

# CONTENTS



## **Introduction.....v**

|  |      |
|--|------|
| Exam breakdown .....                     | v    |
| Previously examined topics by year ..... | vi   |
| How to study .....                       | viii |
| Your study plan .....                    | ix   |
| The examination .....                    | xi   |

## **BIOLOGY .....1**

|  |    |
|--|----|
| 1. Living Things: Animals and Plants.....        | 2  |
| 2. Feeding and Digestion .....                   | 8  |
| 3. Respiration and Breathing .....               | 18 |
| 4. Circulation of Blood .....                    | 24 |
| 5. Excretion: Removal of Waste Products.....     | 28 |
| 6. The Skeleton .....                            | 30 |
| 7. Sensitivity and Co-ordination .....           | 34 |
| 8. Reproduction .....                            | 38 |
| 9. Genetics .....                                | 43 |
| 10. Plant Structure and Transport in Plants..... | 45 |
| 11. Photosynthesis and Tropisms.....             | 51 |
| 12. Plant Reproduction .....                     | 55 |
| 13. Ecology and Habitat Study .....              | 60 |
| 14. Micro-organisms.....                         | 69 |

## **CHEMISTRY .....71**

|  |    |
|--|----|
| 15. Elements, Compounds and Mixtures.....                              | 72 |
| 16. The Periodic Table, Metals, Alkali and Alkaline Earth Metals ..... | 76 |
| 17. Solutions and Separating Mixtures .....                            | 86 |
| 18. Air, Oxygen and Carbon Dioxide .....                               | 95 |

|  |     |
|--|-----|
| 19. Water .....  | 104 |
| 20. Atomic Structure, Ionic and Covalent Bonding ..... | 112 |
| 21. Acids and Bases .....                              | 121 |
| 22. Fossil Fuels, Acid Rain and Plastics .....         | 127 |

## **PHYSICS .....131**

|  |     |
|--|-----|
| 23. Measurement, Density and Flotation .....         | 132 |
| 24. Speed, Velocity and Acceleration .....           | 138 |
| 25. Forces, Levers and Moments of a Force .....      | 141 |
| 26. Work, Power and Energy .....                     | 150 |
| 27. Pressure .....                                   | 156 |
| 28. Heat and Temperature .....                       | 163 |
| 29. Light .....                                      | 176 |
| 30. Sound .....                                      | 183 |
| 31. Magnetism .....                                  | 187 |
| 32. Static Electricity and Current Electricity ..... | 190 |
| 33. Electronics .....                                | 201 |

# 2

## Feeding and Digestion

aims

In this chapter you need to learn:

1. The six constituents of a balanced diet and the source and function of each constituent.
2. The food pyramid.
3. Mandatory experiments to test for (a) starch (b) reducing sugars (c) protein (d) fat.
4. Mandatory experiment: Investigate the conversion of chemical energy in food to heat energy.
5. The processes involved in human nutrition.
6. The digestive system.
7. Enzymes.
8. Mandatory experiment: To investigate the action of amylase on starch.
9. Types of teeth and their structure.

All living things need food for energy, growth and repair, movement and protection from disease.

### Balanced diet

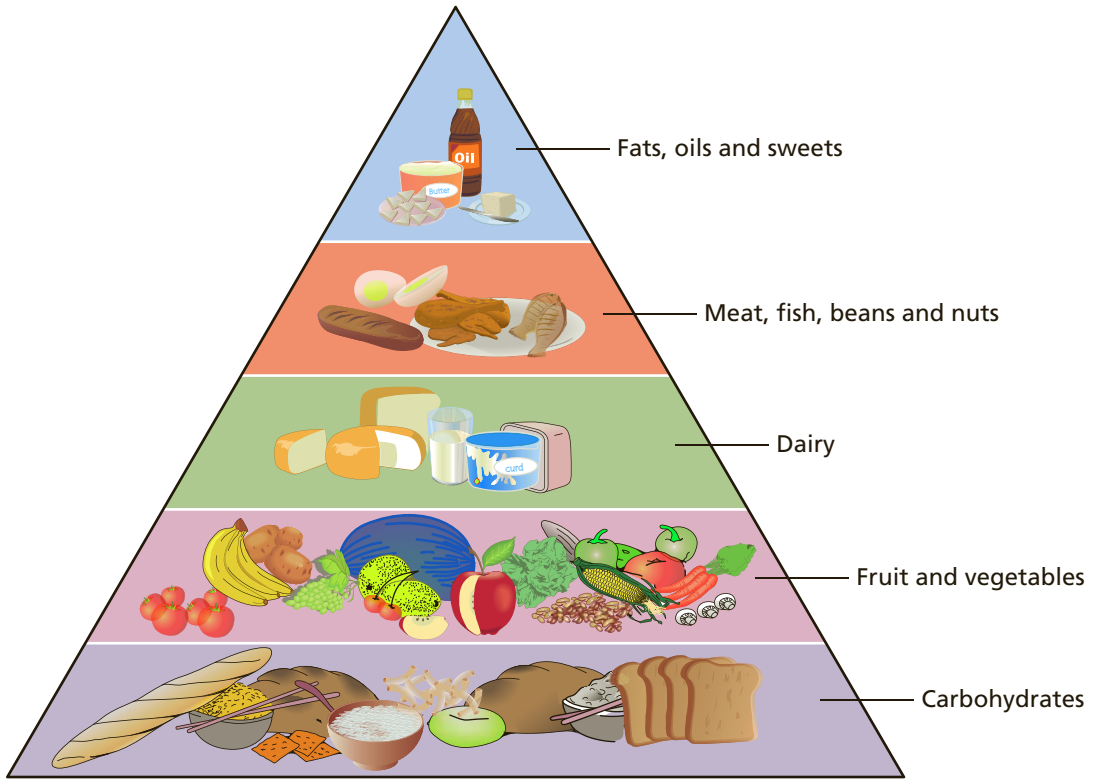
In order to stay healthy, humans need a balanced diet. A balanced diet contains six constituents: carbohydrates (including fibre), fats, proteins, vitamins, minerals and water.

key point

A **balanced diet** contains the right amount of the food types essential for healthy living.

| Type         | Source  | Function  |
|--------------|---|---|
| Carbohydrate | Bread, potatoes and sugar                                 | Quick release of energy   |
| Protein      | Meat, fish and vegetables                                 | Growth and repair   |
| Fat          | Butter, oils and margarine                                | Slow release of energy  |
| Vitamins     | Vitamin C from oranges<br>Vitamin D from milk             | Vitamin C for healthy skin and gums<br>Vitamin D for strong bones and teeth |
| Minerals     | Calcium from milk and eggs<br>Iron from spinach and liver | Calcium for strong bones and teeth<br>Iron for making red blood cells       |
| Water        | Drinks and vegetables                                     | Prevents dehydration  |
| Fibre        | Cereals and vegetables                                    | Prevents constipation   |

# The food pyramid



| Level  | Quantity eaten | Examples                                 |
|--------|----------------|--|
| Top    | Smallest       | Fats, sugars and confectionary           |
| Second | Small          | Meat, fish, beans and nuts               |
| Third  | Medium         | Milk, butter, cheese and milk products   |
| Fourth | Large          | Fruit and vegetables                     |
| Bottom | Largest        | Bread, pasta, cereals, rice and potatoes |



## Mandatory experiments

### (a) To test for starch

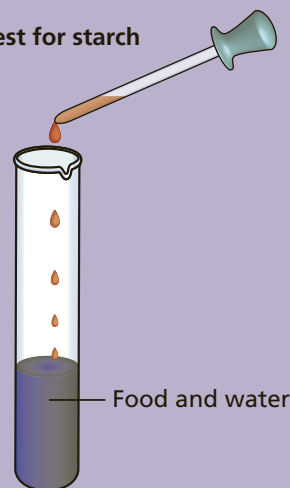
#### Procedure

1. Add some water to the food and mash it up into a paste.
2. Add iodine to the food.

#### Result

The food turns blue-black in colour.

Test for starch



### (b) To test for reducing sugars

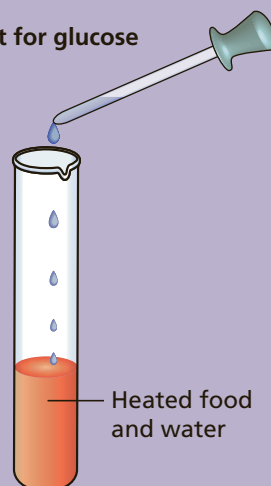
#### Procedure

1. Add some water to the food and mash it up into a paste.
2. Add Benedict's solution to the food.
3. Heat gently in a water bath.

#### Result

The food turns green and then orange-red.

Test for glucose



### (c) To test for proteins (Biuret test)

#### Procedure

1. Add some water to the food and mash it up into a paste.
2. Add some 10 per cent sodium hydroxide solution.
3. Add some drops of copper (II) sulphate solution.
4. Heat gently.

#### Result

The food turns violet in colour.

Test for protein





### Sample questions and answers

1. Tests were carried out on three foods by a pupil in a school laboratory. The results are given in the table below. A + sign means a positive test and a – means a negative test. (Junior Cert 2006, Q3a (iii))

| Food tested | Food tests |                |         |     |
|-------------|------------|----------------|---------|-----|
|             | Starch     | Reducing sugar | Protein | Fat |
| Food A      | +          | –              | –       | +   |
| Food B      | –          | –              | +       | +   |
| Food C      | +          | –              | +       | +   |

- (a) Which of the foods A, B or C would most likely be cheese, meat or fish?

**Answer**

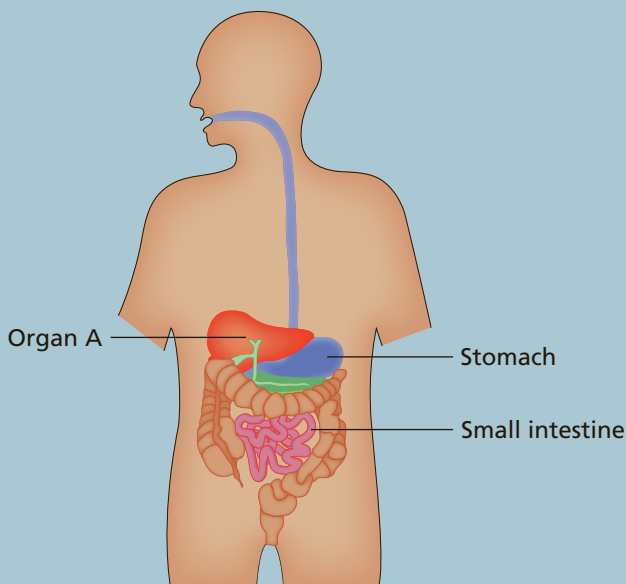
Food B: Cheese, meat and fish contain protein and fat.

- (b) Which of the foods A, B or C would most likely be crisps or chips?

**Answer**

Food A: Crisps and chips contain starch and fat.

2. The diagram shows the human digestive system. (Junior Cert 2007, Q2b)



aims

In this chapter you need to learn:

1. The difference between speed and velocity.
2. The definitions of speed, velocity and acceleration.
3. How to draw and use distance/time graphs and velocity/time graphs.

## Speed

The world's fastest athletes can run 100 m in less than 10 seconds. The average speed of the athlete is found by dividing the distance travelled by the time taken.

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{100 \text{ m}}{10 \text{ s}} = 10 \text{ m/s (or } 10 \text{ m s}^{-1}\text{)}$$

key point

**Speed** is the rate of change of distance with time.

## HL Velocity

Like speed, velocity is measured in metres per second ( $\text{m/s}$  or  $\text{m s}^{-1}$ ). It tells us the speed that something is travelling at, but it also tells us the direction in which it is travelling. For example, an athlete is running with a velocity of  $17 \text{ m s}^{-1}$  due south.

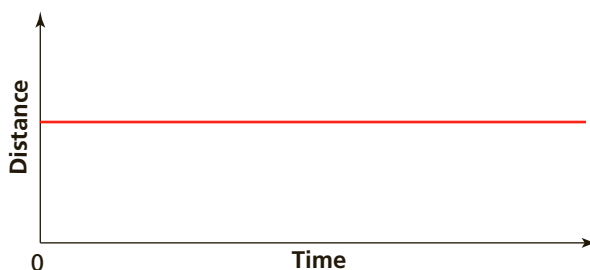
key point

**Velocity** is speed in a given direction.

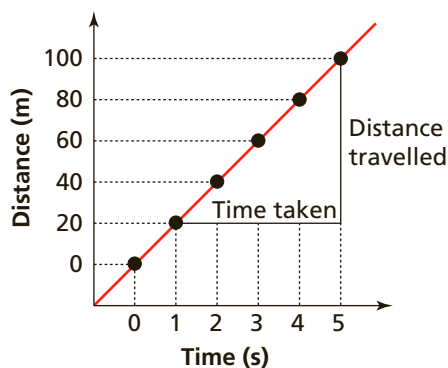
## Distance/time graphs

Distance/time graphs are used to calculate velocity.

When an object is **stationary**, the distance travelled does not change with time. Therefore, velocity =  $0 \text{ m s}^{-1}$ .



| Time (s)     | 0 | 1  | 2  | 3  | 4  | 5   |
|--------------|---|----|----|----|----|-----|
| Distance (m) | 0 | 20 | 40 | 60 | 80 | 100 |



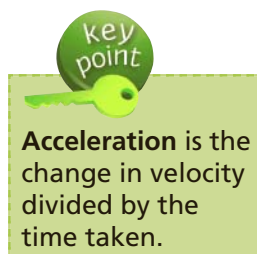
When an object is moving at **constant velocity**, the speed remains the same.

$$\text{velocity} = \frac{\text{distance}}{\text{time}} = \frac{100 \text{ m}}{5 \text{ s}} = 20 \text{ m s}^{-1} \text{ (or } 20 \text{ m/s)}$$

## Acceleration

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

When an object increases its velocity, it is accelerating. When it decreases its velocity, it is decelerating.



### Example

A car takes 10 seconds to change its velocity from  $20 \text{ m s}^{-1}$  to  $50 \text{ m s}^{-1}$ . What is its acceleration?

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}} = \frac{50 \text{ m s}^{-1} - 20 \text{ m s}^{-1}}{10 \text{ s}} = \frac{30 \text{ m s}^{-1}}{10 \text{ s}} = 3 \text{ m s}^{-2}$$

We say that the car has an acceleration of 3 metres per second per second ( $3 \text{ m/s/s}$ ). This is usually written as  $3 \text{ m/s}^2$  or as  $3 \text{ m s}^{-2}$ .

### Example

A car starts from rest with a constant acceleration of  $5 \text{ m s}^{-2}$ . How long will it take to reach a speed of  $30 \text{ m s}^{-1}$ ?

$$\begin{aligned} \text{acceleration} &= \frac{\text{change in velocity}}{\text{time taken}} \\ 5 \text{ m s}^{-2} &= \frac{30 \text{ m s}^{-1} - 0}{t} \\ t &= \frac{30 \text{ m s}^{-1}}{5 \text{ m s}^{-2}} = 6 \text{ seconds} \end{aligned}$$

**Velocity/time graphs** are used to calculate acceleration.

| Time (s)       | 0 | 1 | 2  | 3  | 4  | 5  |
|----------------|---|---|----|----|----|----|
| Velocity (m/s) | 0 | 5 | 10 | 15 | 20 | 25 |