BIO-RAD Explorer™

Biofuel Enzyme Reactions Kit for AP Biology:

A ThINQ!™ Investigation

Catalog #17001235EDU

Manual Preview

BIO-RAD

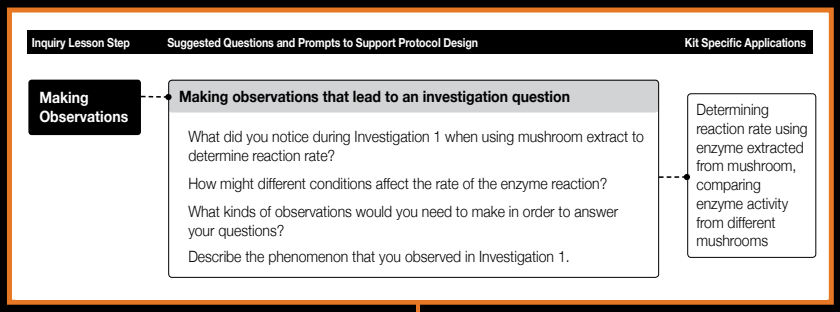
Overview

Bio-Rad's ThINQ! Investigations are real-world, hands-on, inquiry-driven laboratories that align with the AP Biology framework. Each ThINQ! Investigation Kit comes with an instructor guide and student manual that support open, guided, and structured inquiry.

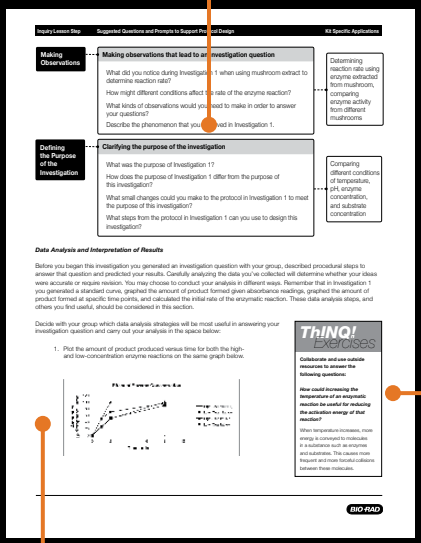
The ThINQ! Biofuel Enzyme Reactions Kit includes six laboratories that use a colorimetric assay to test cellobiase activity. This gives instructors the flexibility to choose to do any or all of the six included laboratories as open, guided, or structured inquiry investigations. The instructor guide provides the necessary support and includes the following features.

Teacher Model Process

Suggests questions that help you guide your students through the inquiry and protocol design process.

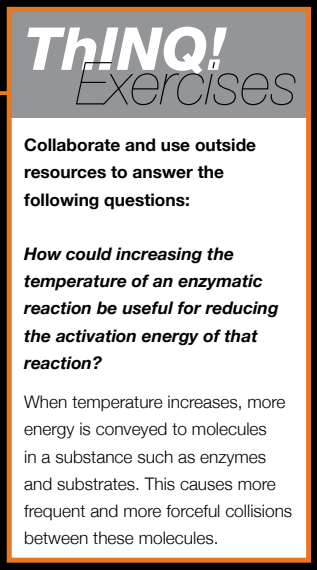


Inquiry Lesson Step	Suggested Questions and Prompts to Support Protocol Design	Kit Specific Applications
Making Observations	**Making observations that lead to an investigation question** What did you notice during Investigation 1 when using mushroom extract to determine reaction rate? How might different conditions affect the rate of the enzyme reaction? What kinds of observations would you need to make in order to answer your questions? Describe the phenomenon that you observed in Investigation 1.	Determining reaction rate using enzyme extracted from mushroom, comparing enzyme activity from different mushrooms



Answer Keys

Provide sample answers to ThINQ! Exercises and Focus Questions in the student manual.



ThINQ! Exercises

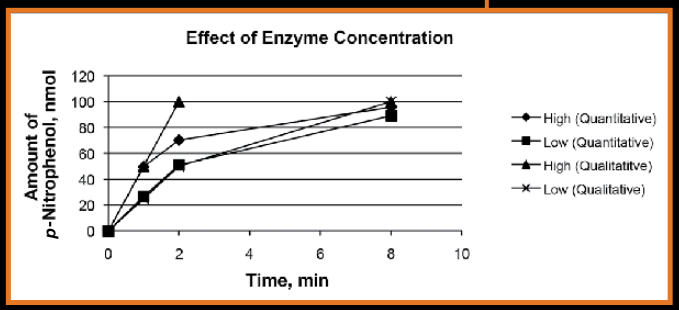
Collaborate and use outside resources to answer the following questions:

How could increasing the temperature of an enzymatic reaction be useful for reducing the activation energy of that reaction?

When temperature increases, more energy is conveyed to molecules in a substance such as enzymes and substrates. This causes more frequent and more forceful collisions between these molecules.

Sample Data

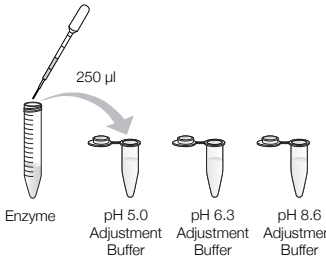
Provide scientist-verified data for each investigation.



Quick Guides

Include easy-to-follow graphic protocols for each lab. You choose whether to provide these to your students based on the level of inquiry you want to achieve.

4. Have a stopwatch ready. Using a clean DPTP, add 250 µl of enzyme to each of the labeled microcentrifuge tubes and start your stopwatch.

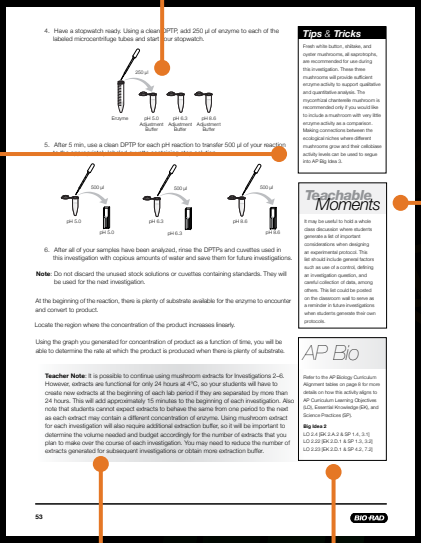


Tips & Tricks

Help you conserve supplies and time, avoid common mistakes, and conduct the labs successfully.

Tips & Tricks

Fresh white button, shiitake, and oyster mushrooms, all saprotrophs, are recommended for use during this investigation. These three mushrooms will provide sufficient enzyme activity to support qualitative and quantitative analysis. The mycorrhizal chanterelle mushroom is recommended only if you would like to include a mushroom with very little enzyme activity as a comparison. Making connections between the ecological niches where different mushrooms grow and their cellobiase activity levels can be used to segue into AP Big Idea 3.



Teachable Moments

Suggest ways to help you guide your students through the inquiry process.

Teachable Moments

It may be useful to hold a whole class discussion where students generate a list of important considerations when designing an experimental protocol. This list should include general factors such as use of a control, defining an investigation question, and careful collection of data, among others. This list could be posted on the classroom wall to serve as a reminder in future investigations when students generate their own protocols.

AP Bio

Aligns activities to AP learning objectives.

AP Bio

Refer to the AP Biology Curriculum Alignment tables on page 8 for more details on how this activity aligns to AP Curriculum Learning Objectives (LO), Essential Knowledge (EK), and Science Practices (SP).

Big Idea 2

LO 2.4 [EK 2.A.2 & SP 1.4, 3.1]
LO 2.22 [EK 2.D.1 & SP 1.3, 3.2]
LO 2.23 [EK 2.D.1 & SP 4.2, 7.2]

Teacher Notes

Provide instructions on supplementary activities and alternative lab configurations.

Teacher Note: It is possible to continue using mushroom extracts for Investigations 2–6. However, extracts are functional for only 24 hours at 4°C, so your students will have to create new extracts at the beginning of each lab period if they are separated by more than 24 hours. This will add approximately 15 minutes to the beginning of each investigation. Also note that students cannot expect extracts to behave the same from one period to the next as each extract may contain a different concentration of enzyme. Using mushroom extract for each investigation will also require additional extraction buffer, so it will be important to determine the volume needed and budget accordingly for the number of extracts that you plan to make over the course of each investigation. You may need to reduce the number of extracts generated for subsequent investigations or obtain more extraction buffer.

Biofuel Enzyme Reactions Kit Contents (catalog #17001235EDU)

Each kit contains sufficient materials for eight student workstations (two to four students per workstation) to complete all six investigations as outlined in the instructor manual.

Enzyme, cellobiase, 1 ml	1 vial
Substrate, *p*-Nitrophenyl glucopyranoside, 90 mg	1 vial
Standard, *p*-Nitrophenol (1 mM, 4 ml)	1 bottle
2x stop solution, 100 ml	1 bottle
10x resuspension buffer, 50 ml	1 bottle
Extraction buffer, 50 ml	1 bottle
Disposable plastic transfer pipets	40
1.5 ml microcentrifuge tubes	90
15 ml conical tubes	5
1.5 ml standard disposable polystyrene cuvettes, 100	1 box
Instructor guide, printed	1
Student manual available for download online	

Ordering Information

Catalog #	Product Description
17001235EDU	**Biofuel Enzyme Reactions Kit**
1665036EDU	**Biofuel Enzyme Kit Reagent Refill Pack**, temperature sensitive
2239955EDU	**Semimicrovolume Disposable Polystyrene Cuvettes**, 1.5 ml
1660475EDU	**Conical Centrifuge Tubes**, pkg of 50
1660480EDU	**Disposable Plastic Transfer Pipets**, nonsterile, 500
2239480EDU	**EZ Micro™ Test Tubes**, 1.5 ml, pkg of 500
1660553EDU	**Classroom Digital Micropipet**, 100–1,000 µl
1660508EDU	**Professional Adjustable-Volume Digital Micropipet**, 100–1,000 µl
2239350EDU	**TBR-40 Tips**, pkg of 1,000, 100–1,000 µl, in enclosed rack
2239040EDU	**BR-40 Pipet Tips**, pkg of 500, 100–1,000 µl, bulk
1702525EDU	**SmartSpec™ Plus Spectrophotometer**
1660504EDU	**Temperature-Controlled Water Bath**, 120 V
1660562EDU	**Digital Dry Bath**, 115 V
1660501EDU	**Mini Incubation Oven**, 120 V
1660603EDU	**Mini Centrifuge**, 120 V

Visit **bio-rad.com/web/Plan/BiofuelAP** for more information.

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Web site *bio-rad.com* ***USA*** *1 800 424 6723* ***Australia*** *61 2 9914 2800* ***Austria*** *43 1 877 89 01 177* ***Belgium*** *32 (0)3 710 53 00* ***Brazil*** *55 11 3065 7550* ***Canada*** *1 905 364 3435* ***China*** *86 21 6169 8500* ***Czech Republic*** *420 241 430 532* ***Denmark*** *45 44 52 10 00* ***Finland*** *358 09 804 22 00* ***France*** *33 01 47 95 69 65* ***Germany*** *49 89 31 884 0* ***Hong Kong*** *852 2789 3300* ***Hungary*** *36 1 459 6100* ***India*** *91 124 4029300* ***Israel*** *972 03 963 6050* ***Italy*** *39 02 216091* ***Japan*** *81 3 6361 7000* ***Korea*** *82 2 3473 4460* ***Mexico*** *52 555 488 7670* ***The Netherlands*** *31 (0)318 540 666* ***New Zealand*** *64 9 415 2280* ***Norway*** *47 23 38 41 30* ***Poland*** *48 22 331 99 99* ***Portugal*** *351 21 472 7700* ***Russia*** *7 495 721 14 04* ***Singapore*** *65 6415 3188* ***South Africa*** *27 (0) 861 246 723* ***Spain*** *34 91 590 5200* ***Sweden*** *46 08 555 12700* ***Switzerland*** *41 026 674 55 05* ***Taiwan*** *886 2 2578 7189* ***Thailand*** *66 662 651 8311* ***United Arab Emirates*** *971 4 8187300* ***United Kingdom*** *44 020 8328 2000*

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