Unit Support Notes

Unit Support Notes — Science: Practical Experiments (National 2)

Valid from August 2015

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Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

Contents

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the *Science: Practical Experiments* (National 2) Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- the *Unit Specification*
- the *Unit Assessment Support* pack

General guidance on the Unit

Aims

The *Science: Practical Experiments* (National 2) Unit is a free-standing Unit and is designed to meet the needs of a broad range of learners who may choose to study it.

The general aim of the Unit is to provide opportunities for learners to carry out practical experiments in science-related contexts.

Progression into this Unit

Entry into this Unit is at the discretion of the centre.

This Unit may be suitable for learners who have successfully completed qualifications in science, numbers skills or related areas at SCQF level 1.

Prior learning, life and work experiences may provide an appropriate basis for entry into this Unit. This could include relevant skills, knowledge and understanding and appropriate experiences and outcomes.

Skills, knowledge and understanding covered in this Unit

As this Unit will be delivered on a free-standing basis, teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

Content and contexts which are used in the teaching of this Unit are at the discretion of the centre. However, content and contexts should provide evidence that all Outcomes and Assessment Standards in the Unit have been achieved.

Learners who complete this Unit will be able to:

1 Carry out practical experiments.
2 Handle information from practical experiments.

Progression from this Unit

This Unit may provide progression to:

- other Science Units and Courses at National 2
- other Units, Awards and Courses at National 2
- other related Units, Awards and Courses at National 3
- further study, employment and/or training

Further details about these Units can be found on SQA's website.

Learners may progress to other Units at the same level or Units and Courses at higher levels. The nature of this progression will depend on the individual needs of the learner.

The skills, knowledge and understanding developed in this Unit could also support progression in other curriculum areas as well as life and work contexts.

Approaches to learning, teaching and assessment

The purpose of this section is to provide general advice and guidance on approaches to learning, teaching and assessment which can be used for the delivery of this Unit.

Learning and teaching

The skills-based focus of the Unit lends itself to the use of a variety of learning and teaching approaches, reflecting the values and principles of the curriculum. Effective learning and teaching will draw on a variety of approaches to enrich the experience of learners. In particular, a mix of approaches which provide opportunities for personalisation and choice will help to motivate and challenge the learners.

Learning should be relevant to the learner's everyday life, their overall learning programme, and/or work and leisure. Teachers/lecturers could also consider interdisciplinary and cross-curricular approaches to learning and teaching, and explore how extra-curricular activities or the personal interests of learners could be included and recognised.

Many of these approaches could involve group work. Group work approaches can be used within Units where it is helpful to simulate real-life situations, share tasks and promote teamworking skills. However, there must be clear evidence for each learner to show that they have met the required Assessment Standards for the Unit.

Learners should be given the opportunity to use their normal mode of communication and have access to the appropriate resources for support where they would normally be available in real-life situations in which the activity is being carried out.

Examples of learning and teaching approaches and ways of recording evidence are provided in the table on the next page.

Science: Practical Experiments (National 2)

The general aim of this Unit is to provide opportunities for learners to carry out practical experiments in science-related contexts. Science could include: Biology, Chemistry and Physics. The learner will:

Outcomes and Assessment Standards	Guidance and suggested learning and teaching approaches
1 Carry out practical experiments by: 1.1 Contributing to the planning of given experiments 1.2 Participating in carrying out given experiments 1.3 Following safe working practices appropriate for given experiments	Possible contexts for practical experiments could include:

Biology	Chemistry	Physics
The living body	Acids and alkalis	Energy (eg electricity)
Plants	Clothing, fibres and dyes	Forces (eg magnetism)
Environment	Metals	Light, colour and sound
	Fuels	
Animal kingdom	Matter/substances	Earth and space
	Detergents	

Teachers/lecturers should choose the scientific context and the experiments to be carried out. Teachers/lecturers are free to choose experiments from across the science-related contexts or choose all experiments from one specific science-related context, as appropriate. Examples of possible activities and/or experiments which could be carried out are available in the Science: Practical Experiments resource sheet in Appendix 2.

In preparation for the practical experiments, learners could investigate different aspects of science

(eg the effects of energy and forces on materials and objects, the conditions required to grow plants, type of fuels). This could include using sources of information (eg books, posters, films, guest speakers, internet) to identify key factors, materials required and/or types.

Learners contribute to the planning for a given experiment by identifying equipment and/or resources required; identifying steps to be followed in the experiment and making simple predictions about what might happen during the experiment.

Learners could be asked to choose the appropriate equipment and/or resources from a list of alternatives/selection of images/pictures. Learners could also be supported in identifying the steps to be followed. For example, the learners could be given a list of instructions for the given experiment and asked to put them into the correct sequence.

Learners could be asked to choose a simple prediction from a list of alternatives. Some learners may need to discuss alternatives and be given some prompting in order to select a simple prediction. Learners should be reminded that an incorrect prediction does not mean they failed; it could just mean that the experiment revealed new facts or information which they had not considered before.

Learners could also help set out equipment and/or resources for the experiment and help prepare equipment and/or resources for recording the results of the experiment as part of the planning for a given experiment. Learners then actively participate in a given experiment. Examples of experiments could include:

Biology	**Chemistry**	**Physics**
Plants	Matter/substances	Energy and forces
♦ creating the appropriate environment to grow strawberries	♦ mixing different solutions together to create a reaction (eg mixing baking soda and vinegar to make a ‘volcano’)	♦ creating energy (eg creating static electricity using balloons)

	<table><tr><td>♦ creating the appropriate environment to grow mushrooms</td><td>♦ testing materials to determine properties (eg does black or white absorb more heat?)</td><td>♦ testing a selection of different materials/liquids for buoyancy</td></tr></table> It is expected that, when carrying out the given experiments, learners will be given specific instructions and will be following safe working practices and complying with health and safety requirements, including using equipment and resources appropriately. This could form part of the instructions given by the teacher/lecturer at the beginning of the experiment. Examples could include: ♦ wearing protective clothing (eg overall, disposable gloves, eye protectors/goggles) ♦ protecting workspace during experiments (eg putting down newspaper, plastic sheeting) ♦ making sure workspace is clear of hazards (eg tucking stools under desks)
2 Handle information from practical experiments by: 2.1 Recording appropriate information 2.2 Presenting information in an appropriate format 2.3 Drawing simple conclusions from practical experiments	Learners record and then present the results of practical experiments in an appropriate format. Teachers/lecturers could provide pre-prepared worksheets for learners to use to record the results of practical science-related experiments. Learners could also communicate the conclusions of practical science-related experiments by responding to prompt questions, taking part in group discussions and/or by working in pairs. Alternatively, teachers/lecturers could help learners identify an appropriate format for recording and presenting their findings. Examples could include: ♦ taking, saving and printing photographs of the experiment (eg 'volcano' erupting) ♦ completing a pre-prepared table/checklist (eg with number of times, temperatures, heights) ♦ recording results from a series of tests and plotting results on a given graph template (eg amount of rain collected each week/month) Learners also draw simple conclusions from practical experiments. Teachers/lecturers could discuss the results of practical experiments with learners (eg when we did 'X' the result was 'Y') and/or help learners draw conclusions by using prompt questions (eg 'what would happen if..?', 'which materials

	floated the longest?', 'what material(s) went on fire first?') Examples of simple conclusions which could be drawn by learners include: ♦ Different plants need different conditions to grow — strawberries need bright conditions, mushrooms need dark and damp conditions. ♦ Making a 'volcano' — mixing ingredients together can be dangerous. ♦ Testing materials for heat absorption — black absorbs more heat than white. ♦ Creating energy — static electricity will make a balloon stick to clothes.

Assessment
There is no external assessment for National 2 Units. All Units are internally assessed against the requirements outlined and described in the *Unit Specification* and the *Unit Assessment Support* pack.

To achieve the Unit, learners must achieve the Unit Outcomes.

Evidence for this Unit could be collected during learning and teaching activities.

Teachers/lecturers could therefore record naturally occurring evidence as a way of meeting the Unit Outcomes. Naturally occurring evidence is evidence which occurs within and as part of the learning and teaching, and can be recorded for assessment purposes in a variety of ways, including:

- observation of evidence demonstrated during an activity (using an observation checklist, visual recording, photography or equivalent)
- oral questioning before, during and on completion of an activity (recorded using an audio-visual or audio recording or using detailed written assessor notes as evidence)
- learning and teaching activities which generate physical evidence for assessment
- identifying opportunities to record evidence within out-of-centre activities

Alternatively, where assessment is carried out as a discrete activity, this could be as a single event or it may be broken up into smaller, more manageable sections. In this case, care must be taken to avoid duplication of evidence and potential assessment.

Learners will benefit from receiving accurate and regular feedback on their work regarding their learning. This helps to ensure they are actively involved in the assessment process. It is also important that different approaches to assessment are adopted to suit the varying needs of learners.

Authentication
For guidance on authentication of evidence that is gathered outwith the direct supervision of the teacher/lecturer responsible for the learner, eg outside the school or classroom, refer to SQA's *Guide to Assessment.*

It is important that teachers/lecturers track and keep accurate records of their assessments in order to:

- inform learners of their progress
- identify where further consolidation is required
- retain and store appropriately evidence of work in progress and completed work for verification purposes

It is anticipated that learners will need a high degree of teacher/lecturer assistance. More details about the type of support are provided within the Equality and inclusion section.

Developing skills for learning, skills for life and skills for work

The *Unit Specification* lists the skills for learning, skills for life and skills for work that learners should develop in this Unit. These are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and should be built into the Unit where there are appropriate opportunities. The level of these skills will be appropriate to the level of the Unit.

Skills for learning, skills for life and skills for work	**Examples of learning and teaching approaches**
1 Literacy	
1.3 Listening and talking Listening means the ability to understand and interpret ideas, opinions and information presented orally for a purpose and within a context, drawing on non-verbal communication as appropriate. Talking means the ability to communicate orally ideas, opinions and information for a purpose and within a context.	Where appropriate, learners could use their normal mode of communication to: ♦ communicate, eg identify equipment and/or materials required for given practical science-related experiments ♦ respond, eg communicate the results of given practical science-related experiments
2 Numeracy	
2.3 Information handling Information handling means being able to interpret data in tables, charts and other graphical displays to draw sensible conclusions. It involves interpreting the data and considering its reliability in making reasoned deductions and informed decisions. It also involves an awareness and understanding of the chance of events happening.	Where appropriate, learners could demonstrate information handling by: ♦ recording the results of given practical science-based experiments ♦ drawing simple conclusions from the results of given practical science-related experiments
5 Thinking skills	
5.1 Remembering Remembering is the ability to identify, recognise and recall facts, events and sequences.	Where appropriate, learners could demonstrate remembering skills by: ♦ following the steps required to carry out given practical science-based experiments
5.3 Applying Applying is the ability to use existing information to solve a problem in a different context, and to plan, organise and complete a task.	Where appropriate, learners could demonstrate application skills by: ♦ helping to plan, organise (eg equipment and/or materials), and carry out given practical science-related experiments

5.4 Analysing and evaluating This covers the ability to identify and weigh-up the features of a situation and issue and to use your judgement of them in coming to a conclusion. It includes reviewing and considering any potential solutions.	Where appropriate, learners could demonstrate analysis and evaluation skills by: ♦ recording the results of given practical science-related experiments and drawing simple conclusions from these results

It is important that learners have opportunities to develop these broad general skills as an integral part of their learning experience.

There will be opportunities for the development of additional skills for learning, skills for life and skills for work throughout this Unit. These will vary from centre to centre depending on the approaches being used to deliver the Unit.

Equality and inclusion

The additional support needs of learners should be taken into account when planning learning experiences or when considering any reasonable adjustments that may be required. Assessment methods should offer all learners an equal opportunity to demonstrate their achievement. This should be reflected in the language used, the use of different assessment presentation methods and the use of appropriate illustrative materials that reflect an inclusive view.

Learners undertaking qualifications at SCQF level 2 are likely to require more support with their learning than at other levels. The support provided should be appropriate for the learner, for the subject area and for the activity involved. Examples of support might include:

- allowing extra time to complete activities
- practical helpers under direct learner instruction could assist with practical activities (this could also include a reader and/or scribe as appropriate)
- the use of specialised and adapted equipment
- the use of ICT, including adaptive technologies such as braille and assistive technologies (such as voice-activated software) to support learners with limited capacities to write

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these *Unit Support Notes* is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment to take account of the specific needs of learners can be used. However the centre must be satisfied that the integrity of the assessment is maintained and where the alternative approach to assessment will generate the necessary evidence of achievement.

Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- Assessment Arrangements (for disabled candidates and/or those with additional support needs) — various publications on SQA's website: http://www.sqa.org.uk/sqa/14976.html
- *Building the Curriculum 4: Skills for learning, skills for life and skills for work*
- *Building the Curriculum 5: A framework for assessment*
- *Guide to Assessment* (January 2014)
- Principles and practice papers for curriculum areas
- *Research Report 4 — Less is More: Good Practice in Reducing Assessment Time*
- *Coursework Authenticity — a Guide for Teachers and Lecturers*
- *SCQF Handbook: User Guide* *(published 2009)* and
- SCQF level descriptors: www.sqa.org.uk/sqa/4595.html
- *SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work*
- *Skills for Learning, Skills for Life and Skills for Work: Using the Curriculum Tool*
- SQA *Guidelines* on e-assessment for Schools
- SQA Guidelines on Online Assessment for Further Education
- SQA e-assessment web page

Appendix 2: Science — Practical Experiments resource sheet

Biology

Context	Topic	Experiment/activities
Living body	Heart and circulatory system	Investigate the effect of exercise on pulse rate.
		Find out whether different parts of the body give equally good and reliable pulse rate readings.
	Lungs and breathing	Investigate the effect of exercise on the rate of breathing.
		Compare the carbon dioxide content of expired and un-expired air.
		Investigate the change in chest circumference when breathing in and out.
		Measure lung capacities of group members and compare with their weight/height.
	Food and digestion	Investigate a range of foods for the presence of starch and sugar.
		Investigate a range of foods for the presence of protein.
		Investigate the changes which take place when bread is chewed for a while.
		Investigate the water content of food by weighing the amount of water taken up by dehydrated food (eg dried fruit, rice, pasta).
		Test foods for fat (eg milk, butter, instant meals, snacks, nuts, raw fruit and vegetables) using filter paper.
	The senses	Investigate the sensitivity of different parts of the arm, eg forearm, palm, fingertip, wrist.
		Investigate the ability to recognise/identify foods while blindfold with/without the opportunity to smell.
		Investigate the relationship between eye colour and sensitivity to cold.
	Reproduction	Plan and carry out a survey to find out whether birth weight is related to sex of a baby.
	Healthy bodies and lifestyle	Investigate distribution of body fat by measuring under skin of various parts of the body (eg skull, fingers, lower arms) using skin callipers.
		Investigate connections between height and weight by measuring the height and weight of a small group of people.
		Using paper tubes, investigate the strength of bones. Show, using weights, that they can withstand more force along the length than from the side.
		Investigate muscle fatigue using finger muscles to repeatedly stretch an elastic band. Find out how the number of repetitions per 20 seconds changes as the time of the exercise increases.

Plants	Variety of plants	Test green and variegated leaves for presence of starch.
		Test acidity of soil in a coniferous and deciduous forest.
		Plan and carry out a survey of the different plants growing in a small area.
	Seed biology	Investigate the best conditions for seed germination, eg heat, light, moisture.
		Investigate different methods of seed dispersal.
		Design and carry out an investigation into which kind of wind-dispersed seed travels the furthest when dropped from the same height.
	Plant development	Investigate how the direction of light affects plant growth.
	Plant growth	Investigate the effect on growth of different conditions, eg air, water, temperature, soil, drainage.
		Investigate using different solutions/media to grow plants and measure which one grows the quickest over a period of time.
Environment	Water pollution	Examine water samples for quantity and variety of life from polluted and non-polluted environments.
		Test acidity of water at different points in a stream to find out if it is always the same.
	Litter and the environment	Plan and carry out an audit of litter in a social area, eg school playground.
		Plan and carry out an investigation into whether the amount of litter dropped is affected by the number of bins available.
	Detergents and their effect on the environment	Investigate the effect of small quantities of detergent on the growth of algae (eg green pond scum or algae from a pet shop that sells fish).
Animal kingdom	Environment	Use a choice chamber (a box with four compartments, ie wet and dark/wet and light/dry and dark/dry and light), drop in some woodlice and find out which environment they prefer.
		Investigate your environment (eg school playground) and find out what kind of creatures live there.
	Food chains	Investigate a simple food chain in action — make a 'planet in a bottle' using brine shrimps, algae and sand in salty water.
		Investigate the role of decomposers by making a wormery. Use layers of sand and soil to track the worms' movements.

Chemistry

Context	Topic	Experiment/activities
Fuels	Fire and fire safety	Investigate the effect of oxygen starvation on a flame — vary size of beaker and measure time for flame to extinguish.
		Make CO_2 extinguisher using vinegar and bicarbonate of soda. Place in large dish next to a lit candle. Once chemicals have mixed, the CO_2 extinguishes the flame.
		Test a variety of flameproof and non-flameproof materials.
		Find out about different types of fire extinguishers, eg which one to use in different types of fires and test different extinguishers.
	Food as fuel	Burn different food types (eg peanuts, sugar) and investigate heat produced.
		Investigate the products of burning such foods.
Matter/substances	Solids, liquids and gases	Find the temperature of melting ice and investigate the effect of adding salt.
		Find the temperature of boiling water and investigate the effect of adding salt.
		Investigate how to speed up/slow down evaporation.
		Investigate the melting points of different solids, eg chocolate.
		Create carbon dioxide and inflate a balloon (over the neck of a bottle) by using yeast, sugar and warm water or lemon juice, baking soda and water.
	Solutions	Test which substances are soluble from a list, eg sugar, salt, chalk, instant coffee.
		Investigate the effect of heating on speed of dissolving.
		Investigate the effect of stirring/crushing on speed of dissolving.
		Investigate mixing of liquids, eg syrup and water, oil and water; mix water, vegetable oil, salt (and food colouring for effect) to create lava lamp effect in a cup; make your own volcano by mixing vinegar, washing up liquid and baking soda.
Matter/substances	Mixing and separating substances	Mix sand and water, and investigate the effectiveness of using different types of filter to separate them.
		Mix and separate salt and water, copper sulphate and water.
Metals	Causes of corrosion	Carry out test-tube experiments to show that water and air are needed for rusting.
		Investigate the effect of acid rain and salt on the rusting process.
		Use rust indicator to show what parts of a nail rust first.

	Causes of corrosion	Plan and carry out a survey to find the extent of corrosion in a particular area.
		Investigate metals to find one which does not rust easily.
	Prevention of corrosion	Investigate ways of slowing down or stopping rusting.
Clothing, fibres and dyes	Clothes	Compare the properties of a natural and a man-made fabric. Test wear resistance (rub with sandpaper block), wind resistance (blow air through material with a hairdryer and see if a piece of paper on the other side blows about), insulating properties.
	Fibres	Compare the strength of different types of fibre by hanging weights on to threads until they break.
	Dyes	Make dye (eg by using whins, brambles, onion skins, beetroot, coffee). Compare the colour fastness with that of a mineral dye.
		Investigate the ease with which different fabrics can be dyed (eg nylon is not very absorbent and so it does not dye well).
Acids and alkalis	Common acids and alkalis	Create PH scale for classroom and then use litmus paper and/or natural indicator (eg red cabbage) to test a range of common household acids and alkalis brought in my pupils
	Neutralisation	Neutralise weak acid solutions with indigestion remedies or toothpaste and then test with litmus
	Acid rain	Investigate the effect of weak acid on plant growth by watering some cress plants with water and other cress plants with weak acid
		Investigate the effect of weak acid on limestone or chalk powder
Detergents	Removing dirt	Investigate the effect of detergent on the surface tension of water. Look at water droplets with/without detergent in them. Add detergent to water which has an object (eg a paperclip) sitting on its surface
		Investigate the effectiveness of water with and without detergent on removing soot from cloth. Run water with/without detergent through sooty cloth and see the difference in the water which comes through

Physics

Context	Topic	Experiment/activities
Energy	Sources and use of energy	Use a solar-powered sensor to measure solar energy in different locations.
		Make wind turbine, following investigation into different sources of energy, eg renewable and non-renewable.
	Energy changers	Build an elastic band roller or projectile launcher and investigate the effect of increasing the number of winds/length of elastic.
		Investigate the effect of changing the number of winds on the distance travelled by a wind-up toy.
		Investigate the effect of changing the number of panels/and angle of panel, on solar power output.
	Heat energy	Investigate the effect of heat energy on solids, eg bi-metallic strip; metal ball and holder.
		Investigate effect of heat energy and liquids, eg boiling/evaporation rates for different liquids.
		Investigate effect of heat on gases, eg make a hot air balloon using kit.
		Test the thermal conductivity of different metals.
		Test materials for best insulator.
	Electricity	Test materials for static, eg ability to pick up pieces of paper after rubbing.
		Use static electricity to move an empty drinks can; bend water; make pepper (in a clear plastic box) jump and stick to the lid of the box.
		Investigate which materials retain static charge over time.
		Build a simple circuit which includes a bulb, a meter and a battery and test the effect of including more than one bulb; including different types of bulb; test different types of materials to see if they conduct.
		Design and build a hoop and wire game.
Forces	Push and pull	Investigate the use of pulleys with different weights.
		Test different thread strengths.
		Investigate the stretching of elastic bands of different thickness.
		Investigate the best shape for a parachute by designing and testing different shapes.
	Floating and sinking	Test a selection of different liquids for buoyancy.
		Test which materials float and which sink in water, eg an orange (with and without rind). Investigate the effect of adding salt to water, eg to make an egg float in a glass of water.
		Design and make a Plasticine ® shape which will float.
	Friction	Test the speed of movement of toy car on different surfaces.
		Test the speed of movement of toy car on different slopes.

	Magnetism	Investigate the attraction of unlike poles and repulsion of like poles using two magnets.
		Using iron filings, investigate the magnetic field around a bar magnet, eg a pair of magnets with poles placed North to North and a pair of magnets with poles placed North to South.
		Make a floating compass with a needle and cork. Investigate the direction it points with a magnet present and without a magnet present.
		Make an electromagnet by coiling wire around an iron nail and connecting it to electric circuit. Investigate the effect that number of turns in the coil, size of current flowing, and the presence of an iron core (with or without nail) have on its strength (eg the ability to pick up paper clips).
Light, colour and sound	Light and colour	Investigate refraction of light through water/glass/ Perspex using various shapes of block, eg cube, pyramid.
		Investigate the splitting of white light into a spectrum using a prism and a light source, eg a ray box or torch.
		Investigate colour mixing using a light source and colour filters.
		Test which colour absorbs more light and heat by covering glasses of water with different coloured paper, leaving the glasses in the sun and then measuring the temperature of water in each glass.
	Sound	Look at the effect of sound waves on soap film or stretched clingfilm (movement of soap film or sand and rice on clingfilm).
		Investigate pitch and length of vibrating string or column of air (eg by using a home-made guitar).
Earth and space	Earth, sun and moon	Investigate factors affecting the size and shape of craters on the moon, eg drop different size marbles into a tray of sand.
	Planets and stars	Make a telescope using two convex lenses (focal lengths of lenses 5cm and 25cm, lenses placed 25cm apart and compare the image seen with the original object.
	Gravity	Drop different weights of similar shape from a height and investigate the rate at which they fall.

Administrative information

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History of changes to Unit Support Notes

Unit details	Version	Description of change	Authorised by	Date