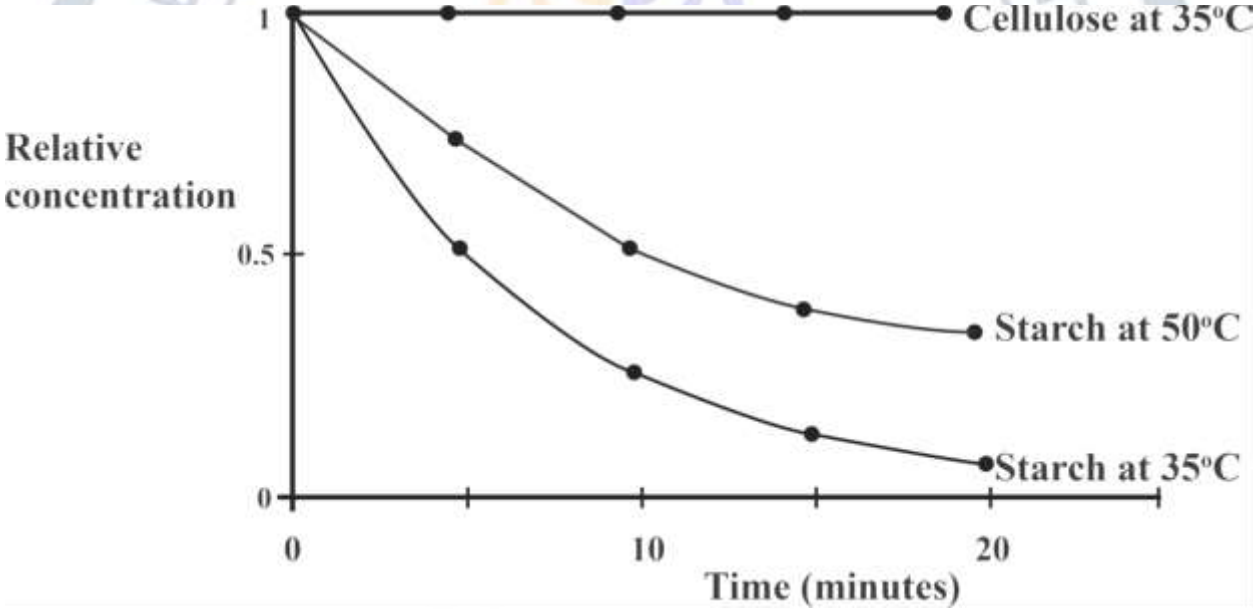
MARKING GUIDE FOR SENIOR FIVE EOT ONE.

N.B THIS SECTION IS COMPULSORY TO ALL STUDENTS.

I. In an experiment to investigate the reaction of Starch and cellulose. Starch and Cellulose were crushed in warm water and filtered to obtain the filtrate. Enzyme Amylase was added to separate filtrates of starch and cellulose. The concentration of starch was monitored at 35°c and 50°c while that of cellulose was monitored only at 35°c. The results of the experiment are shown below. Study the graph carefully to answer questions below.



a) Compare the relative Concentrations of cellulose and Starch at 35°c. **(03 marks)**

<table>
<tr><th>Description</th><th>Marks allocated</th><th>Advice</th></tr>
<tr><td>Similarities
(in both) Cellulose and Starch, the relative concentration was Equal/Same; and (very) High at O minute or Initially;</td><td>Any (01)</td><td>Word(s) signifying similarity used.</td></tr>
<tr><td>Differences
<table>
<tr><td>Cellulose relative concentration</td><td>Starch relative concentration.</td></tr>
<tr><td>Remained constant throughout the experiment;</td><td>Changes/decreases throughout the experiment;</td></tr>
<tr><td>No minimum attained/remained high;</td><td>Attains minimum level;</td></tr>
<tr><td>Higher throughout the experiment;</td><td>Lower throughout the experiment;</td></tr>
</table></td><td>Any (02)</td><td>Complete statements written with while or whereas used.</td></tr>
</table>

b) Describe the effect of Amylase enzyme on the relative concentrations of the following.

(i) Cellulose.

Amylase has no effect on cellulose relative concentration; (01)

AVP-Cellulose relative concentration remained high and constant.

(ii) Starch. **(05 marks)**

Starch at 350c

From 0-minute to 10-minutes, Amylase caused (led) (resulted) relative concentration of starch to decrease rapidly/sharply/steeply/drastically; (04)

From 10 minutes to 20 minutes, Amylase caused the relative concentration of starch to decrease gradually/slowly; to minimum;

Starch at 50°c

Amylase has no effect on the relative concentration of starch;

c) Explain the effect of Amylase on the relative concentration of

(i) Starch at 50°c

Amylase has no effect because of very high temperature beyond the optimum; causes denaturation of Amylase; decrease in relative concentration of starch was because of very high temperature which increased kinetic energy of α-glucose molecules; Vibrated

highly/increased molecular motions; causing breakage of hydrogen; and glycosidic linkages/bonds; stabilizing the structure.

Accept Glycoside bonds.

Accept- Heat causes Unwinding due to breakage of Hydrogen bonds, water access glycoside bonds for hydrolysis.

(ii) Cellulose at 35°c

Amylase has no effect on cellulose relative concentration because amylase is specific to digestion of alpha (α-1, 4) glycosidic bonds not (β-1,4) beta glycosidic bonds in cellulose;

(iii) Starch at 35°c (17 marks)

From 0-minute to 10-minutes, Amylase caused (led) (resulted) relative concentration of starch to decrease rapidly because of favourable/optimum temperature for amylase activity; starch is made up of large proportion of amylopectin; with fewer amylose helices entangled;

Amylopectin is highly branched/ brush-like structure; with very many terminal glucose molecules; which causes (very) many ends for hydrolysis by amylase; open molecular structure causes easy access of glycoside/glycosidic bonds by amylase;

From 10 minutes to 20 minutes, Amylase caused the relative concentration of starch to decrease gradually because most of remaining starch was amylose, with compact/closed helical/spiral structure; sustained by hydrogen bonds; amylase doesnot easily access the glycosidic bonds; also fewer ends or terminal glucose molecules, fewer points for amylase to begin hydrolysis;

Starch/depletion/exhaustion/starch concentration a limiting factor;

d)(i) Calculate the average rate of breakdown of starch by amylase for the first 10 minutes at both temperatures. (03 marks)

At 35°c

$$\text{Rate}=\frac{1.0-0.25}{10-0};$$

$$=\frac{0.75}{10};$$

$$=0.075 \text{ per-minute};$$

At 50°c

$$\text{Rate}=\frac{1.0-0.52}{10-0};$$

$$= \frac{0.48}{10};$$

=0.048perminute; (halves)

(ii) Suggest why cellulose and starch were crushed into a filtrate. (02 marks)

Crushing weakens the inter and intra-molecular forces of attraction in the polysaccharides such as hydrogen bonds and glycosidic linkages; for easy digestion/break-down/hydrolysis; increasing surface area for hydrolysis;

e) Explain the adaptations of the following to their roles.

(i) Starch (05 marks)

Large (long) molecules, insoluble in water, doesnot affect water potential/osmotically inert/no chemical effect to cell; doesnot diffuse out of cells; Amylopectin highly branched/brush like structure for easy hydrolysis; Fold into compact shapes, a lot stored in small space; Branching makes starch compact, much glucose molecules stored in small space;

(ii) Cellulose. (05 marks)

Microfibrils linked together by hydrogen bonds forming strong fibres; large bundles of macrofibrils give rigidity and strength; Fully permeable allow water and dissolved substances to enter and leave cell; Large molecules, insoluble in water;

Hemicellulose binds tightly to microfibrils forming a strong lattice; Gaps in microfibrils deposited with lignin increasing tensile strength/prevent rotting/infection/decay; Microfibrils arranged in overlapping layers give strength; Hydrogen bonds allow flexibility/extension/stretching under mechanical distortion;