Science lessons for Grade 8

Lessons in this section

Using these lesson plans

These sample lessons for Grade 8 are suitable for use with a whole class. The lessons are single examples to illustrate different teaching and learning activities. They are not intended to be taught as a sequence. They are drawn from different topics and points in the teaching year to show spread rather than sequence.

The objectives for the lessons are drawn from the standards for Grade 8. The relevant standards are shown in the lesson plans.

The lesson plans indicate any safety issues relevant to the lessons. They also provide equipment lists and any short- and long-term preparation required by the lessons. Some of the plans include notes that provide additional information relevant to the teaching of the lesson that may not be readily accessible elsewhere.

Most of the lessons are organised in three parts: an introduction to the lesson, a main activity, and a final phase to help students reflect on the lesson and consolidate their learning. As part of the introduction, you should outline the purpose of the lesson, drawing out for students what they will learn and how this builds on previous work. In the final part of the lesson, you will need to establish the key learning points, what students need to remember and what they will go on to learn next. There is no expectation that students should copy out the key learning points in their exercise books.

The lesson plans do not include homework tasks because the lessons are single examples taken out of sequence. You will need to provide this, since homework is an important part of a lesson.

Each lesson plan has enough material to support about 60 minutes of teaching. You may need to supplement the activities with simpler or more challenging tasks if the students in your class have a range of attainment. You could choose from activities in textbooks or from your own resources. If you wish, different tasks can be given to different groups of students, according to their needs.

For some classes there may be too much material in the lesson plan for 60 minutes. In this case, you could designate one of the activities in the lesson as homework, or carry it forward to the next lesson. Be selective about which activity to cut – it does not have to be the last one merely because it comes at the end.

Lesson 8.3 ‘How reactive are metals?’ is an example of a science lesson that spans several science periods. The lesson requires students to record results over a period of about a week and time must be allocated to this in subsequent lessons. In a lesson of this nature, the consolidation phase must take place at the end of the period of observations.

8.1 Diagnosing diabetes

Objectives

- Know the symptoms, causes and problems of diabetes.
- Consider the extent to which the evidence justifies a conclusion.

Preparation

You will need to make some synthetic 'urine'. Do this by dissolving some Bovril, Marmite or food colouring in warm water to produce a suitably convincing colour. Make up samples as follows:

1 healthy: no additions;
2 diabetes: add 1 g of glucose to 100 cm^3 'urine';
3 kidney disease: add 0.5 g albumin to 100 cm^3 'urine';
4 jaundice: add a small amount of soap solution.

Each group of students will need a set of each of the 'urine' samples.

Introduction

Vocabulary
diagnosis
symptom

What is meant by being ill?

The chances are that many of the class will have been ill and so they will have experiences to bring to the lesson. Start the lesson by asking question about students' experiences of being ill and lead on to asking less personal questions about how illness is recognised.

Start by asking questions such as:

Q Who has been ill?

Follow up by asking several students who have been ill:

Q How did you know you were ill?

Here you want to establish that their bodies reacted in some way that was abnormal. This can be then be developed by questions that start to lead towards how illness is diagnosed:

Q What questions were you asked by your parents / nurse / doctor about being ill?

This can be developed further by asking:

Q What measurements or tests were done?

Here you should establish that taking temperature and blood pressure are common but you should also ask about other measurements. Discuss the answers and, if it does not emerge from the discussion, approach the testing of urine samples by asking:

Q How could the doctor tell if some part of a person's internal chemistry was not working properly?

Conclude this section of the lesson by making sure students know that some illnesses cause the normal chemistry of the body to malfunction. This often results in the presence of unusual chemicals in the urine and thus testing urine can give clues to the nature of the illness and help in diagnosis. The practical activity is concerned with testing 'urine' for some specific illnesses.

Main activity

Vocabulary

carbohydrate
diabetes
glucose
jaundice
kidney
protein
sulfur

Resources (per group)

Samples of 'urine'
Reagent strips to test for glucose and for protein
Charts for strips
Powdered sulfur
Test-tubes and rack
Dropping pipette
Spatula
Resource 8.1

Diagnosing illness by testing urine

Students should work in groups of up to four.

Ask students to divide into groups and hand out **Resource 8.1**. Tell them that they are going to act as laboratory technicians and analyse 'urine' samples from three patients. Their results will help a doctor decide which illness each of the patients may have.

Give each group 'urine' samples from three patients and a further sample from a healthy person for comparison. They must do all the tests on all the specimens, so they will have to divide each of their samples into subsamples.

Although the samples are not real urine, they should be treated as if they were and students should wear rubber gloves. This will add greater reality to the lesson. Encourage students to label samples and keep a careful record of their results as if they were in a hospital laboratory.

Ask the class to clear away the materials after they have completed the practical work.

Consolidation

Vocabulary

metabolic disorder

Draw the following table on the board:

Patient	Diabetes	Jaundice	Kidney failure
A			
B			
C			

Ask each group of students to report their results and place a mark in a box for each patient to determine the frequency of the diagnosis. Discuss the level of agreement and the reasons why students may not have obtained the same answers. Explain that laboratory test are done by highly trained people and that it is usual for more than one subsample to be tested. If there is not an agreement, then further tests would be carried out.

The illnesses investigated are not caused by any invading micro-organisms but are disorders that result from metabolic failure in the body. Diabetes is a common disorder in Qatar. In diabetes the body is unable to deal with carbohydrates in the normal way, which results in the excretion of glucose in the urine. One of the standard diagnostic tests for diabetes is the identification of glucose in the urine. This used to be done by taste!

Other tasks

If time allows, groups could be asked to test the 'urine' samples of patients thought to have more than one of the disorders.

Summary for students

- Illnesses have symptoms, some of which are specific.
- Some illnesses result from metabolic disorders.
- Chemical tests are used to aid the diagnosis of metabolic disorders.
- Diabetes is a disorder of the body's chemical system for dealing with carbohydrates and results in glucose in the urine.
- Diabetes is common in Qatar.

Notes

It is quite possible that some of the pupils in the class, their relatives or friends may have diabetes and you should be sensitive to this. On the other hand, a pupil may be willing to share their experience of being diabetic or to ask a relative or friend to tell the class about diabetes and how it is controlled.

8.2 Plant food

Objectives

- Know that green plants make their own food by photosynthesis.
- Plan investigations, controlling variables.

Preparation

You will need to grow a number of leafy pot plants (such as Pelargonium) to provide the material for this lesson. You will also need sets of equipment and chemicals to decolourise leaves and test them for starch. A week or so before the lesson a few plants should be placed in a dark cupboard to de-starch. You should test that leaves have de-starched before the lesson. If they have not, you should delay the lesson until such time as they have.

Safety

In this lesson students will handle plant leaves. It is important that you know if any student is allergic to this material and that you take appropriate action. Students will also use hot alcohol to decolourise leaves. To prevent a risk of fire it is essential that when alcohol is being used there are no naked flames in the room.

Introduction

All flesh is green

Start this lesson by writing the phrase ‘all flesh is green’ on the board and ask students to explain their understanding of this. You should ask questions such as:

Q What do you understand by this phrase?

Q Why can flesh be described as green?

Q You eat food from animals. What is the source of animals’ food?

Q Some animals eat other animals. What do these other animals eat?

The purpose of this line of questioning is to establish that all animal material can be tracked back to a plant origin. This would be an opportunity to revisit work done on food chains and food webs and to remind students that green plants are at the base of all food chains and food webs.

You should now tell the class that this and other lessons are designed to examine the evidence supporting the assertion that green plants make their own food. Tell them that the purpose of today’s lesson is to look for the presence of a food material (starch) in the leaves of a plant and to answer the research question ‘Does a plant leaf accumulate starch when kept in light and dark conditions?’ Write this research question on the board. This should lead to further questioning:

Q How can we test leaves for starch? (students should recall testing starch as a food substance)

Q How can we determine whether starch is accumulated in light and dark conditions?

Discussion of the answers should establish the need to test plants kept in light and dark conditions and to control any other variables. Some students will realise that the outcomes of the starch test will not be detected because of the green colour of the plant leaves and may suggest that they need to be decolourised.

End this part of the lesson by telling the class that they will be given some plant leaves to test for starch. Some of the leaves will be from a plant kept in darkness for a few days and others will be taken from a similar plant that has been kept in the light. To observe the outcome of the starch test they will have to decolourise the leaves.

Main activity

Resources (per group)

- Leaves from plants kept in light and dark conditions
- Beakers and test-tubes
- Forceps
- Dropping tube
- White tile
- Bunsen burner
- Alcohol
- Iodine solution

Do leaves contain starch?

Students should work in groups of about four.

Give each group a few leaves from the 'light' and 'dark' plants. These should be kept separate and placed in beakers of hot water for a few minutes: Ask the class:

Q Why do we need to put the leaves in hot water for a few minutes? (to break down cell walls and soften the leaves)

The leaves should now be taken out of the hot water and any excess water removed. The hot water should be kept in the beaker as it will be used in the next stage of the activity. **At this point any open flames should be extinguished.**

You should now provide each group with a little alcohol. Students should take two test-tubes and put some alcohol in each. In one tube they should place their 'light' leaves and in the other their 'dark' leaves. Both tubes should now be placed in the beaker of hot water used to soften the leaves. Alcohol boils at a lower temperature than water and students may observe boiling. The hot alcohol will remove most of the green colour of the leaves.

After a few minutes students should remove the leaves from the alcohol and wash them in the hot water. You might ask:

Q Why do we need to put the leaves in hot water again? (to remove the alcohol that will disrupt the starch test)

The washed leaves should be placed on a white tile. If the procedure has been carried out appropriately, they will be very pale green or white. A few drops of iodine solution should be added to each leaf. The presence of starch is indicated by a blue-black colour.

When all groups have completed their testing, bring the class together to discuss the results. While there may be variation, you should be able to establish that the leaves from the 'light' plant contain starch while those of the 'dark' plant do not, or that leaves from the 'light' plant contain more starch than those from the 'dark' plant. You should now get students to consider explanations for the observation:

Q How can we explain these observations?

Try to get as many ideas as possible from different students. Some will suggest that plants just use up starch when kept in darkness, others may suggest that plants make starch in light. It is important to point out that this activity does not show that plants *make* starch. It shows that plants kept in the light contain more starch than plants kept in darkness.

Round off this section of the lesson by returning to the research question written on the board at the start and discussing the strength of the evidence for a statement about the accumulation of starch by leaves kept in light and dark conditions. This discussion should be extended into a consideration of further experiments that could be done. Possible activities are:

- Covering some of the leaves of a plant so that no light gets to them, keeping the plant in light for a few days and testing covered and uncovered leaves for starch.

- Repeating the above with a de-starched plant.

When discussing additional experiments, encourage students to consider the factors that have to be kept constant and those that have to be varied.

Consolidation

In the final section of the lesson you should return to the research question and ask students to provide answers and to back their answers with evidence. You should stress that this is just part of the evidence to suggest that plants make their own food. Further evidence is needed. More experiments will be done in other lessons and evidence collected that can be used to support or refute the claim that green plants make their own food.

Other tasks

Students could plan and carry out the other experiments that have been suggested or devise other activities to investigate the proposition that green plants make their own food and the conditions that might favour or hinder this.

Summary for students

- The leaves of green plants kept in the light contain starch.
- The leaves of green plants kept in the dark contain little or no starch.
- Starch reacts with iodine solution to form a blue-black colour.
- Leaves must be softened and cell walls broken down by hot water before being tested for starch.
- Leaves must be decolourised by hot alcohol before being tested for starch.
- In experimentation all but one of the variables must be kept constant.

Notes

This is just one of a series of activities that should be done to help establish that green plants make their own food by photosynthesis. Understanding the process and the factors that affect it has proved to be difficult for many students.

8.3 How reactive are metals?

Objectives

- Deduce a reactivity series for common metals based on their reactions with air, oxygen, water and dilute acids.

Preparation

Part of this lesson consists of a teacher demonstration of the reactions of sodium and potassium with air and water. It is very important to rehearse the experiment before the lesson if you have not done it before.

Safety

This work involves the use of sodium and potassium. These metals must not be handled by students. They must be handled only by the teacher with a safety screen between the demonstration and the class. Wear safety spectacles and a laboratory coat as both metals often explode on contact with water. Only small pieces should be placed in water: a cube of side 2 mm is sufficient. The metals should not come into contact with the skin; handle small pieces with a spatula.

Getting a piece of sodium or potassium in the eye is very dangerous. It should be washed out completely with large amounts of water and medical help sought immediately.

These metals must be stored under heavy (medicinal) paraffin to prevent them from catching fire in air. If the paraffin has become depleted in the main bottle, top it up. Each bit of metal that is used should be cut on, and cleaned with, filter paper, which should afterwards be rinsed carefully with much water to destroy any remaining pieces of metal.

Keep the sodium or potassium bottle closed all the time except for the short periods when a piece is being removed.

Introduction

This is the introductory lesson to the topic on metals in Grade 8. Students will have studied metals before in Grade 4 and they will be familiar with the uses of metals from their daily lives.

Ask questions designed to establish what metals they know about, what they are used for and why they are used in this way:

Q Name some things that are made of metal.

Q Which metal are they made of?

Q Why are they made of metal?

This questioning should lead to the fact that metals are strong and can be cast or bent into useful shapes. They can easily be made into useful small objects, such as keys, wire and coins, and into large objects, such as cars and aeroplanes. Students may also note that metals are good conductors of heat and electricity (they have studied electricity in Grade 7 and will study heat in Grade 8).

Carry on questioning to lead to the idea of corrosion:

Q What happens to metal objects, like silver jewellery, if they are left out in the air?

Q What happens to metal objects if they are left in contact with water?

Q What happens to metal objects in the sea?

This should lead to ideas about the tarnishing of silver and the rusting of steel. Students will also realise that iron rusts much faster when it is in contact with salt water.

The next line of questions should lead to the idea that some metals corrode or tarnish faster than others.

Q Which metals stay shiny and which metals quickly go dull after you polish them?

Q Do all metals rust?

Finally, ask questions that lead to a design for an experiment to investigate corrosion:

Q How can we find out which metals stay shiny in air the longest?

Q How can we find out which metals corrode the most in water?

Q How can we investigate how fast metals corrode in salt water?

Students will be able to design experiments to investigate these quite easily. What they will probably miss is the need to control variables; water vapour must not be allowed to come into contact with the metals left to tarnish in air and air must not be allowed to touch the metals in the water. Explain this need to control variables. The experiment they will do will ensure that only dry air is used to study the reaction on air. It is very difficult, however, to remove all air from water, so this will not be done in the experiment.

Main activity

The corrosion of metals in air and water

Resources (per group)

- Plastic lunch box
- Calcium oxide lump
- Small piece of fine emery paper
- 14 corked test-tubes in racks
- Labels or a marker pen
- Salt water or seawater
- 3 samples of each of the following metals, about 1 ×3 cm:
  - copper
  - aluminium
  - iron (nail)
  - zinc
  - gold leaf (optional
  - magnesium
  - nickel
  - lead
- Resource 8.2

Activity 1 The corrosion of metals in air, water and salt water

Students should work in groups of around six. Each group should divide and work on the three experiments simultaneously. Time: about 10–15 minutes.

Follow the instructions in **Resource 8.2**. Each group will set up three corrosion experiments that will be left for a week. They should observe them each day and note any changes.

Time-lapse digital photography may be used with one group; the camera should be set up to take a photograph of the metals (in salt water, as this gives the fastest corrosion) every 120 minutes for two days or so. The system should not be moved and the light source should be constant during the observation time.

Help the groups with the technicalities of setting up the experiments. Ask questions to ensure they are clear about why they are doing the experiments. Make sure they are aware of the purpose of the calcium oxide (or anhydrous magnesium chloride) drying agent in the lunch box.

Resources

Glass trough half full of water, with glass plate on top
Potassium
Sodium
Spatula and forceps
Filter paper
Fireproof mat

Activity 2 The reaction of sodium and potassium with air and water

Teacher demonstration. Time: about 15 minutes.

Arrange the class for a demonstration. Nobody should be near enough to the demonstration bench to touch it. You should be able to walk right around the desk. Set up a safety screen (see safety note above) and wear safety glasses.

Hold a piece of sodium in the forceps and cut it with a spatula. Show students the shiny metal. Watch as it corrodes within seconds. Place a small piece (2 mm × 2 mm) on a fireproof mat and leave it. Draw attention to it when it starts smoking in air.

Lift the glass plate on the trough, place a piece of sodium in the water and replace the lid immediately. Watch what happens. Repeat.

Repeat all experiments with potassium, noting the greater reactivity of potassium compared with sodium.

Consolidation

The consolidation phase of this lesson will take place after one week.

Invite some of the groups to present and discuss their results. The significant points that should emerge are that some metals will have corroded more (i.e. faster) than others and that this was observed in air, water and salt water.

Q Which metals corroded the most?

Q Did the metals that tarnished most in air also corrode most in water and salt water?

Q Did the metal corrode most in air, water or salt water?

The metals will have corroded fastest in salt water. Some, such as copper and nickel, will probably not have changed at all in water and air. Magnesium will have gone dull quickly in air and will have corroded away a little in water and completely in salt water.

Q Which metals are the most reactive?

Q Which metals are the least reactive?

Use this line of questioning to draw up a reactivity order for the metals. Magnesium will be at the top and copper will be at the bottom. Sodium and potassium can be added to the top of the list. It is often difficult to place aluminium on this list because of its anomalous behaviour (see the notes below).

Summary for students

- Most metals react with air but some react faster than others.
- Most metals react with water but some react faster than others.
- Metals corrode particularly fast in salt water.
- These reactions allow the metals to be placed in a reactivity order: potassium, sodium, magnesium, iron, lead, nickel, copper. Aluminium is not easy to place in this order.

Notes

The anomalous behaviour of aluminium

It is not easy to establish where aluminium should go in the reactivity order. If it is cleaned with emery paper, it tarnishes within minutes. It then does not react further with either air or water. It will corrode away completely in the salt water.

Aluminium is a reactive metal and should be around the same place as magnesium in the reactivity order. However, it quickly forms a layer of aluminium oxide on its surface and this layer protects the surface from any further reaction. If the layer is scratched away, aluminium reacts quickly (and gets hot). In salt water, the aluminium oxide layer is disrupted and so the metal corrodes quickly.

If the metal is dipped in mercury or a solution of a mercury salt, the layer is disrupted and the metal then disintegrates very quickly in air. Mercury and its salts are very toxic, however, and should not be present in schools.

8.4 Interpreting information

Objectives

- Present qualitative and quantitative data using a range of methods, such as descriptions and tables and through pictures, graphs and diagrams, using ICT methods where appropriate, and draw conclusions from them.

Introduction

This is a lesson on an important scientific skill: how to interpret data and display it in different ways. Students will be asked to translate data from one form (such as a graph) to another (such as a table) and will be asked questions on what the data tell us. The data shown are about energy use, but any kind of data can be used in a lesson like this.

Question the students:

Q What ways of displaying information have you met in your science lessons?

Write down on the board a list of the different ways of displaying information they suggest. They will probably suggest tables, graphs, lists, flowcharts, etc. Do not forget text paragraphs.

Main activity

Resources
Resource 8.3

Activity 1 Translating information from one form to another

Hand out **Resource 8.3** to each student. The resource contains four items of information. Ask them to display each of these in a different way. The list on the board will help them think of a different way.

If necessary, do one example on the board: display the table on the cost of producing 1 kW h of electricity in the form of a bar chart.

Circulate around the class and give assistance where needed.

Ask students individually to compare the way they have chosen to display the information with what is displayed in Resource 8.3. Ask questions such as:

Q Which set of data is easier to understand? Why is it easier to understand?

Q Do they both contain the same amount of information?

Q Do they both display the data as accurately?

Students should realise that, quite often, displaying data in a form that is easy to read and interpret means that it may not be displayed quite as accurately. They should realise that the way data are displayed often depends on who the display is created for and how long they have to read it. This idea is developed further at the end of the lesson.

Resources
Resources 8.3 and 8.4

Activity 2 Interpreting data displays

This activity can be done at home.

Hand out **Resource 8.4**, which contains some questions for students to answer relating to the information on **Resource 8.3**.

Consolidation

Bring the class together and discuss the advantages and disadvantages of different ways of displaying data. Ask questions such as:

Q What kind of data display can be interpreted quickly?

Q How would you display data if you were communicating with someone who did not know much about the subject?

Q How would you present data if you wanted to present it in the most detailed way?

At the end of the discussion, students must recognise that the way data is presented depends on who the reader is, how much they know about the topic and how much time they have to study the information, as well as what the information is.

Summary for students

- There are many different ways of communicating information.
- The way that information is communicated depends on who it is for as well as what it is.