

Unit 2: Using Equipment to Make Scientific Observations and Measurements

Unit reference number: D/600/5929

QCF level: 1

Credit value: 4

Guided learning hours: 40

Unit aim

The aim of this unit is to give learners the knowledge, skills and understanding required to make observations and measurements in order to undertake scientific explorations safely and effectively using the relevant equipment.

Unit introduction

Employees working in practical scientific occupations need to know how to use a wide variety of scientific equipment safely for observation and measurement purposes in laboratories, workplaces or field studies. These skills are essential to provide accurate qualitative and quantitative information which will form the basis for scientific investigation with the aim of reaching conclusions and informing decision making.

This unit will enable learners to become familiar with a range of accessible observation and measurement scenarios and techniques. They will become familiar with the key characteristics of some of the most commonly used equipment, along with the correct use of some technical and scientific terminology. Learners will have the opportunity to make both qualitative and quantitative observations and measurements in a variety of practical situations. The unit gives learners the opportunity to develop knowledge, skills and understanding which will provide a foundation for progression and employment in industries associated with scientific activity.

Tutors may find it effective to deliver this unit alongside another which provides meaningful opportunities for observation and measurement, for example *Unit 8: Forensic Detection*.

Essential resources

Learners require access to an appropriate range of equipment and materials to carry out measurements and observations during practical work and to take measurements in the field. Access to a laboratory would be an advantage.

Learning outcomes and assessment criteria

In order to pass this unit, the evidence that the learners present for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit.

On completion of this unit learners should:

Learning outcomes		Assessment criteria	Unit amplification
1	Know the types of observations and measurements in scientific investigations	1.1 identify types of measurements and their units	<i>Measurement:</i> types, e.g. weight, length, volume, time; units e.g. millimetres, centimetres, metres, kilometres, millilitres, litres, grams, kilograms, hours, minutes, seconds; measurement abbreviations; accuracy, e.g. to nearest gram, within five seconds, to two decimal places
		1.2 identify types of scientific observation	<i>Observation:</i> types, e.g. field, laboratory, short observations over a single session or during a day, long observations over a number of days; basic concept of hypothesis; predicted outcome
2	Know equipment needed for basic scientific observations and measurements	2.1 list the equipment needed for basic scientific observations and measurements	<i>Equipment:</i> e.g. microscope, scales, thermometer, rulers, stopwatch, beakers, measuring cylinders, burettes, pipettes, Bunsen burners, test tubes, clamps, tripod <i>Measurements:</i> using equipment, e.g. setting up a microscope and slide, taking measurements from a thermometer, rule, pipette
3	Be able to make accurate scientific observations and measurements in given situations	3.1 predict outcomes of scientific observations and measurements in given situations	<i>Observations:</i> make and record scientific observations accurately
		3.2 use appropriate equipment safely to make scientific observations and measurements in given situations	<i>Health and safety:</i> health and safety requirements, e.g. Personal Protective Equipment (PPE), removal of inappropriate garments and belongings, centre policies and procedures, risk assessment

Learning outcomes	Assessment criteria	Unit amplification
	3.3 record observations and measurements accurately from given situations	<p><i>Measurements:</i> use equipment to take and record accurate measurements</p> <p><i>Observations:</i> predict possible outcomes; draw conclusions from analysed results; use calculations; present results to an appropriate degree of accuracy</p>
	3.4 present conclusions from given situations	<p><i>Results:</i> presentation, e.g. tables, charts, drawings, specimens, photographs, products; methods, e.g. verbal, written, electronic; comparison with hypothesis/predictions; conclusions, e.g. interpret simple patterns in experimental results; perform simple calculations, e.g. obtain averages, totals, maximum, minimum</p>
	3.5 compare conclusions from scientific observations and measurements for given situations against predictions	

Information for tutors

Delivery

This practical unit has been designed to introduce learners to key elements of scientific investigation. The unit does not require access to a formal laboratory but it would be advantageous.

It is essential that learners are introduced to some basic scientific concepts, such as the 'setting of a hypothesis' and working principles such as health and safety at work.

The overall aim of the unit is to introduce learners, many of whom will have little or no prior scientific background, to scientific methods of investigation and reasoning. It also introduces the use of scientific observation and measurement to test how/why/what/will questions. It is therefore important that this unit is delivered in a manner designed to promote the interest and relevance of science while laying the foundations for progression.

All the activities can either be undertaken individually or as part of a group. Each learner could be encouraged to build their own portfolio of scientific experiments. It may then be appropriate to use this evidence against the assessment criteria for the unit.

Learners should be given the opportunity to participate in a range of scientific investigations, for example they may wish to explore why it is that a given mass of ice floats, or they may set up a series of tests with an environmental theme to evaluate the effectiveness of various forms of insulation and their cost-effectiveness. The precise nature of the investigation is less important than the accessibility of the scenario as a means of developing knowledge, skills and understanding. Scenarios suggested to learners should engage them in meaningful observation and measurement.

Learners will also benefit from talks by guest speakers or visits to scientific establishments.

Assessment

To achieve learning outcome 1, learners must identify types of measurements and their units and identify types of scientific observation. A series of practical tasks and/or experiments could be used as assessment evidence, supported by assessor observation records.

To achieve learning outcome 2, learners must list the purpose of different pieces of equipment needed for basic scientific observations and measurements. Learner practical demonstrations could be used as assessment evidence, supported by assessor observation records. Assessment is best integrated with the practical tasks completed for learning outcome 1.

Learning outcome 3 deals with making predictions, observations and measurements and presenting conclusions. It also covers the importance of health and safety during practical investigations. Learners need to demonstrate their skills and ability to make accurate scientific measurements and observations, recording their observations and data accurately. They need to present the information in a relevant format using the correct units and draw logical, valid conclusions. This can be evidenced through assessor observations of learners carrying out practical work, supported by appropriate observation records.

Suggested resources

Books

Hutchings K, Bertin I and Osborne C – *Classical Chemistry Experiments*
(The Royal Society of Chemistry, 2000) ISBN 9780854049196

Sykit S – *Signs, Symbols and Systematics* (ASE, 2000) ISBN 9780863573125

Websites

Focus Educational Software Ltd www.focuseducational.com

Sector Skills Council for Science,
Engineering and Manufacturing
Technologies www.semta.org.uk