**GRADE 10A: Biology 5**

**Human health and disease**

<table>
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<th>About this unit</th>
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<tr>
<td>This unit is the fifth of eight units on biology for Grade 10 advanced. The unit is designed to guide your planning and teaching of biology lessons. It provides a link between the standards for science and your lesson plans. The teaching and learning activities should help you to plan the content and pace of lessons. Adapt the ideas to meet your students’ needs. For extension or consolidation activities, look at the scheme of work for Grade 11A and Grades 8 and 9. You can also supplement the activities with appropriate tasks and exercises from your school’s textbooks and other resources. Introduce the unit to students by summarising what they will learn and how this builds on earlier work. Review the unit at the end, drawing out the main learning points, links to other work and real world applications.</td>
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**Previous learning**

To meet the expectations of this unit, students should already understand and be able to explain how colour blindness, haemophilia, cystic fibrosis and Huntington’s chorea are inherited. They should know the symptoms, causes and problems of diabetes and obesity.

**Expectations**

**By the end of the unit**, most students classify diseases and illnesses into different types and distinguish between endemic, epidemic and pandemic diseases. They know what constitutes a balanced diet and the energy and nutrient requirements for different lifestyles. They know why an inappropriate diet can lead to malnutrition, anorexia or obesity. They link poor diet to coronary heart disease and diabetes. **Students who progress further** understand the links between smoking and impairment of the gaseous exchange and cardiovascular systems. They know the nature of asthma, bronchitis, emphysema and lung cancer and how they affect the efficiency of gaseous exchange.

**Resources**

The main resources needed for this unit are:
- whiteboard, overhead projector (OHP)
- calorimeter, oxygen bottle/supply
- Internet access

**Key vocabulary and technical terms**

Students should understand, use and spell correctly:
- types of disease or illness: physical, mental, social, infectious, non-infectious, degenerative, inherited, deficiency
- endemic, epidemic, pandemic
- balanced diet, nutrient balance, energy content
- anorexia, obesity, coronary heart disease, diabetes (insulin-dependent or type-1 diabetes)
- basal metabolic rate (BMR)
- body mass index (BMI)
- essential amino acids
- serum cholesterol
- high-density lipoproteins (HDL), low-density lipoproteins (LDL)
- atherosclerotic plaques
- non-insulin diabetes, 'late-onset' diabetes, type-2 diabetes
- vegetarian, vegan
## Objectives for the unit

<table>
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<tr>
<th>6 hours</th>
<th>SUPPORTING STANDARDS</th>
<th>CORE STANDARDS</th>
<th>EXTENSION STANDARDS</th>
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<td>1 hour</td>
<td><strong>Classifying diseases</strong></td>
<td>8.7.4 Know that smoking damages the lungs and reduces the efficiency of gas exchange.</td>
<td>10A.10.1 Classify diseases or illnesses as physical, mental, social, infectious, non-infectious, degenerative, inherited or deficiency.</td>
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<tr>
<td>2 hours</td>
<td><strong>Relating balanced diet to lifestyle</strong></td>
<td>9.6.4 Explain how colour blindness, haemophilia, cystic fibrosis and Huntington’s chorea are inherited.</td>
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<td>3 hours</td>
<td><strong>Dietary-related health problems</strong></td>
<td>8.9.1 Know the symptoms, causes and problems of diabetes and obesity.</td>
<td>10A.10.2 Distinguish between endemic, epidemic and pandemic diseases.</td>
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## Activities

<table>
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<th>Possible teaching activities</th>
<th>Notes</th>
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<tr>
<td><strong>1 hour</strong></td>
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<tr>
<td><strong>Classifying diseases</strong></td>
<td>Introduce the topic by asking students to each produce a list of human diseases and illnesses. Use the board or OHP to collate their suggestions in a long list. Ask students, in pairs, to organise or classify the diseases and illnesses into logical groups. Different categories will be suggested and can be useful for discussion later. Explain and classify diseases or illnesses as physical, mental, social, infectious, non-infectious, degenerative, inherited or deficiency. Ask students to chart the statistics on the frequency of the identified diseases in Qatar and compare these with other selected countries, using information from the Internet. Provide each student with a piece of A3-size plain paper and ask them to produce a poster to display the types of diseases and illnesses in Qatar, or in the world, or in various selected countries. Ask students to role-play situations that illustrate changing conceptions of disease.</td>
<td><strong>ICT opportunity:</strong> Use of the Internet.</td>
<td>Use this column to note your own school’s resources, e.g. textbooks, worksheets.</td>
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<tr>
<td><strong>2 hours</strong></td>
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<tr>
<td><strong>Relating balanced diet to lifestyle</strong></td>
<td>Introduce this topic by asking students to recall the essential requirements of a balanced diet. Collate their answers on the board or OHP. Ask students to construct a table to display the dietary components to show why each is required and what effect a deficiency of each component has on the body and health of the individual. Let students determine whether they have a healthy diet. Ask them to keep a food diary for a week. Then ask them to analyse their data – either the whole week or one or two typical days, depending on the time available and how detailed the diary entries are. Ask students which factors have to be considered in connection with different lifestyles when producing recommendations for a specific diet for an individual. They should include factors such as: • age and body size (affect growth requirements); • gender (influences energy needs); • activity or occupation; • climate.</td>
<td><strong>Enquiry skills 10A.1.4, 10A.1.6</strong></td>
<td><strong>Enquiry skill 10A.2.1</strong></td>
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ICT opportunity: Use of the Internet.

Enquiry skill 10A.1.8

Enquiry skills 10A.3.1–10A.3.3

Enquiry skills 10A.3.1–10A.3.3
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| **Ask students to prepare diet sheets for a range of different individuals. For example:**  
- people with different occupations (e.g. office workers, building labourers, athletes),  
- women who are pregnant or lactating;  
- children, adolescents and the elderly (who have different growth and energy demands that need to be satisfied);  
- people with special dietary needs (e.g. vegetarians, vegans, diabetics). | Provide students with a table of the amino acid content of a range of food items and ask them to select a suitable diet to satisfy the daily needs of a vegetarian. To do this activity students need to know about essential amino acids and appreciate the need to eat a mixed plant diet to supply all the required amino acids. | Prepare a suitable table of amino acids from analytical tables of appropriate foods. | |
| **Provide students with a table of the amino acid content of a range of food items and ask them to select a suitable diet to satisfy the daily needs of a vegetarian. To do this activity students need to know about essential amino acids and appreciate the need to eat a mixed plant diet to supply all the required amino acids.** | | | |
| **3 hours**  
**Dietary-related health problems**  
Know why an inappropriate diet can lead to anorexia, obesity, coronary heart disease or diabetes. | Introduce this topic by asking students to identify dietary-related health problems.  
Select the examples of anorexia, obesity, coronary heart disease and diabetes to study the effects of an inappropriate diet.  
Provide sets of cards with the names of the health problem, the causes of the health problem and the symptoms written on them (e.g. cards might simply state: ‘anorexia’, or ‘problems with adjusting to adulthood’, or ‘more common in girls’). Mix up the sets of cards from all the disorders and ask students, working in pairs, to arrange the cards into the correct sets.  
Get students to use the Internet to locate information on anorexia, obesity, coronary heart disease and diabetes.  
Divide the class into small groups to investigate one of these disorders in detail and ask them to make a presentation to the class.  
Form the class into teams and ask each to make contact with a different health-promoting organisation in Qatar. The class should work together to find out the trend of national statistics for anorexia, obesity, coronary heart disease and diabetes, and to discover what actions the health-promoting organisations are taking.  
Encourage students to produce posters illustrating a range of food items that are either beneficial or harmful to the heart. | | Prepare suitable sets of cards.  
**ICT opportunity:** Use of the Internet.  
Enquiry skills 10A.1.4, 10A.3.4 | |
| **Discuss the energy balance of the body with students.**  
**Refer to the basal metabolic rate (BMR) and variables associated with it:**  
- gender (higher in males);  
- age (decreases with age);  
- body mass (increases with body mass).  
**Clarify that if you take in more energy than you use, you will create a positive energy balance. The energy will be stored and your weight will increase. Eventually, repeated weight increases will result in you becoming overweight or even obese.**  
**Discuss body mass index (BMI) with students. Body mass index is an internationally accepted method of classifying body weight relative to a person’s height.**  
**Establish the BMI of members of the class, using the following formula and table:**  
\[\text{BMI} = \frac{\text{body mass}}{\text{height}^2}\] | | | |
### Objectives | Possible teaching activities | Notes | School resources
---|---|---|---

| BMI Classification of body weight | | | 
| Less than 20 | Underweight | | 
| 20–24.9 | Normal | | 
| 25–29.9 | Overweight | | 
| 30–40 | Obese | | 
| More than 40 | Severely obese | | 

Ask students to find out the daily energy requirements for men and women.

Discuss the main factors leading to obesity: a poor diet high in fats coupled with a sedentary lifestyle.

Discuss the increasing incidence of obesity in the richer countries of the world; accompany this discussion with statistics and/or graphs.

Point out that obesity can lead to increased risk of developing coronary heart disease, stroke, raised blood pressure, raised blood cholesterol and can even lead to type-2 diabetes.

Demonstrate, using a food calorimeter, how the caloric value or energy content of a food (e.g. a chopped nut) can be determined. A calorimeter is filled with a known volume of water and its temperature measured. A known weight of food is then ignited and burnt in an atmosphere of oxygen until completely oxidised. The temperature of the water is re-measured. The energy content of the food can be determined from:

\[
\text{mass of water (g)} \times \text{the temperature rise (°C)} \times 4.2 \text{ J} ÷ \text{mass of food (g)}
\]

Ask students to record the data, carry out the weighing of the food, and take the temperature of the water before and after the combustion process. They can then calculate the caloric value of the food and compare the value with the expected ‘book’ value. Ask students why the two figures differ; identify the sources of error in the procedure.

Compare the caloric value of carbohydrates, fats and proteins. Discuss why fat is used to store energy (twice the energy content per gram of glycogen and also lighter).

Discuss the relationship between diet and coronary heart disease (CHD).

On the question of any aspect of diet in Qatar: are there recommendations from the Qatari health ministry on the consumption of certain foodstuffs?

Source a graph displaying the incidence of CHD together with one displaying the corresponding levels of serum cholesterol in men and women in Qatar.

Discuss the transport of cholesterol by lipoproteins in the blood.

Ask students to use the Internet to investigate the relationship between high-density lipoproteins (HDL) (so-called ‘good cholesterol’) and low-density lipoproteins (LDL) (so-called ‘bad cholesterol’), and the association with saturated fats and the development of atherosclerotic plaques which may form in the coronary arteries.

Ask students to investigate the effect of diet in the incidence of type-2 diabetes. Non-insulin diabetes or ‘late-onset’ diabetes is associated with the frequent consumption of sugar-rich foods, which can result in the reduced sensitivity of cells to insulin.

**Safety:** Ensure no one has a nut allergy.

The calorimeter should be set up carefully before the lesson. Technical help may be required with the oxygen bottle supply and electrical ignition of the food sample in its crucible after weighing.

Enquiry skills 10A.3.1–10A.3.3

**ICT opportunity:** Use of the Internet.

Source information from the Qatari health ministry.
### Assessment

**Examples of assessment tasks and questions**

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<tr>
<th>Assessment</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Classify the following diseases or illnesses as <strong>physical, mental, social, infectious, non-infectious, degenerative, inherited or deficiency</strong>.</td>
<td>Provide a long list of diseases and illnesses in random order for classification.</td>
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<tr>
<td>Distinguish between <strong>endemic, epidemic and pandemic</strong> diseases. Give examples.</td>
<td>Provide a typical daily menu showing each meal itemised and provide another list of food components from food tables showing their analysis.</td>
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<tr>
<td><strong>What constitutes a balanced diet?</strong> Examine the typical daily menu provided and explain whether it is a balanced diet using the data provided.</td>
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<td><strong>Explain how a vegetarian would obtain a balanced diet.</strong></td>
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<tr>
<td><strong>Explain how an inappropriate diet is related to the incidence of coronary heart disease.</strong></td>
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<td><strong>What are the causes of obesity? Explain the health-related problems arising from obesity.</strong></td>
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