Elementary astronomy: the universe

Lesson plan and teacher's notes · Form 1 Physics · 1 period of 40 minutes

School	(write school name)	**Teacher**	(write name)
Date	(date)	**Class**	Form 1
Subject	Physics	**Enrolment**	Boys ___ Girls ___ Total ___
Time	40 minutes	**Topic**	Elementary astronomy: the universe

Learners say what astronomy and the universe are, describe what the universe contains, and build a scale model or diagram of the planets and a simple simulation of an astronomical event such as an eclipse. The lesson is practical and uses materials found in the classroom or at home.

Specific outcomes

By the end of the lesson, learners should be able to:

1. Say what astronomy and the universe are
2. Describe what the universe contains
3. Build a scale model or diagram of the planets showing relative sizes and positions
4. Use a model to show an astronomical event such as an eclipse or planetary motion

Prior knowledge

- The Sun, Moon and stars can be seen in the sky
- Drawing to scale with a ruler
- Comparing sizes of objects

Teaching and learning materials

- chalk and board
- plasticine, clay or fruits of different sizes
- a ball and a torch
- string and a ruler
- paper and pencils

References

Ministry of Education (CDC) Form 1 Physics syllabus and module; 25Schools learners' note: Elementary astronomy: the universe.

Lesson development

Stage and time	Teacher activities	Learner activities
Introduction 5 min	Ask learners what they can see in the sky on a clear night. Write astronomy and universe on the board with their meanings.	Name what they have seen in the night sky and copy the two meanings.
Development: the universe 10 min	Explain that the universe is everything that exists, including all matter, energy, space and time. Show that it contains billions of galaxies and that each galaxy has billions of stars. Give the age scientists estimate, 13.8 billion years.	Copy the key facts and say why the stars cannot be counted one by one.
Development: scale model 15 min	Explain that a larger planet must look larger than a smaller one and each planet must be in its correct place. Show how to choose objects of different sizes and place them in order.	In groups, build or draw a scale model of the planets showing relative sizes and positions.
Development: simulating an event 7 min	Show how a torch, a ball and a smaller object can simulate an eclipse or the motion of the planets.	Try the simulation and say what each object stands for.
Conclusion 3 min	Ask why a model helps to understand what is too large to see. Set the homework.	Answer and copy the homework.

Teacher's content notes

Read these before the lesson. They are what you need to know, not what to copy onto the board.

What astronomy studies

Astronomy is the study of the physical nature of celestial objects and of the phenomena we observe in the universe. Celestial objects are things found in space, such as stars and planets. In elementary astronomy you explore the solar system, stars, planets, galaxies and celestial phenomena.

The universe

The universe is the totality of all existence. It includes all matter, energy, space and time. Scientists estimate that it is about 13.8 billion years old. It contains billions of galaxies, and each galaxy is made of billions of stars.

Key words

A galaxy is a very large group of stars. A star is a celestial object that makes up galaxies. A planet is a celestial object found in space. A phenomenon is an event in space, such as an eclipse.

Building astronomical models

A model helps you to understand what is too large to see. One activity is to create a scale model or diagram of the planets that shows their relative sizes and their positions. Draw or build it to scale so that a larger planet looks larger than a smaller one, and place each planet at its correct place in the solar system.

Simulating an event

A second activity is to simulate an astronomical event such as an eclipse or the motion of the planets. Use materials that you can find in the classroom or at home and say what each material stands for.

Questions to ask during the lesson

Question	Expected answer
A learner looks at the night sky and asks what astronomy is and what the universe is. (a) State what astronomy studies. (b) State what the universe is. (c) Name two kinds of objects found in space.	(a) The physical nature of celestial objects and the phenomena we observe in the universe. (b) Everything that exists, including all matter, energy, space and time. (c) For example stars and planets.
A learner tries to count the stars in the universe and gives up. (a) Say how many galaxies the universe contains. (b) Say how many stars each galaxy has. (c) Explain why she cannot count them one by one.	(a) Billions of galaxies. (b) Billions of stars. (c) The number is far too large to count one by one.
A group builds a scale model of the planets for the classroom. (a) State two things the model must show. (b) Say what a larger planet must look like in the model. (c) Say why a model helps.	(a) Relative sizes and positions. (b) Larger than a smaller planet. (c) It helps you understand what is too large to see.
A teacher asks a class to simulate an astronomical event with things from home. (a) Name one such event. (b) Name one material you could use. (c) Say what the material would stand for.	(a) An eclipse or the motion of the planets. (b) For example a ball or a torch. (c) A celestial object such as a planet or a star, chosen by the learner and explained to the class.

Worked examples for the board

Example 1: why relative sizes and positions matter

A learner asks why a scale model of the planets must show relative sizes and positions. A model that keeps the sizes in the right proportion shows which planets are larger and which are smaller. A model that keeps the positions in the right order shows how the planets are arranged.

Example 2: describing the universe

The universe is everything that exists, including all matter, energy, space and time. It is estimated to be about 13.8 billion years old. It contains billions of galaxies and each galaxy is made of billions of stars.

Example 3: planning a simulation

To simulate an eclipse a learner chooses a torch, a ball and a smaller object. She decides what each stands for, places them in line and observes the result. She then explains the event using the model.

Board plan

Write the title. Left: the meanings of astronomy and the universe. Centre: key facts about the universe in a table. Right: steps for building the model of the planets, then the simulation of an eclipse.

Part	What it is
Universe	Everything that exists, including all matter, energy, space and time
Galaxy	A very large group of stars
Star	A celestial object that makes up galaxies
Planet	A celestial object found in space
Astronomical phenomenon	An event in space, such as an eclipse

Key facts about the universe

Mistakes to expect

Learners often think	Put it right
The stars can be counted one by one.	The universe contains billions of galaxies and each galaxy has billions of stars, so the number is far too large to count one by one.
A model of the planets can use any sizes and any order.	A model must keep the sizes in proportion and the planets in the correct order, otherwise it does not show how they are arranged.
Astronomy is only about looking at stars.	Astronomy studies the physical nature of celestial objects and the events, called phenomena, that we observe in the universe.

Differentiation

Learners who struggle

Give learners a list of the planets in order and let them match each planet to an object of a suitable size before they build the model. Work in mixed groups.

Learners who finish early

Ask learners who finish early to simulate a second astronomical event, such as the motion of the planets, and explain what each material stands for.

Hearing or visual impairment

For learners with visual impairment, use objects of clearly different textures and sizes so that they can feel the order and relative sizes of the planets. For learners with hearing impairment, write each key word on the board and use gestures and the model to show the steps.

No projector, no printing

Use fruits, stones, seeds or balls of paper of different sizes for the planets, a ball and a torch or a candle-free light such as a phone torch for the eclipse, and string on the floor for the order of the planets.

If time is short

Teach the meanings and the key facts about the universe, then do the scale model. Leave the simulation of an event for the next lesson.

Evaluation

Question or task	A correct answer shows
A learner says that the universe is just the stars you see at night. (a) Give the meaning of the universe. (b) Name two things it contains. (c) Explain why its stars cannot be counted one by one.	(a) Everything that exists, including all matter, energy, space and time. (b) Galaxies and stars. (c) Billions of galaxies each have billions of stars, so the number is far too large.
A group builds a model of the planets using a stone for a small planet and a large ball for a big planet. (a) Say why the sizes of the objects matter. (b) Say why the planets must be placed in order. (c) Describe what the model helps learners to understand.	(a) A larger planet must look larger than a smaller one. (b) Each planet must be at its correct place in the solar system. (c) It helps learners understand what is too large to see.
A teacher wants to show an eclipse in class using a torch, a ball and a small object. (a) Name the astronomical event. (b) Say why a model is used for it. (c) Say what a learner should check about the objects used.	(a) An eclipse, which is an astronomical phenomenon. (b) A model shows an event that is too large to see in the classroom. (c) Which object stands for which celestial object.

Homework

A learner wants to explain astronomy to her younger brother. (a) Write what astronomy studies. (b) Draw a simple diagram of the planets showing their relative sizes. (c) Write one thing a model helps him to understand.

Extra practice with answers

Question	Answer

1. A pupil finds a word in her book and wants its meaning. (a) Give the meaning of galaxy. (b) Give the meaning of star. (c) Give the meaning of astronomical phenomenon with an example.	(a) A very large group of stars. (b) A celestial object that makes up galaxies. (c) An event in space, such as an eclipse.
2. A learner reads that scientists estimate the age of the universe. (a) State the estimated age. (b) State what the universe includes. (c) State how many galaxies it contains.	(a) About 13.8 billion years. (b) All matter, energy, space and time. (c) Billions of galaxies.
3. A learner builds a model in which every planet is the same size, and her friend says it is wrong. (a) Say what is wrong. (b) Say how to correct it. (c) Say what else the model must show.	(a) Sizes are not in proportion. (b) Make a larger planet look larger than a smaller one. (c) The correct position of each planet in the solar system.
4. A class has only classroom materials to show the motion of the planets. (a) Suggest materials. (b) Say what each could stand for. (c) Say what the model shows.	(a) For example balls, stones and string. (b) The balls and stones stand for planets and the string for their paths or positions. (c) How the planets move and are arranged.
5. A learner says elementary astronomy is only about the Sun. (a) Correct her. (b) List four things explored in elementary astronomy. (c) Say what celestial objects are.	(a) It explores more than the Sun. (b) The solar system, stars, planets and galaxies, and celestial phenomena. (c) Things found in space, such as stars and planets.

Answers to the learners' check-yourself questions

1. What is astronomy?
   The study of the physical nature of celestial objects and the phenomena in the universe.
2. What does the universe include?
   All matter, energy, space and time.
3. About how old is the universe, according to estimates?
   About 13.8 billion years.
4. What does a galaxy contain?
   Billions of stars.
5. Name two things that a scale model of the planets must show.
   Their relative sizes and their positions.
6. Your class is asked to make a scale model of the planets for an open day at your school. A learner says that all the planets can be the same size because the model is only for show. (a) Do you agree? (b) Say what the model must show instead. (c) Suggest materials you could use to make it.
   (a) No. (b) The model must show the relative sizes of the planets, so larger ones look larger, and their positions in the solar system. (c) Any local materials, for example paper, seeds, soil or bottle tops.
7. A group wants to show an eclipse or the motion of the planets to Form 1 learners who have never seen a model of space. (a) Which kind of astronomical activity is this? (b) Explain why a model helps the learners to understand. (c) Say one thing the group

should do to make sure that the learners can s

(a) Simulating an astronomical event. (b) Space is too large to see, and a model shows the parts and their movement in a way that can be seen in the classroom. (c) Make the parts large and clear, keep their sizes and positions in proportion and explain each part to the learners.

Teacher's reflection

What went well:

What I will change next time:

Learners who need follow-up: