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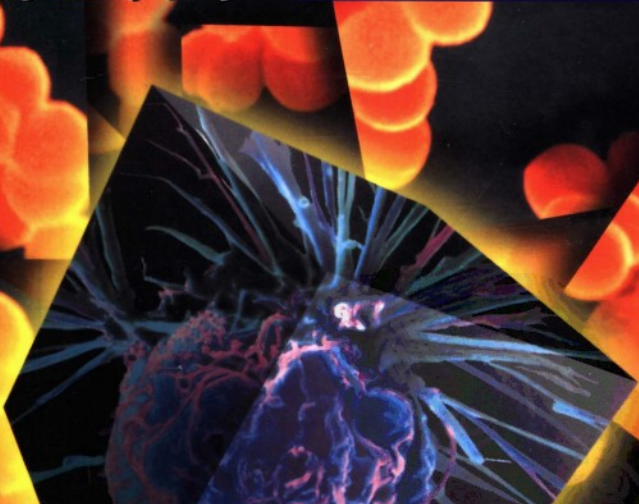
BIOLOGY

Mastering Basic Concepts 2

基础生物学

WORKBOOK Second edition



Pang King Chee Cheung Lai Man

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Ms Cheung Lai Man

Reviewer: Dr Jeffrey R. Day

Workbook 2

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本书原系牛津大学出版社出版、香港等地区广泛使用的中学教材。应国内教学改革之需,现影印出版,故本书主体部分繁体汉字暂未更动。1997年7月1日,中国政府恢复对香港行使主权。书中有些地方(如行政机构的提法、为课程内容而设置的示意图等)与现实可能有不尽相符之处,有待改编新版时修订,敬请读者注意。

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Preface

This is the second of three workbooks for certificate level biology students. The practicals provided form an integral part of a teaching course based on the textbooks, and the approaches behind their design are therefore in line with those adopted by the textbooks. Outlines of the practicals are provided in relevant parts of the textbooks to help teachers and students understand the links between them and the text.

The practicals and activities in the workbooks are specially written to help students learn effectively. They have a number of important features:

1 Emphasis is placed on helping students to grasp the underlying purpose of each practical. Hence, apart from the title which describes the nature of the practical activity, a clear statement of ***purpose*** is included at the beginning of each practical to help students realize the importance of the work.

2 Relevant ***background information*** is provided to help students understand the design and procedures of the practical work.

3 ***Procedures*** are written concisely and are well supplemented with diagrams to promote understanding.

4 Suitable spaces and tables are provided to help students record their results systematically for easier analysis.

5 Carefully designed ***questions*** are included at the end of each practical to help students interpret their results, understand procedures and precautions, and also to draw their own conclusions from the data. In this revised edition, the nature of each question is clearly indicated on the left margin to help teachers and students appreciate its purpose.

The questions are classified as:

i **Recall and understanding (R&U)**
These questions check how well students can remember what they have learnt and test students' understanding of different aspects of a piece of practical work.

ii **Observation (O)**
These questions help to focus students' observations on major aspects of the practical.

iii **Application and Analysis (A&A)**
These questions help students to apply their knowledge to explain their observations and analyse the results they obtained.

iv **Conclusion (C)**
These questions help students to draw conclusions based on their observation and analysis.

v **Evaluation (E)**
These questions help students make judgements about different aspects of the practical work, make suggestions about or modify procedures to achieve additional outcomes or point out shortcomings.

In addition, this revised edition is enhanced by a new section entitled ***Hints for studying and on assessment*** at the end of the workbooks offering advice to students on study skills and preparation for assessment.

The three workbooks adequately cover all the practicals required by the latest CDC biology syllabus. In addition, a few other practicals and interesting activities such as visits and essay writing have been included for a more comprehensive and coherent biology course.

We are grateful to Ms Betty Chan, Mr S.L. Lam, Mr Patra Ngai, Mr Samsom Liu, Mr Carvan Cheng, Mr Ng Kai Chiu and Ms Fion Yiu for their technical support and trials of the practical work. Wholehearted thanks are especially due to Dr Jeffrey Day for his valuable and expert advice and comments on the language and contents of the revised edition. Thanks also are due to the editorial staff of the publisher for their expert editorial support as well as their devotion and commitment to the project.

The contents of this edition have been revised based on comments and suggestions received from teachers and students to whom we are grateful. Features from the first edition which teachers and students found useful and helpful are retained. Improvements have been made including simplification of the contents to suit better the needs of teaching, updating the information and enhancing the format for more attractive presentation.

We sincerely hope that students and teachers will find the workbooks useful in practical sessions, as well as helpful in developing the necessary concepts in biology.

We would be most grateful for any feedback and suggestions on the worksheets so as to enable us to make improvements in future editions.

Pang King Chee
Cheung Lai Man

CONTENTS

Chapter 14 Support and Movement

Chapter 15 Detection of Environmental Conditions in Mammals

Hints for Studying and on Assessment (II)

* These practicals are considered optional. Working on these experiments may not be essential if teaching time is not sufficient.

RESPIRATION: RELEASING ENERGY FROM FOOD

Practical 10.1 To find out if carbon dioxide is given out by mouse

Purpose

To find out if respiring animals release carbon dioxide.

Background information

Hydrogencarbonate indicator is a good indicator for detecting carbon dioxide. Its colour changes with the concentration of carbon dioxide in air:

Colour of indicator	CO_2 concentration in air
Yellow	> 0.03%
Orange/Red	~ 0.03%
Purple	< 0.03%

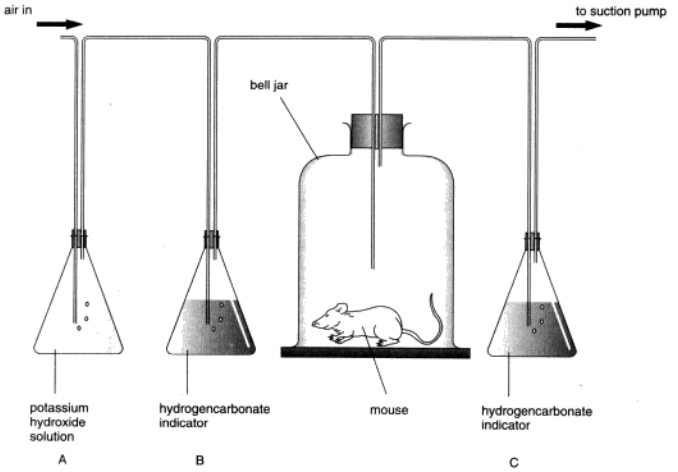
The air breathed out by a mouse is passed through hydrogencarbonate indicator to see whether the mouse has released carbon dioxide.

Apparatus and materials

per group of four:

1 bell jar
3 conical flasks
5 glass tubings
4 corks
1 suction pump
hydrogencarbonate indicator
potassium hydroxide solution
1 mouse

Procedure



1 Set up the apparatus as shown in the diagram.
2 Turn on the suction pump to draw a continual stream of air through the set-up for 30 minutes or more.
3 Observe any colour changes in flasks A, B and C.

Results

Flask	Original colour of the solution	Colour of the solution after the experiment
A		
B		
C		

Questions

1 In which direction will air flow through the system?

_____

R&U

2 What is the job of the potassium hydroxide solution in flask A?

3 What are the reasons for the hydrogencarbonate indicator in flasks B and C?

C O

4 What happens to the colour of the solution in flask B? What can you conclude from this result?

5 Is there any colour change in flask C? What can you conclude from this result?

A&A

6 How would you set up a control for this experiment?

*Practical 10.2 To find out if carbon dioxide is given out by germinating seeds

Purpose

To find out if living plants release carbon dioxide.

Background information

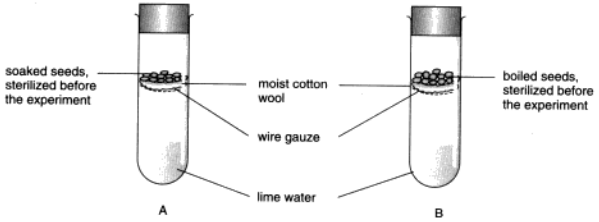
Carbon dioxide turns lime water milky. In this practical, germinating seeds are placed above the lime water in a boiling tube. Any carbon dioxide given out by the seeds will get in contact with lime water.

Apparatus and materials

per group of four:

2 boiling tubes and corks
2 wire gauzes
2 stands and clamps
cotton wool
soaked seeds, sterilized before the experiment
boiled seeds, sterilized before the experiment
lime water

Procedure



1 Set up two boiling tubes as shown in the diagram. Use two different sets of seeds:
   a soaked seeds, sterilized before the experiment
   b boiled seeds, sterilized before the experiment
2 Leave the tubes for a few hours.
3 Look for any changes in the colour of the lime water.

Results

Tube	Original colour of lime water	Colour of lime water after the experiment
A		
B		

Questions

R&U

1 What is the job of the moist cotton wool?

_____

2 What is the reason for having a tube with boiled seeds?

_____

3 Why should the surface of the seeds be sterilized before the experiment is set up?

_____

_____

C O

4 In which tube(s) does the lime water change colour? What can you conclude from this result?

_____

Practical 10.3 To find out if a living mouse produces heat using a differential air thermometer

Purpose

To find out if respiring animals release heat.

Background information

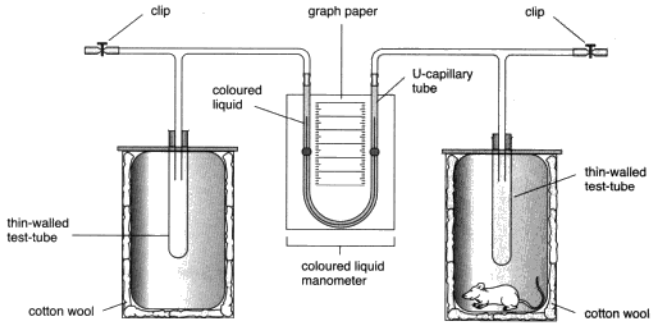
Differential air thermometer is a sensitive device for detecting small changes in temperature. It is used to find out if a living mouse produces heat.

Apparatus and materials

per class:

1 differential air thermometer
1 mouse

Procedure



1 Set up the differential air thermometer as shown.
2 Open the clips on both sides of the thermometer before the experiment starts. Wait until the coloured liquid levels in both sides of the capillary tube are balanced.
3 Close the clips. Observe any changes in the liquid levels.

Results

What happens to the liquid levels?

_____

_____

Questions

R&U

1 Why are the clips on both sides opened before the experiment?

_____

_____

_____

2 What is the function of the cotton wool?

_____

C O

3 What do you observe about the liquid levels in the U-tubes? What conclusions can you draw from this result?

_____

_____

_____

_____

A&A

*4 What will be the difference in results if the mouse is replaced by numerous insects (e.g. cockroaches)?

_____

_____

*Practical 10.4 To find out if germinating seeds produce heat using thermos flasks

Purpose

To find out if plants release heat.

Background information

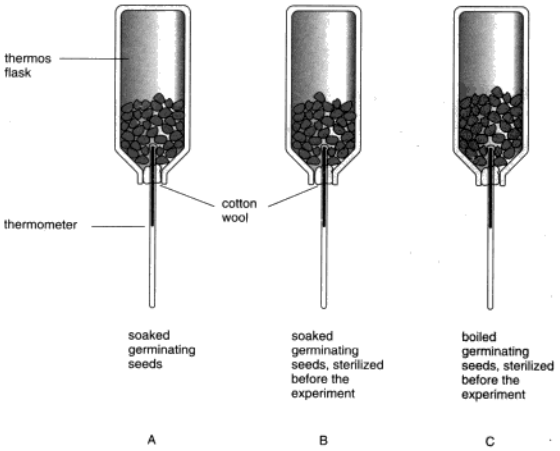
Thermos flasks can insulate heat well. Put some germinating seeds into a thermos flask and measure any changes in temperature. An increase in temperature shows that heat is released during germination.

Apparatus and materials

per group of four:

3 thermos flasks
cotton wool
3 thermometers
soaked germinating seeds
soaked germinating seeds, sterilized before the experiment
boiled germinating seeds, sterilized before the experiment

Procedure



1 Set up the 3 flasks as shown.
2 Note the temperature of each flask at the start of the experiment.
3 Notice and **record** the temperature of the flasks every 5 minutes for a total of 40 minutes.

Results

Record your results in the table below.

Time (min)	Temperature (°C) of flask		
	A	B	C
0			
5			
10			
15			
20			
25			
30			
35			
40			

Questions

O R&U 1 Plot the results on a graph paper.

R&U 2 Why should the flasks be put in an inverted (upside-down) position?

_____

_____

O 3 Which flask has the greatest change in temperature?

_____

A&A 4 Compare the temperature changes in flasks A and B. Explain any differences.

_____

_____

_____

R&U 5 Why should the seeds in flask C be boiled?

_____

_____

6 What conclusions can you draw from this experiment?

*Practical 10.5 To show anaerobic respiration in germinating seeds

Purpose

To show anaerobic respiration.

Background information

All living organisms respire. Respiration can be classified into two types, aerobic respiration and anaerobic respiration. In the process of respiration, glucose is broken down to release energy in the form of ATP. In plants, ethanol and carbon dioxide are also formed as by-products while lactic acid is formed in some animals. More energy is given out in aerobic respiration than in anaerobic respiration.

Most organisms are able to respire both aerobically and anaerobically. Aerobic respiration takes place in most organisms, e.g., mammals, birds, insects, fish, plants, when oxygen is present. On the other hand, anaerobic respiration takes place in some organisms, e.g. germinating seeds, yeast, when oxygen is absent. This practical tries to show anaerobic respiration by removing oxygen from the set-up. Any release of carbon dioxide when there is no oxygen present will be the evidence of anaerobic respiration. Presence of carbon dioxide can be determined by testing the gas evolved, if any, with hydrogencarbonate indicator.

Apparatus and materials

per group of two:

2 boiling tubes
1 small piece of wire gauze
1 syringe and plastic tube
1 wash-basin
soaked seeds, sterilized before the experiment
paraffin oil (石蠟油)
hydrogencarbonate indicator