



AP[®] Biology (Operational) 2004 Sample Student Responses

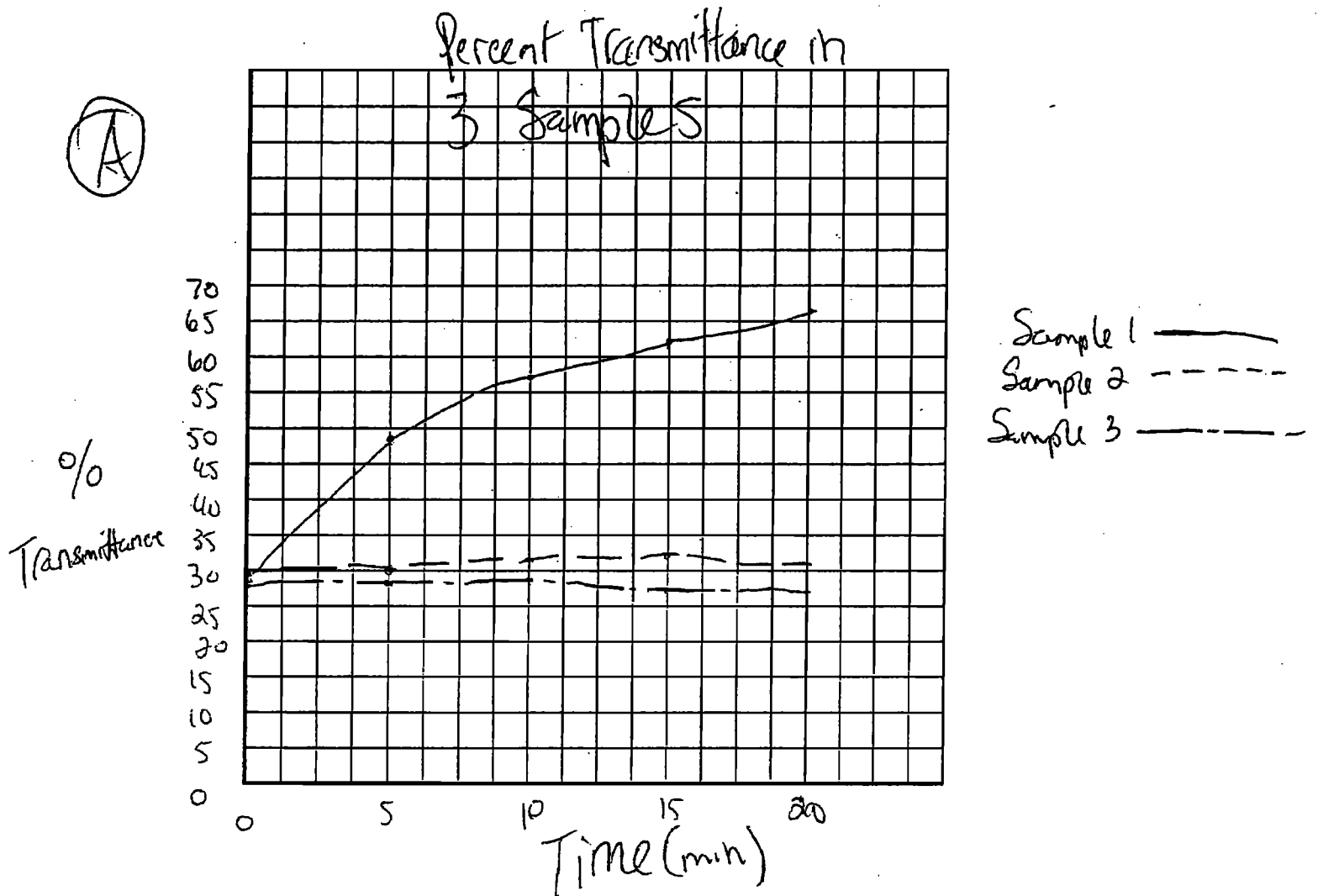
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- (B) The control of this experiment was sample one or the unboiled sample in normal light. It served as the control because it was the sample to which all the others were compared. Furthermore, it represented normal conditions for photosynthesis; the presence of light and non denatured enzymes in the chlorophyll & chloroplasts.
- (C) Photosynthesis produces electrons through the splitting of water. As a photon energizes ~~the~~ photosystem II, ~~the~~ a molecule of water is split and ~~the~~ the electrons from the reaction are carried through the second photosystem and then reenergized in the first photosystem ~~by~~ by another

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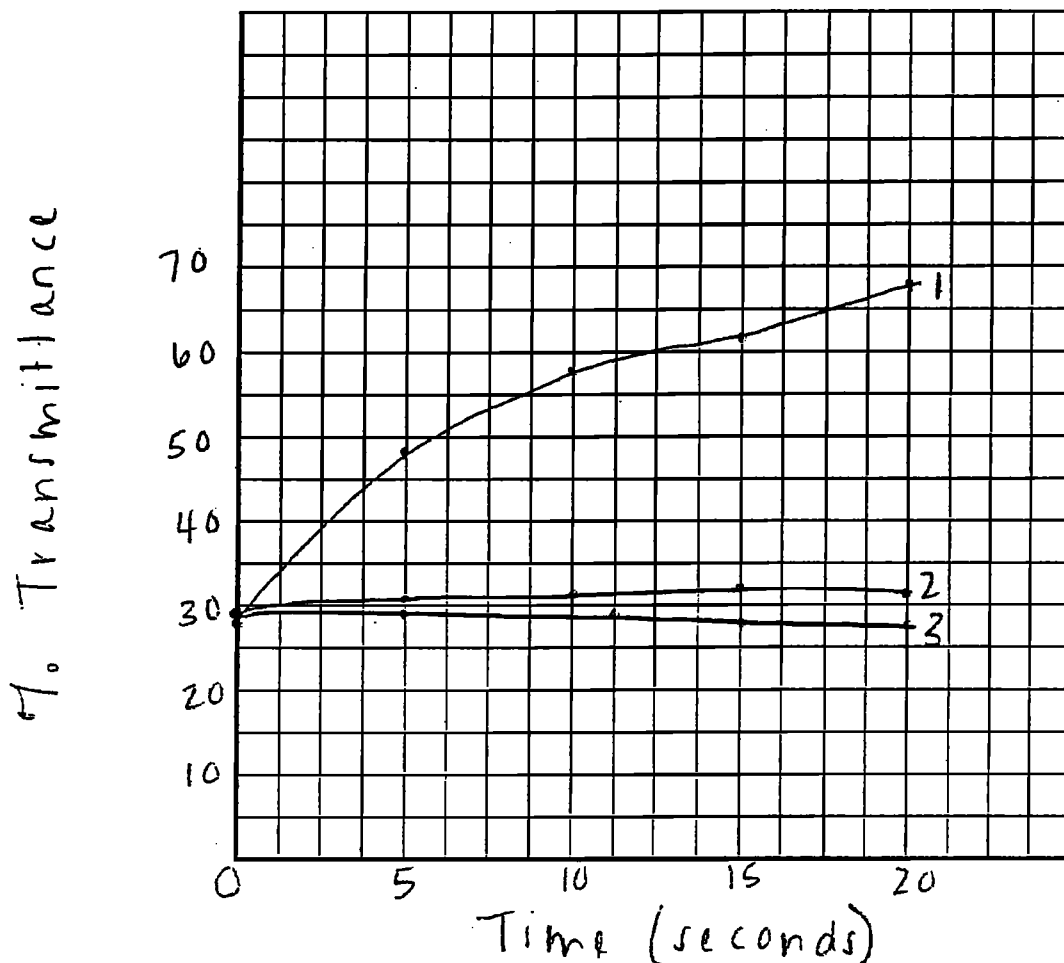
photon and carried along the first photosystem. They are eventually taken up by $\text{NADP}^+ + \text{H}^+$, in this experiment, ~~the~~ DPIP was the final electron acceptor in the process. Because both photosystems in cyclic and non cyclic photophosphorylation require light to energize the electrons the sample with the light therefore had the highest % transmittance of electrons and thus the highest rate of photosynthesis. The dark unboiled sample ~~had~~ had some photosynthesis, most likely as a result of taking off the foil briefly ~~and~~ to place the test tube in the spectrophotometer thereby exposing the sample to light. However, because ^{for} the duration of the experiment sample 2 was in the dark, it would have had a very low rate of photosynthesis. The final sample was boiled which would have had a detrimental effect on the photosystems which are based on enzymes and proteins. Because these denature at high temperatures the photosystems and chlorophyll 680 + 700 would not have been able to function properly, thus giving the results of no net gain of electrons.

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ADDITIONAL PAGE FOR ANSWERING QUESTION 3

Percent Transmittance Over Time



In this experiment, sample 1, the chloroplast suspension plus DPIP, acted as the control. It was the only sample that was unboiled and kept in a normal, light environment. It was also the sample, which the other two could be compared to in the end of the experiment in order to maintain accurate results.

From observing the graph above, one can see that each curve indicates that there were differences in the number of electrons produced in the three samples. In photosynthesis, electrons are generated in photosystem I by the process of electron phosphorylation. In this process, a water is broken down so that an atom of

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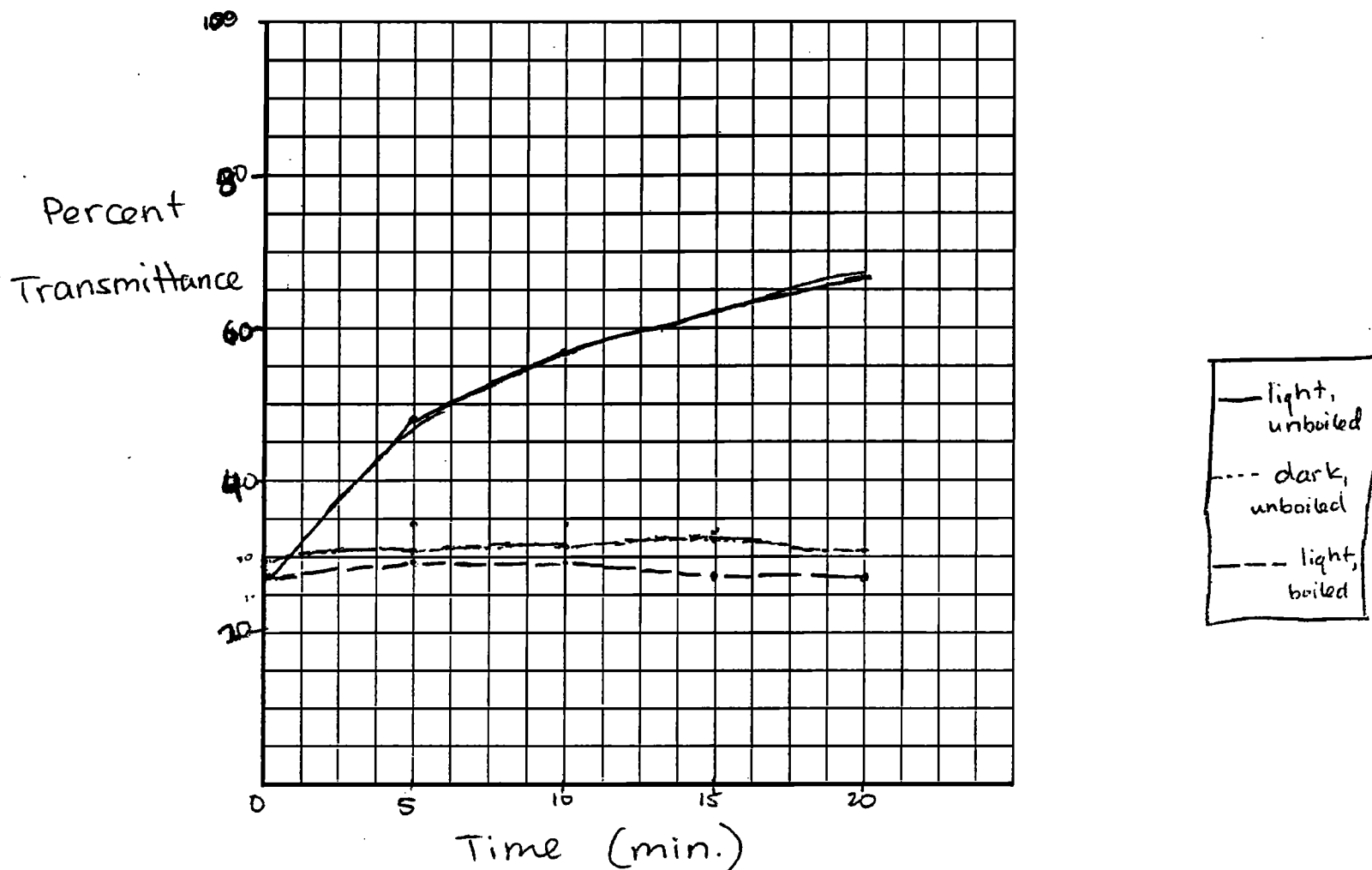
ADDITIONAL PAGE FOR ANSWERING QUESTION 3

Hydrogen can release an electron. The first curve has the highest % transmittance because it is depicting a chloroplast under normal conditions. The other two curves are producing lower % transmittances, because in both cases the chloroplast has been harmed in some way. Sample 2 has not been exposed to light, so it can only do minimal amounts of photosynthesis. Sample 3 has been boiled and the enzymes normally used to breakdown the water molecule are now denatured (they have changed shape and cannot work properly). This accounts for the differences seen between the three curves.

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b.) The control of this experiment is the Sample 1. It is in a more natural environment. There are no major changes, such as foil for darkness or boiling for higher temperatures, to alter the photosynthetic rate.

c.) Electrons are generated by light and temperature in photosynthesis. If either source is sparse. The number of electron production is lowered. The darkness was the ~~closest~~ closer to the

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control because only one factor was changed. The boiled chloroplasts with light were also low in electron productivity. The chloroplasts need both light and ~~at~~ normal temperatures to produce a good number of electrons.

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