

Topic 9 – Practical 2

Investigating conditions needed for germination

Safety

- Pyrogalllic acid is harmful if swallowed.
- Sodium hydroxide is corrosive.
- Wear eye protection when setting up Experiment a.
- If acid comes in contact with skin or eyes, rinse with plenty of water.

Apparatus and materials

- 20 cm³ pyrogalllic acid in sodium hydroxide solution
- two identical conical flasks with bungs
- four Petri dishes or crystallising dishes
- cress seeds
- pea seeds
- cotton wool
- water
- thread
- tissue paper
- access to an incubator at 30°C
- access to a refrigerator at 4°C
- three thermometers

Introduction

In this practical, you will investigate:

- a whether oxygen is necessary for germination
- b whether water is necessary for germination
- c the effect of temperature on germination.

Procedure – Experiment a

- 1 Spread a layer of cress seeds on a sheet of paper. Roll a piece of wet cotton wool over the seeds so that they stick to the surface. Repeat, to obtain two seed-covered balls of wet cotton wool.
- 2 Carefully pour about 20 cm³ pyrogalllic acid in sodium hydroxide solution into one of the two conical flasks. Pyrogalllic acid in alkaline solution absorbs oxygen from the air, turning from a colourless solution to a purple colour. Seeds in this first flask will be deprived of oxygen. Pour 20 cm³ water into the second flask so that seeds in this flask have a normal supply of oxygen.
- 3 Suspend the cotton wool balls with attached seeds from the bungs using the thread and insert into the flasks, ensuring that the seeds do not come into contact with the liquid at the bottom of the flasks. Push in the bungs firmly to make certain that the flasks are tightly sealed.
- 4 Place the two flasks in identical conditions of light and temperature. Leave for about 3 days.
- 5 Observe the seeds and note the proportion of seeds that have germinated in each flask.

Procedure – Experiment b

- 6 Take four identical Petri or crystallising dishes (or similar containers that can be covered to prevent evaporation). Place a layer of cotton wool or tissue paper in the base of each one.
- 7 Label the dishes A, B, C and D and set up the following conditions in each:

- A – wet cotton wool and peas that have been pre-soaked in water
- B – dry cotton wool and pre-soaked peas
- C – dry cotton wool and dry peas
- D – pre-soaked peas covered with water

Use the same number of seeds (about 10) in each container. Cover the containers with cling film and leave in identical conditions of light and temperature for 4–5 days.

- 8 Note the number of seeds that germinate in each container, and the conditions that produced the maximum proportion of germinating seeds.

Procedure – Experiment c

- 9 Place ten pea seeds on moist cotton wool in three similar containers (as above) and place them in the following conditions:
- at 30°C in an incubator
 - at 4°C in a fridge
 - at room temperature (approximately 20°C)

Place a thermometer alongside each dish in order to monitor the temperature.

- 10 Leave the containers in these conditions for 1 week, checking the temperatures daily. After a week, note the number of seeds that have germinated in each container. Measure the lengths of the roots and shoots in each case to assess the extent of germination.

Note: Ensure that the cotton wool does not dry out. Add a little water if necessary.

Questions and further work

- 1 Summarise the results of all three experiments in a suitable way.
- 2 a Outline the conditions that are **essential** for germination.
- b Outline the conditions that are **desirable** for germination.
- 3 Each species of plant has its own optimum temperature for seed germination. Why is Experiment c unlikely to enable you to determine this temperature for the seeds you have used? Suggest how you would modify Experiment c to enable you to determine this temperature for your seeds and others.