the scientists decision to sterilize the seeds surfaces and cultivate them in soil that had been heated to 85 °C for two days. **(2)**

(b) Describe the significance of the soil's lack of plant-useful mineral ions.

(1)

There were four groups of pea plants: A, B, C, and D.

- Group A: nitrate fertilizer plus heat-treated mycorrhizal fungus added
- Group B: nitrate fertilizer and the addition of mycorrhizal fungus
- Group C: ammonium fertilizer and heat-treated mycorrhizal fungus added
- Group D: ammonium fertilizer and the addition of mycorrhizal fungus

The fungus that was heat-treated was heated for one hour to 120 °C.

(c) Describe how the control groups, A and C, operate. **(2)**

The plants were taken out of the soil and the roots were cut off from the shoots by the scientists after six weeks. For three days, they dried the plant material at 90 °C in an oven.

The mean dry masses of each set of pea plants' roots and branches were then ascertained.

(d) Make recommendations for what the scientists ought to have done to ensure that the plant samples had completely dried out and were free of water. **(2)**

4.

The table below displays the scientist's findings.

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)

(a) Based on the information in the table, what conclusions may be made on the following?

The impact of the fungus on pea plant growth. **(2)**

(b) The impact of ammonium and nitrate fertilizers on pea plant growth. **(2)**

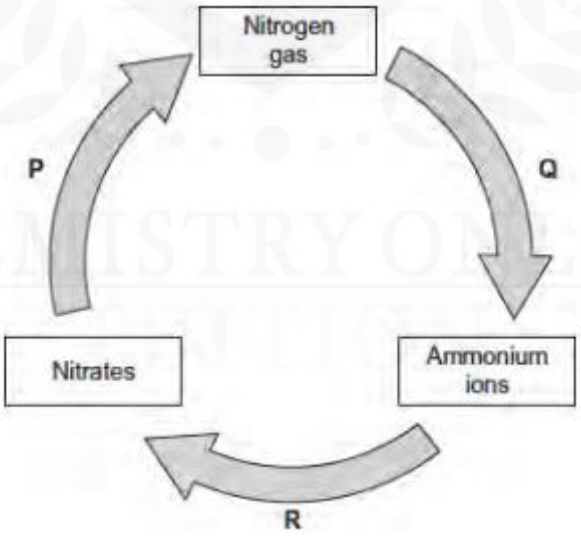
The dry masses of the roots and shoots were measured independently by the scientists. This was because they were curious about the pea plant's shoot-to-root growth ratio. The part of the pea plant that is picked for trade is the shoot.

(c) Describe why the investigation use of the dry mass determination method was appropriate. **(2)**

(d) In terms of commerce, which treatment had the best outcome? Explain your response. **(2)**

5.

The nitrogen cycle is partially depicted in the diagram.



(a) Of the three processes P, Q, and R, which one involves nitrification? **(1)**

(b) One way that microbes enrich soil with ammonium ions is depicted in the above diagram.

Explain the second way that microorganisms enrich soil with ammonium ions. **(2)**

I am Sorry !!!!!

(c) Anaerobic conditions are necessary for denitrification. The soil is aerated by plowing. Describe the impact plowing would have on the soil fertility. **(2)**

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