



CHEMISTRY ONLINE
— **TUITION** —

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BIOLOGY

ENERGY TRANSFERS IN & BETWEEN ORGANISMS

Level & Board	AQA (A-LEVEL)
TOPIC:	ENERGY & ECOSYSTEM
PAPER TYPE:	QUESTION PAPER - 1
TOTAL QUESTIONS	6
TOTAL MARKS	30

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Energy and Ecosystems - 1

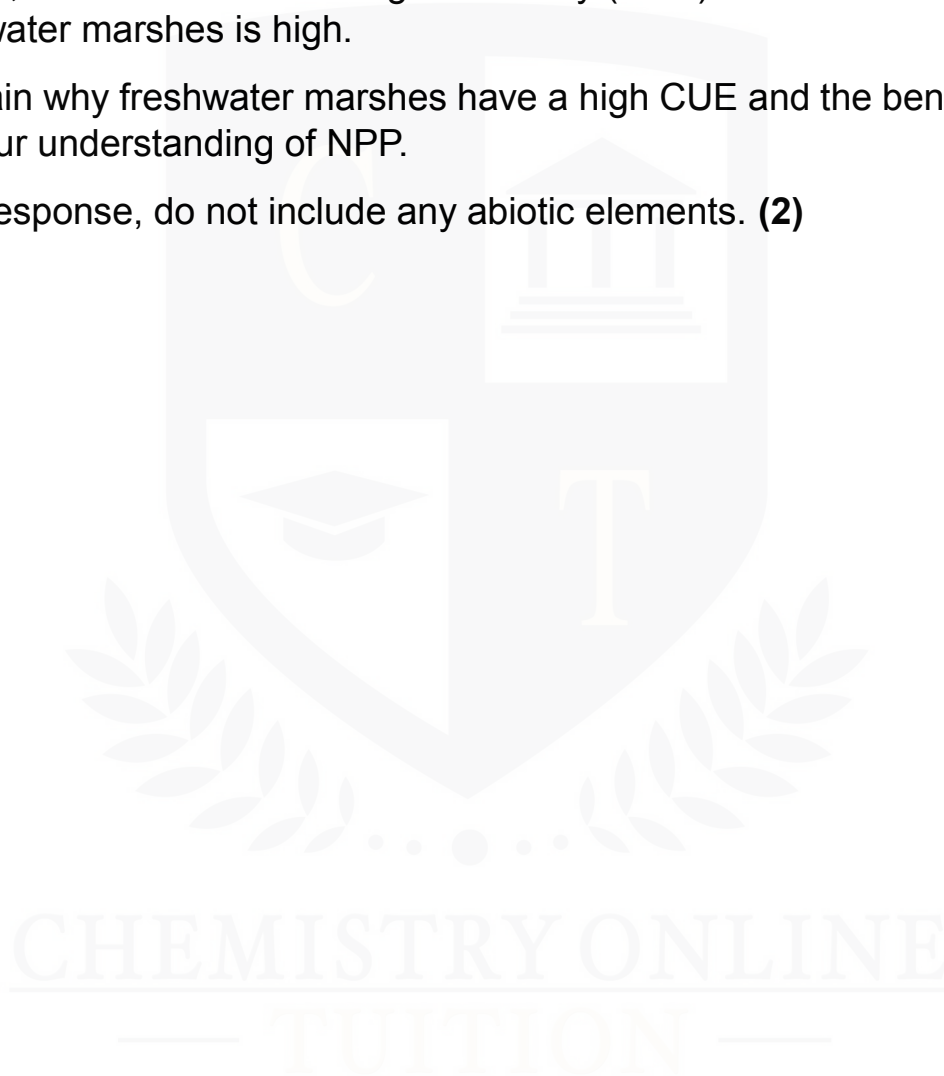
1.

Of all ecosystems, freshwater marshes have some of the greatest rates of net primary production (NPP) and gross primary production (GPP).

This ratio, known as carbon usage efficiency (CUE) or NPP:GPP. The CUE of freshwater marshes is high.

(a) Explain why freshwater marshes have a high CUE and the benefit of this using your understanding of NPP.

In your response, do not include any abiotic elements. **(2)**



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(b) Soils found in freshwater marshes are often wet. Anaerobic conditions are produced by this.

Explain why these soils have low quantities of nitrite and nitrate ions and comparatively large concentrations of ammonium molecules using your understanding of the nitrogen cycle. (2)

A student looked into how quickly a freshwater marsh plant grows. With this equation, one may find a plant's growth rate (R).

$$R = \frac{(\ln W_2 - \ln W_1)}{t}$$

Where

\ln = natural logarithm

t = duration of the investigation in days

W_1 = plant biomass at the start of the investigation

W_2 = plant biomass at the end of the investigation

The student applied the above calculation, but instead of using biomass, she utilized height. She didn't want to kill the plants in order to calculate their biomass, which is why.

(c) Identify the assumption the learner has made and offer a possible refutation. **(2)**



(d) The student observed that the freshwater marsh plant had grown 268 mm in height and was now measuring 387 mm at the conclusion of the inquiry. The rate of growth (R), according to her calculations, is $0.097 \text{ mm m}^{-1} \text{ day}^{-1}$.

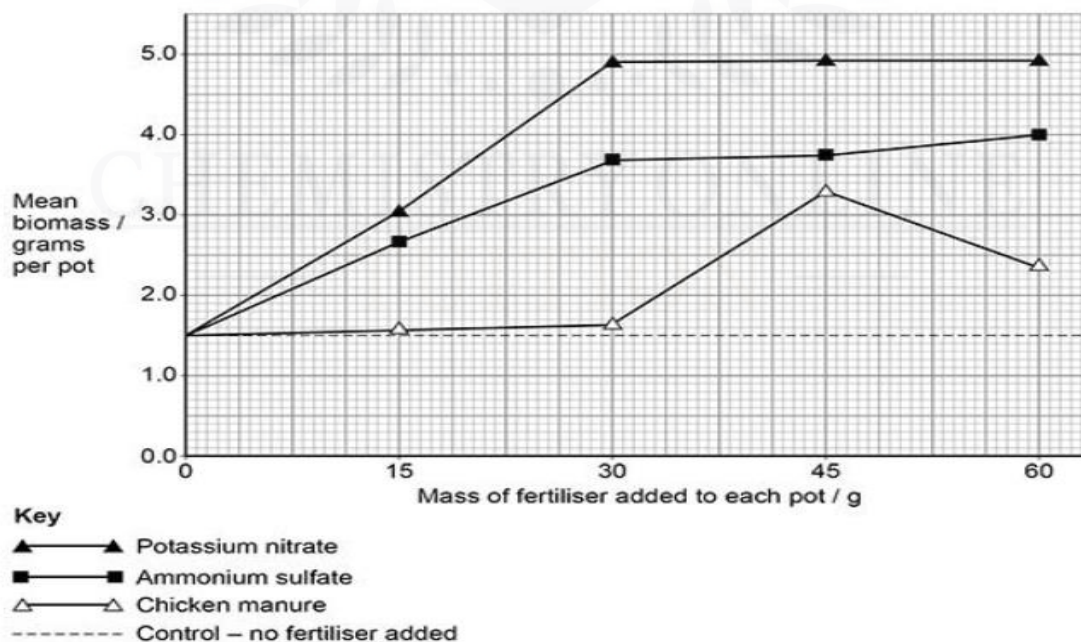
Using this data, find the length of the student's investigation by using the equation and changing biomass to height.

Please respond by giving the closest whole day. Display your work. **(2)**

2.

A scientist looked into how different fertilizers affected spinach plant development. The scientist planted the same number of young spinach plants in each pot, set up a large sample of identical pots of soil, added various masses of fertilizer to selected pots, left the control pots unfertilized, and after 20 days, measured the biomass of spinach plants in each pot.

The graph below displays the scientist's findings after 20 days.



(a) Determine the number of times the mean growth rate per day was higher when 37.5 g potassium nitrate was used instead of 37.5 g ammonium sulfate.

Assume that at the beginning of the study, the spinach plants' mean biomass was 0.5 g per pot. **(2)**



(b) Determine how adding various fertilizers to the soil will affect plant development based on all the facts available. **(5)**

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3.

(a) The spinach plants' dry mass was ascertained by the scientist. He began by heating each sample for two hours at 80 °C.

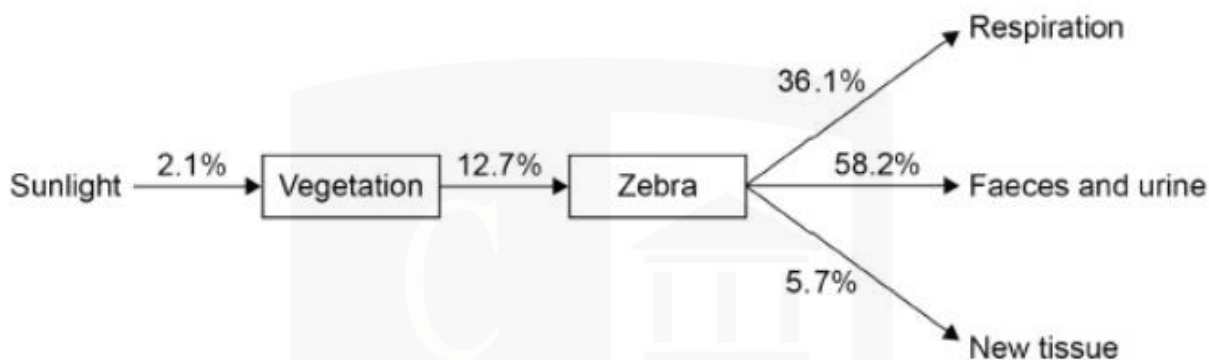
Make recommendations for the scientist's next steps to make sure he has completely dried out the material. **(2)**

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4.

The percentages of solar energy that reach a zebra in a grassland ecosystem are depicted in the diagram.



(a) Determine the percentage of solar energy that would enter zebra urine and feces using the diagram. Please respond with three meaningful figures.

(1)

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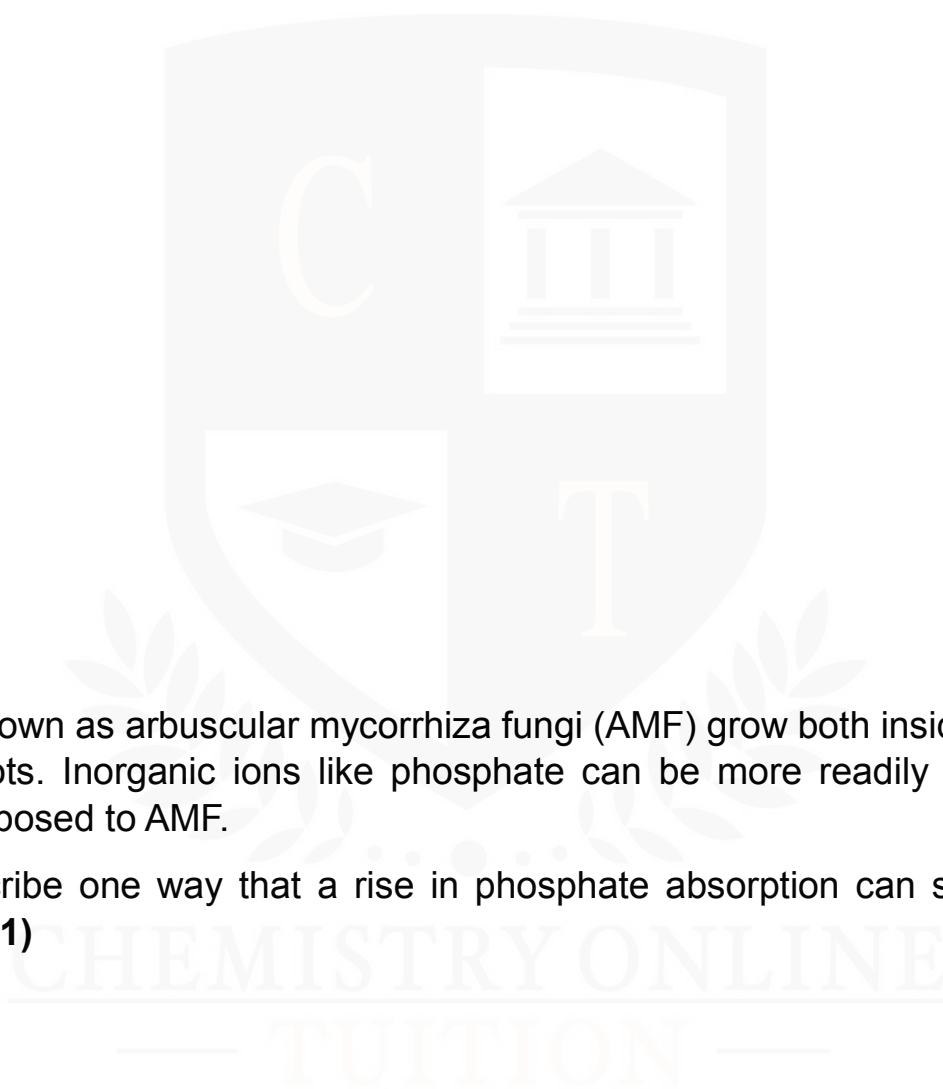
(b) The vegetation's net production in this habitat is $24\,525\text{ kJ m}^{-2}\text{ year}^{-1}$.

Utilizing the following figure and the provided data, compute the energy retained in the zebra's new tissues in $\text{kJ m}^{-2} \text{ year}^{-1}$. **(2)**

5.

Fungi known as arbuscular mycorrhiza fungi (AMF) grow both inside and on plant roots. Inorganic ions like phosphate can be more readily absorbed when exposed to AMF.

(a) Describe one way that a rise in phosphate absorption can spur plant growth. **(1)**



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(b) Provide an example of how AMF could profit from their relationship with plants. **(1)**

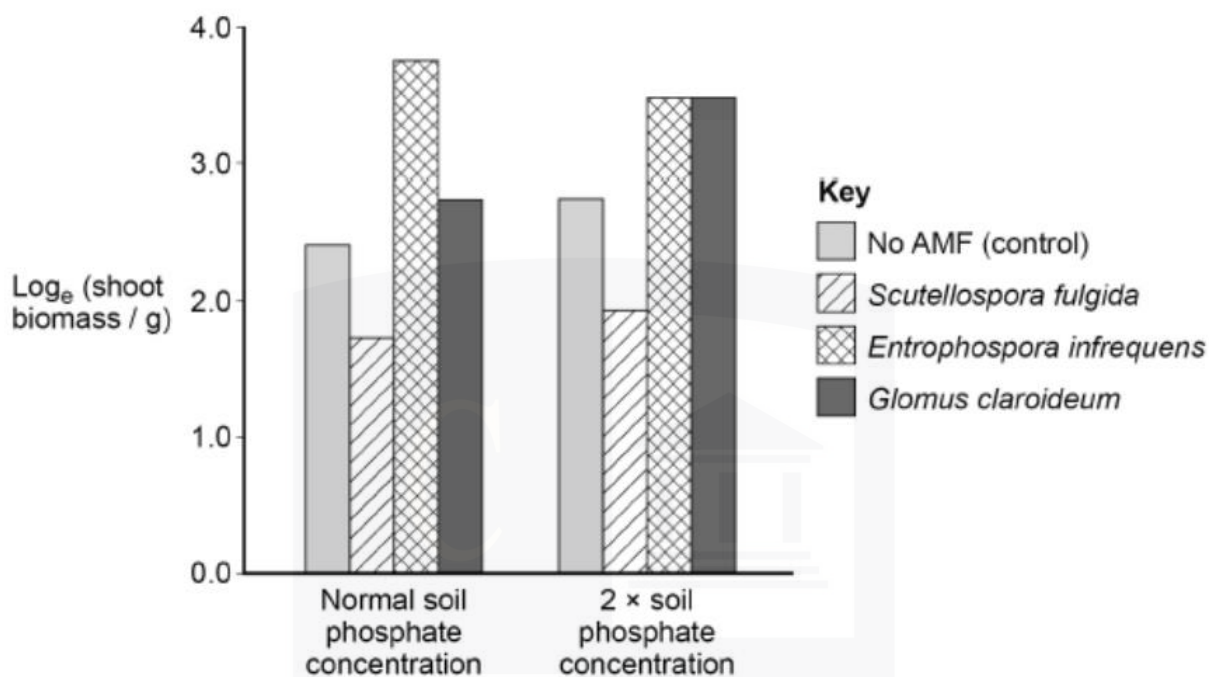
6.

(a) Researchers looked into how various AMF species affected the plant community's productivity in a prairie grassland ecosystem when they grew in or on soil with varying phosphate concentrations.

Similar plots of prairie grassland soil with seeds of the plant species present in the ecosystem were established by the scientists. To certain plots, the scientists applied various AMF species and phosphate amounts. There were also control plots created without AMF species. The scientists calculated the shoot biomass for each plot after 20 weeks.

The graph displays the findings that the scientists were able to collect.

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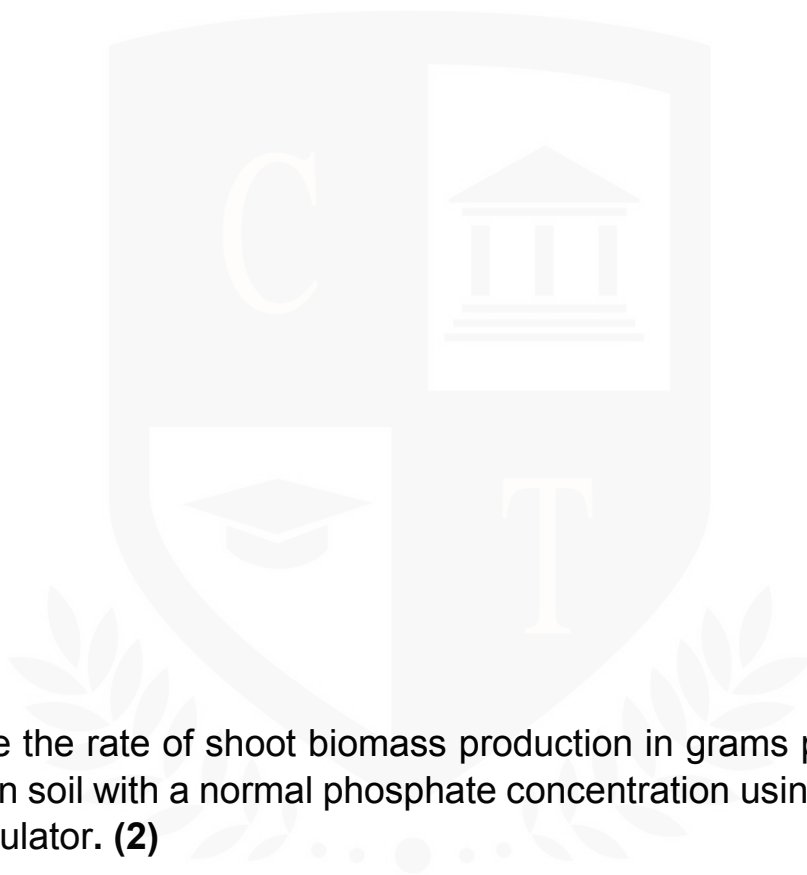


Justify the assessment of increased shoot biomass as a proxy for net primary productivity. (2)

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(b) Analyze the impact of adding AMF species and phosphate to the soil on plant productivity using the information from the graph in part (a). (4)



(c) Calculate the rate of shoot biomass production in grams per day for the control plot in soil with a normal phosphate concentration using the e^x button on your calculator. **(2)**

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- Founder & CEO of Chemistry Online Tuition Ltd.
- Completed Medicine (M.B.B.S) in 2007
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