

**NOTE:** Chapters are marked according to their content.

A – Theory

B – Experiment (Wet lab)

C – Paper Activity (Simulation of experiment)

Lesson: ABE Express: Genetic Engineering Beginner

Target group: Lower Secondary

Duration: 1 day (9.30am to 4.00pm)

Outline:

Expected Time	Activity
Morning (9.30am to 12.30pm)	1A: Programme introduction 1B: Tools of the trade – micropipette, gel electrophoresis and centrifuge
	2A: Explanation of plasmids and restriction enzymes 2C: Simulation of restriction digest using paper models
	3A: Explanation of ligase and ligation products 3C: Simulation of ligation using paper models
	4A: Explanation of verification using gel electrophoresis 4B: Verification of restriction digest and ligation
Afternoon (2.00pm to 4.00pm)	5A: Explanation of bacterial transformation 5B: Bacterial transformation with ligation products
	Introduction to other applications of genetic engineering

Lesson: ABE Express: Genetic Engineering Intermediate  
 Target group: Upper Secondary  
 Duration: 1.5 days  
 (Day 1: 9.30am to 4.00pm / Day 2: 9.30am to 12.30pm)

Outline:

Expected Time	Activity
<b>DAY ONE</b>	
Morning (9.30am to 12.30pm)	1A: Programme introduction 1B: Tools of the trade – micropipette and centrifuge
	2A: Explanation of plasmids and restriction enzymes 2B: Restriction digest of pKAN-R and pARA
	3A: Explanation of ligase and ligation products 3B: Ligation to form pARA-R – incubation over lunch
Afternoon (2.00pm to 4.00pm)	1B: Tools of the trade – gel electrophoresis
	4A: Explanation of verification using gel electrophoresis 4B: Verification of restriction digest and ligation
<b>DAY TWO</b>	
Morning (9.30am to 12.30pm)	5A: Explanation of bacterial transformation 5B: Bacterial transformation with ligation products
	Introduction to other applications of genetic engineering
	8A: Explanation of bacterial growth and protein purification 8B: Column chromatography

Lesson: ABE Express: Genetic Engineering Advanced

Target group: JC

Duration: 2 days (9.30am to 4.00pm)

Outline:

Expected Time	Activity
<b>DAY ONE</b>	
Morning (9.30am to 12.30pm)	1A: Programme introduction 1B: Tools of the trade – micropipette and centrifuge
	2A: Explanation of plasmids and restriction enzymes 2B: Restriction digest of pKAN-R and pARA
	3A: Explanation of ligase and ligation products 3B: Ligation to form pARA-R – incubation over lunch
Afternoon (2.00pm to 4.00pm)	5A: Explanation of bacterial transformation 5B: Bacterial transformation with ligation products
	Introduction to other applications of genetic engineering
After Day One	4: Verification using gel electrophoresis – self-directed learning
<b>DAY TWO</b>	
Morning (9.30am to 12.30pm)	6B: Colony PCR 6A: Explanation of PCR and colony PCR
	Introduction to bioethics and simple bioethics discussion
	1B: Tools of the trade – gel electrophoresis
	7: Verification of PCR products using gel electrophoresis
Afternoon (2.00pm to 4.00pm)	8A: Explanation of bacterial growth and protein purification 8B: Column chromatography