

Excellence
Intended for teacher use only

For Achievement with Excellence the student response also includes:

When digging into the school compost, we observed steam coming off it and it felt warm to touch.

We made a mini compost using a plastic bottle and a thermometer was placed inside so the temperature could be recorded.

	Days							
	1	3	6	9	12	15	18	21
Mini compost temperature (°C)	18	23	25	26	32	34	37	40

We found the temperature of the compost increased from 18°C to 40°C over 21 days.

Feeding and absorbing nutrients is important because it is the life process that provides fungi cells with nutrients so other life processes can occur. For example, fungi feeding on the organic waste by extracellular digestion absorb nutrients for cell respiration. Cell respiration would not occur without extracellular digestion breaking down the organic waste and 'converting' it into small enough molecules for cell respiration to 'use'. The main purpose of cell respiration is to convert nutrients absorbed (by extracellular digestion) into energy cells that can be used to sustain life. However, heat is also generated as a by-product in this process.

The compost pile acts as an insulator retaining the heat and causing the temperature of the compost to increase. As the temperature rises this causes the enzymes involved in extracellular digestion to break down the organic matter more 'quickly', which means more nutrients are absorbed for cell respiration and more heat is released by the fungi but remains trapped in the compost, further increasing the temperature of the compost. However, the graph below shows that the temperature of a compost gradually decrease over a long period of time. This is caused by the reduction of organic matter (food) available to be broken down by extracellular digestion causing a decrease in nutrients absorbed for cell respiration and therefore less heat energy being released and trapped.

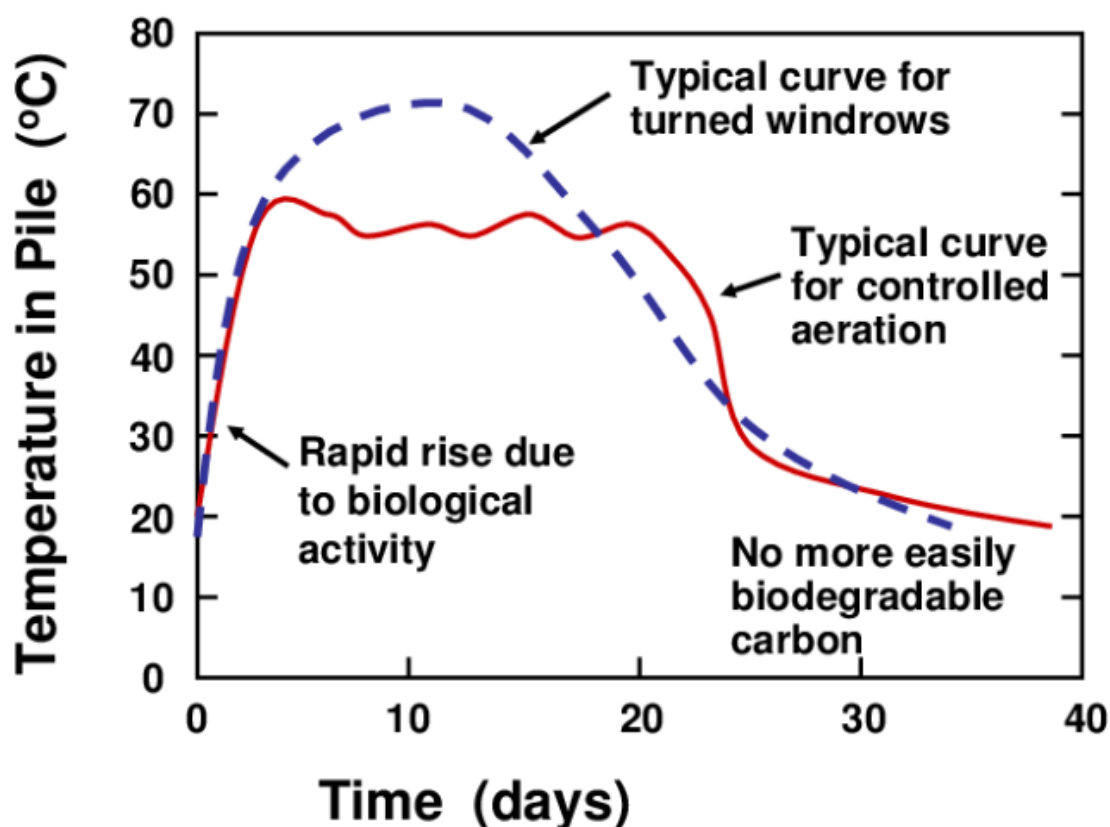


Image source: https://www.researchgate.net/figure/Typical-temperature-curves-for-static-composting-and-aerated-composting_fig2_279715396

Enzymes secreted through extracellular digestion break down the organic matter and make essential nutrients available for other organisms in the compost pile. Essential nutrients include carbon, nitrogen, and phosphorus and are required for many life processes to occur, including cell respiration. This means other organisms in the compost pile use the nutrients made available by extracellular digestion for cell respiration, which releases more heat into the compost's interconnected environment and further increases the temperature.

92020 Excellence Exemplar Notes

The student has explained the relationship between a microorganism and the environment by:

- analysing how nutrients absorbed by extracellular digestion affects the temperature (abiotic factor) inside the compost pile (interconnected environment).
Using data on the temperature of a mini compost over time and direct observations of a compost pile the student has examined how the nutrients absorbed by extracellular digestion causes the temperature of the compost pile to increase. They have described how nutrients produced by extracellular digestion is linked to heat released inside the compost pile.

Expected Student Response for Chemistry and Biology Achievement Standard 1.1

While this standard requires students to demonstrate their understanding of ONE Life Process (LP), their description may include its interconnectedness with other life processes in the microorganism. It is quite appropriate for students to make reference to/include other related life processes as this response does. This might be seen in evidence, especially at the higher levels of achievement, where changes in the environment affect the LP and in turn the LP affects the environment in interconnected ways, reflecting a complex biological system. In this Excellence evidence the reference to cellular respiration is appropriate as it is so closely associated with extracellular digestion, and is highly relevant when discussing the effect of extracellular digestion on the environment – where the increase in temperature is mediated by an increase in cellular respiration.

