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## ***Program Support Notes***

**Senior Secondary**

**28 mins**

# **The Role of Enzymes**

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**Suitable for:**

**Biology**

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# The Role of Enzymes

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## For Teachers:

### Introduction

Enzymes are proteins which are manufactured by the human body during the process of protein synthesis. Enzymes are catalysts and drive every chemical reaction that takes place in the human body, and enable our bodies to be built from proteins, carbohydrates and fats. Enzymes are highly specific in their activity and form an enzyme-substrate complex speeding up processes as they lower the activation energy during a given reaction period. Enzyme activity is dependent on the enzyme - and substrate concentration, the pH, temperature and inhibitors.

Through genetic engineering and by isolating specific enzymes, it has become possible to harness the power of enzymes. The isolation of the enzyme polymerase, from *Thermus aquaticus*, has enormously facilitated the process of PCR. Science has made immense progress in the manufacturing of synthetic and therapeutic enzymes.

### Program Timeline

00:00:00	Introduction
00:01:08	An Introduction to Enzymes
00:04:19	Enzymes in Living Organisms
00:09:06	Enzyme Kinetics and Enzyme Substrate Complex
00:14:04	Enzyme Activity
00:22:37	The Power of Enzymes
00:26:49	Conclusion
00:27:39	Credits
00:28:13	End Program

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# The Role of Enzymes

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## **Student Worksheet:**

### **Before Viewing the Program**

1. As a class brainstorm the following topics
  - a) What are enzymes?
  - b) Where do we find enzymes?
  - c) What is the importance of enzymes?

# The Role of Enzymes

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## While Viewing the Program

1. Why is it important that enzymes catalyse chemical reactions?

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2. Most enzymes are: (Circle the correct response/s)

Lipids

Carbohydrates

Proteins

Inorganic chemicals

3. What are ribozymes?

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4. Is the enzyme altered or used up during the reaction? Explain your answer.

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5. How many enzymes are there in the human body? \_\_\_\_\_

6. Briefly explain the difference between intracellular and extracellular enzymes.

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7. Name the two categories of enzymes in the human body.

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8. What is the function of the enzyme protease?

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9. Is DNA polymerase a: metabolic enzyme / digestive enzyme? (circle correct response)

## The Role of Enzymes

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10. Why would a person who is unable to produce the enzyme protease, benefit from eating pineapple or pawpaw?

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11. Briefly describe the use of bacterial enzymes in managing waste water systems.

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12. Why is the activation Energy important in chemical reactions?

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13. How does the enzyme –substrate complex form?

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14. Why has the 'Induced fit model' become a more favourable model than the 'Lock and key model'?

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15. What makes enzymes so specific?

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## The Role of Enzymes

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16. Name five factors affecting the rate of enzyme activity.

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17. What is the function of co-enzymes and cofactors?

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18. Explain what the optimum temperature of an enzyme is.

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19. When does a set enzyme concentration reach the substrate saturation point?

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20. Name the enzymes commonly used in detergents.

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21. What does the acronym PCR stand for?

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22. What does the PCR process enable scientists to do?

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## The Role of Enzymes

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### *After Viewing the Program*

1. Work in small groups and conduct an experiment to determine the effect of temperature, pH, enzyme concentration or substrate concentration on the rate of enzyme activity.
2. Write an article for a health magazine describing the importance of digestive enzymes.
3. Debate the topic: “The technology of nano-reactors will revolutionise the medical industry.”

# The Role of Enzymes

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## Suggested Student Responses

### While Viewing the Program

1. Why is it important that enzymes catalyse chemical reactions?  
**Enzymes make life on earth possible as they are able to speed up chemical reactions.**
2. Most enzymes are: (Circle the correct response/s)  

Lipids	Carbohydrates
<b>Proteins</b>	Inorganic chemicals
3. What are ribozymes?  
**Ribozymes are RNA molecules (not protein) and able to catalyse reactions during protein synthesis.**
4. Is the enzyme altered or used up during the reaction? Explain your answer.  
**No, the enzyme does not change during the reaction and it is not consumed ie the enzyme can be used over and over again until all the substrate has been broken down.**
5. How many enzymes are there in the human body?  
**3000**
6. Briefly explain the difference between intracellular and extracellular enzymes.  
**Intracellular enzymes function inside cells and are related to metabolic processes of the body while extracellular enzymes function outside cells and are related to digestive activities of the body.**
7. Name the two categories of enzymes in the human body.  
**Digestive enzymes and metabolic enzymes**
8. What is the function of the enzyme protease?  
**Protease breaks down protein into amino acids**
9. Is DNA polymerase a: **metabolic enzyme** / digestive enzyme? (circle correct response)
10. Why would a person who is unable to produce the enzyme protease, benefit from eating pineapple or pawpaw?  
**Pineapple has the enzyme bromalaine, and pawpaw has the enzyme papain – both are able to break down protein. This would mean that the person who is unable to produce protease would be able to digest protein by eating these fruits.**
11. Briefly describe the use of bacterial enzymes in managing waste water systems.  
**Some bacteria able to break down the toxic Hydrogen Peroxide, present in waste water, into water and oxygen.**
12. Why is the activation Energy important in chemical reactions?  
**Enzymes reduce the amount of activation energy required to start the chemical reaction and in this way are able to speed up the reaction.**
13. How does the enzyme –substrate complex form?  
**Enzyme has a region on its surface called the active site. During a reaction, the substrate binds to the active site by weak covalent bonds and forms the enzyme-substrate complex.**



## The Role of Enzymes

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14. Why has the 'Induced fit model' become a more favourable model than the 'Lock and key model'?
- The Induced fit model is more favourable as it depicts the enzyme as a more flexible structure, whereas the lock and key model shows the enzyme as a ridged structure.**
15. What makes enzymes so specific?
- The active site consisting of specific polypeptide chains makes the enzyme so specific.**
16. Name five factors affecting the rate of enzyme activity.
- Temperature, pH, enzyme concentration, substrate concentration and inhibitors**
17. What is the function of co-enzymes and cofactors?
- The function of the co-enzymes and cofactors is to assist the enzyme to become fully active.**
18. Explain what the optimum temperature of an enzyme is.
- It is the temperature at which the enzymes function best ie the temperature at which the enzyme achieves optimal rate of activity.**
19. When does a set enzyme concentration reach the substrate saturation point?
- The substrate saturation point is reached when despite adding more substrate to the solution (rate of enzyme activity remains unchanged) the set amount of enzyme is catalysing as much of the substrate as possible (by adding more substrate the rate of enzyme activity cannot be increased)**
20. Name the enzymes commonly used in detergents.
- Lipase, protease and carbohydrase (mostly amylase)**
21. What does the acronym PCR stand for?
- Polymerase Chain Reaction**
22. What does the PCR process enable scientists to do?
- PCR enables scientists to generate many copies of DNA from the original sequence of nucleotides even when there is only a small amount of DNA available. As little as 20 cells are sufficient to make this process successful. This allows scientists flexibility when studying a particular gene and is useful to forensic scientists when working with small amounts of DNA.**