Science Differentiation in Action

Practical Strategies for Adapting Learning and Teaching in Science for Students with Diverse Needs and Abilities
All documents contained in this resource pack are available in word format (see the attached CD) and can be adapted to suit individual needs.
In the constant quest to develop the art of teaching, teachers continue to seek accessible information to assist them in enhancing learning and teaching for students with special educational needs. The complex and diverse nature of learning precludes the development of definitive reference material to meet the needs of all individual learners. Valuing difference and individuality underpins and is intrinsic to the concept of special educational needs. Viewing learning and teaching through a holistic lens, the interaction of individual social and psychological factors in affecting learning is an intricate process that teachers negotiate on a daily basis.

The teaching of science combines the development of knowledge and understanding of the physical, chemical and biological aspects of the world with the processes of scientific activity, through which knowledge and understanding are developed for pupils with special educational needs. The experience of science will enable the students develop a greater understanding of the world around them as well as developing a range of transferable skills.

Science Differentiation in Action: Practical Strategies for Adapting Learning and Teaching in Science for Students with Diverse Needs and Abilities comprises differentiated lesson plans together with worksheets, activities and ideas that can be implemented in the classroom. It is not intended that individual lesson plans form part of any teacher’s subject planning. They should be seen as an aid to inform and enhance the use of these resources. The material is exemplary material only and does not purport to describe the syllabus. The SESS welcomes comments from individual teachers using this resource pack. A feedback form is included in the Appendix for this purpose.

The Special Education Support Service (SESS) wishes to acknowledge that this document has been compiled with the assistance of the materials and resources referenced throughout this publication. The SESS takes cognisance of the fact that special education is a continually evolving area. Bearing in mind the ever-changing landscape, SESS aims through the newsletter CABHAIR, through such publications as Science Differentiation in Action: Practical Strategies for Adapting Learning and Teaching in Science for Students with Diverse Needs and Abilities and through its targeted programmes of continuing professional development to provide continuous support for teachers in relation to current and possible future developments in the field. Both this publication and the SESS newsletters are available electronically on the SESS website www.sess.ie where direct links are also presented for many websites associated with special educational needs. Links/references that the SESS provides to other websites are to act as a reference to help teachers to identify and locate other Internet resources that may be of interest. These are independently developed by other parties and the SESS does not assume responsibility for the accuracy or appropriateness of the information they contain or necessarily endorse the viewpoints expressed therein. This also relates to any references the SESS makes to specific books, commercial products or services by trade name.

I wish to acknowledge the advice of the SESS Steering committee throughout the design and development of this resource. Special thanks to the teachers of St. Caimin’s Community School, Shannon, Mount Sackville Secondary School, Dublin and School of the Divine Child, Cork for their feedback at the pilot stage. Many thanks also to Mary Casey (Gonzaga College), Susan Dowd (Gonzaga College), Mary Dunne (Presentation College Carlow), Evelyn Jackson (Galway Community College), David Keenanahan (Gonzaga College) and Seamus Walshe (Presentation College Carlow) for their scientific insights and editorial skills. I would like to extend special thanks to Emer Ring, Senior Inspector...
for her continued interest, advice, support and editorial skills in the development of this resource. I am also grateful to the SESS team – in particular Assistant National Co-ordinator Madeline Hickey for her contribution to the development of this work. Finally, thanks to Sean O’Leary, Assistant National Co-ordinator, SESS whose own art of teaching science has indeed awakened a joy of creative expression and knowledge of science amongst teachers and students alike.

Joan Crowley O’Sullivan
National Co-ordinator
May 2008
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Introduction
Introduction

Students with special educational needs attend both mainstream and special schools. One of the dilemmas that we face as teachers on a daily basis is how to adapt the learning outcomes set out in the science syllabus so that they are accessible to a broader range of students. This resource pack outlines general strategies that can be used to adapt activities for all students and provides specific examples of modified activities.

Science education is in a strong position to meet the needs of students with special educational needs because curriculum adaptations can easily be made part of the regular variation within classroom instruction. Active learning, co-operative groups and whole-class discussion, which figure prominently in the research literature on effective science teaching, also provide opportunities for meeting the requirements of students with special educational needs.

In an era of rapid scientific change, the aim of ‘scientific literacy for all’ has become a main objective of a general education. Science, reading and mathematics form the three literacy domains that are included in measures of educational achievement by the OECD (see www.pisa.oecd.org for more information on the Programme for International Student Assessment). Although few people could disagree with the goal of achieving scientific literacy for all students, taking the practical steps to implement a scientific education for students can be a complex and challenging task.

The revised syllabus in Junior Certificate Science is predicated on a hands-on investigative approach to science teaching and learning. Students attain learning outcomes through a variety of investigations and experiments. This investigative approach enhances student motivation by encouraging students to make their own decisions and take some responsibility for their own learning. It also provides valuable opportunities for collaborative learning.

We can and do provide safe programmes for students with special educational needs. In mainstream schools, communicating with resource teachers and learning support teachers can be a first step in adapting content and methodologies for a diverse range of students. Varying learning strategies, planning activities and minimising safety risks form crucial elements in the inclusion of all students in the science classroom or school laboratory. A list of practical Strategies to Support Students with Special Educational Needs in the Mainstream Classroom is located in the Toolkit section of this resource pack.

Differentiation is a process by which we can enable all students to engage in the curriculum by providing learning tasks and activities that are tailored to their needs and abilities.

We can differentiate the
• content being learned by a student, e.g. some students might learn five functions while others learn three;
• process or way in which a student accesses material, e.g. by using the Internet, a computer programme or a textbook;
• outcome or way in which a student shows what he or she has learned, e.g. by writing a paragraph, drawing a diagram etc.

We differentiate in response to a student’s
• readiness, skills and background knowledge;
• interests relevant to the content;
• learning profile, which includes how the student likes to learn (i.e. a visual, auditory, or kinaesthetic learner), the student’s grouping preferences (i.e. individual, small group, or large group) and the student’s preferences for space (e.g. a quiet space in the classroom).

When we differentiate learning and teaching activities to meet the needs and abilities of students, we are making learning more personal and relevant. This personalised approach provides every student with opportunities to reach their potential, whatever their ability level, need or background. Therefore, it does not lower standards, but rather it raises standards for all students through enabling them to access the curriculum at a level appropriate to their needs and abilities. This resource pack contains differentiated lesson plans and resources for the science classroom. It is
not intended that individual lesson plans form part of your subject planning. These plans are included to inform your use of the resources and ideas included in this resource pack. Many of the lesson plans include interactive PowerPoint presentations, which can be used to review lessons quickly with pictures and instructionally sound feedback. These presentations also reduce the need for lengthy descriptions with the instant display of a resource. A picture may instantly promote discussion or remind students of a key concept. This allows us more time to engage meaningfully with students, which can foster student-centred learning. Finally, interactive PowerPoint presentations can present material in a variety of ways and cater for the needs of different learners: verbal, kinaesthetic and/or visual. In short, such presentations encourage interactive student-centred teaching and learning.

This resource pack includes worksheets, activities and ideas that you can use directly in your own classrooms, but the main aim of this pack is to further stimulate your creativity as a teacher in order to enhance the learning opportunities for students within your science classroom. This pack should be used in conjunction with the syllabus documents (Junior Certificate Science Syllabus Revised) and relevant teacher guidelines available from the National Council for Curriculum and Assessment (NCCA). This material is exemplary material only and does not purport to describe the content of the syllabus. Other teachers may also find many of the activities useful in their particular subject areas. While these materials have been piloted and used successfully with second-level students, it is emphasised that these resources do not purport to meet the individual needs of all students. It is envisaged that teachers will further adapt these resources, as required, in accordance with the needs and abilities of individual students in their classes.

Font, picture and diagram sizes can be adjusted to facilitate students’ access to the materials. It is important to note that differentiation is an ever-evolving process that depends not only on our students but also on us as teachers. Just as our students change and develop our approach to differentiation changes. In order to optimise students’ learning and teaching, attention should consistently be directed to the assessment of students’ progress and achievements. Advice on assessment is provided in the Toolkit section of the pack.

The greatest skills that we need as teachers are flexibility and open-mindedness so that we can develop our competence and confidence to meet our students’ needs. Differentiation is not just about facilitating different curriculum content, learning styles and student work, but more importantly, it is about valuing each student by establishing a classroom and school environment where everybody belongs.

Sean O’Leary
Assistant National Co-ordinator
Special Education Support Service
## 2.1 Safety

3 – 4 lessons

### Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Harmful</th>
<th>Irritant</th>
<th>Flammable</th>
<th>Corrosive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxic</td>
<td>Oxidising</td>
<td>Hazard</td>
<td>Substance</td>
</tr>
<tr>
<td>Risk</td>
<td>Hazard Symbol</td>
<td>Chemical</td>
<td>Reaction</td>
</tr>
</tbody>
</table>

### Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to identify safety symbols</td>
<td>To be able to identify hazards particular to themselves and others in the lab</td>
<td>To be able to apply safety issues to new situations and environments, e.g. other specialist classrooms</td>
</tr>
<tr>
<td>To be able to identify safety hazards in the lab</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To be able to identify safety rules</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Sequence of lesson

1. Introduce the concept of safety. Allow students to relate personal experiences of safety. This could be facilitated by using the Safety PowerPoint and encouraging student input during the presentation.
2. Carry out experimental activities in groups with a focus on safety. Discussion of key vocabulary, risks and safety rules.
3. Review – whole class discussion. Possibility of using Safety Quiz PowerPoint to facilitate student understanding.
4. Further class work/homework – see Safety Contract (which can be augmented with visual cues) and Safety Worksheet.

### 1. Differentiate by content (in what ways can I vary the content of what I am teaching?)

#### (A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with hazards (e.g. acid in a beaker) and safety (e.g. safety glasses, hair ribbon, fire blanket, lab coat/apron)</td>
<td>Hazard Symbols</td>
<td>Why do we have safety rules? Appreciation of the importance of safety in our daily lives and in the science lab</td>
</tr>
</tbody>
</table>

#### (B) Variety of resources

As listed above. Also potential use of first aid resources for further exploration of material related to safety

#### (C) Variety of learning environments

Classroom, school laboratory, computer room
2. **Differentiate by process** (How will I teach the lesson?)

**Sequence of lesson as laid out above**
- Introduction – using concrete or symbolic material or a general class discussion
- Teacher may demonstrate use of apparatus to the class, emphasising safety. For resources, guidance and support related to facilitating student experiments and investigations, see [www.juniorscience.ie](http://www.juniorscience.ie)
- Closely observe students as they perform the activities individually or in pairs
- Possible use of Safety Quiz PowerPoint to facilitate discussion. Differentiated questioning can be used in accordance with the needs and abilities of different students
- Students sign Safety Contract, which can also be signed by parents. Insert pictures/symbols on Safety Contract to assist students who require additional support in literacy skills

3. **Differentiate by outcome/product** (How will the student demonstrate understanding?)

**See Worksheets, Classroom Activities and Experiments sections of this resource pack**
- Students may draw hazard symbols in their copies
- Whole class review work completed at end of class
- Homework: Safety Worksheet if not used for class work. Specify time to be allocated to this work at home. Differentiate this worksheet further if required for individual students

Finally - any other possibilities for this lesson?
- Explore students’ learning preferences using the *What I like doing!* worksheet contained in the Classroom Activities section of this resource pack. These worksheets have a reading age of about 7.5 years so they are suitable for a broad range of students. It is also useful to read Ways of Learning and Readability located in the Toolkit section of this folder
- Modelling various hazards through role play and then dealing with them safely
- Compiling a collage of scenes showing unsafe practice
- Other written activities e.g. a log of the different types of safety hazards in the school
- Extension exercise: A world without safety rules: Could we survive?
- Cross-curricular links: Art, Craft & Design, Home Economics, Technology
- For advice on enhancing curricular access through the use of mobile ICT, see [www.laptopsinitiative.ie](http://www.laptopsinitiative.ie)
2.2 BALANCED DIET

(LEARNING OUTCOMES BY SYLLABUS REFERENCE: OB1 AND OB2)

3 – 4 lessons

Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Carbohydrates</th>
<th>Fibre</th>
<th>Starch</th>
<th>Constipation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>Vitamins</td>
<td>Minerals</td>
<td>Calcium</td>
</tr>
<tr>
<td>Iron</td>
<td>Pyramid</td>
<td>Fat</td>
<td>Water</td>
</tr>
</tbody>
</table>

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To recall that a balanced diet is important for health</td>
<td>To label a food pyramid</td>
<td>To be able to compare and contrast different diets</td>
</tr>
<tr>
<td>To identify the six constituents of a balanced diet and give the function of each</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of a balanced diet. Seek level of prior knowledge of class. This could be facilitated by using the Balanced Diet Introduction PowerPoint.
2. Analyse typical diets using volunteers in the class. Discussion of key vocabulary.
3. Review – whole class discussion / dissemination of ideas / extra information. Possibility of using Graphic Organisers located in the Toolkit section of this resource pack to facilitate student understanding.
4. Further class work/homework – see Balanced Diet Worksheet. Devise extension activities as required.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)
   
   (A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with food e.g. fruit, sweets, food packaging A 3-dimensional food pyramid could be constructed in consultation with woodwork teacher</td>
<td>Food pyramid and other images</td>
<td>The interaction of lifestyle, age and diet in healthy living</td>
</tr>
</tbody>
</table>

   (B) Variety of resources

   As listed above. Also potential use of the Internet and/or school or community library for further exploration of material related to diet
(C) Variety of learning environments

Classroom, school laboratory, computer room/library in school

2. Differentiate by process (How will I teach the lesson?)

Sequence of lesson as laid out above
- Introduction – using concrete or symbolic material or a general class discussion
- Divide class into groups. Differentially support groups through assisting students in discussing and analysing their own diets and drawing conclusions as appropriate and encouraging students to extend their thinking and language use
- Possible use of Graphic Organisers information sheet located in the Toolkit section of this resource pack to reinforce content and facilitate student understanding

3. Differentiate by outcome/product (How will the student demonstrate understanding?)

See Worksheets, Classroom Activities and Experiments sections of this resource pack
- Students may use a food diary to assist them to analyse their own diet
- Whole class review work completed at end of class
- Homework: Balanced Diet Worksheet if not used for class work
- Specify time to be allocated to this work at home

Finally - any other possibilities for this lesson?
- Collage of scenes showing different types of food
- Dramatisation, e.g. possible use of role play to highlight the importance of a balanced diet
- Other activities, e.g. create a menu containing balanced meals
- Internet search for material on a healthy lifestyle?
- For advice on enhancing curricular access through the use of mobile ICT, see www.laptopsinitiative.ie
- Visit to a local vegetable garden or shop
- Highlight problems associated with diet and how they can be overcome with a balanced diet
- Cross-curricular links: Geography, Social, Personal and Health Education (SPHE), Home Economics, Mathematics
2.3 DIGESTIVE SYSTEM
(LEARNING OUTCOMES BY SYLLABUS REFERENCE: OB6 AND OB7)
3 – 4 lessons

Keywords/terms to be taught

| Oesophagus | Stomach | Liver | Pancreas |
| Protein   | Vitamins | Minerals | Calcium |
| Small intestine | Large intestine | Molars | Premolars |
| Incisors | Canines | Enzyme | Saliva |

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To locate the parts of the digestive system and know their functions</td>
<td>To identify the four types of teeth and give their functions</td>
<td>To be able to relate biological structure with function</td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of digestion. Seek level of prior knowledge of class. This could be facilitated by using the Digestive System Introduction PowerPoint.
2. Relate parts of the digestive systems to their functions.
3. Review – whole class discussion/dissemination of ideas/extra information. Possibility of using Football Fever game located in the Classroom Activities section of this resource pack to facilitate student understanding.
4. Further class work/homework – see Digestive System Worksheet. Devise extension activities as required.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

(A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with digestion e.g. chewed food</td>
<td>Images of digestive system</td>
<td>The role played by each part of the digestive system in providing energy for cells</td>
</tr>
</tbody>
</table>

(B) Variety of resources

As listed above. Also potential use of the Internet and/or school or community library for further exploration of material related to diet

(C) Variety of learning environments

Classroom, school laboratory, computer room library in school
### 2. Differentiate by process (How will I teach the lesson?)

**Sequence of lesson as laid out above**
- Introduction – using concrete material or a general class discussion
- Possible demonstration: Dissection of digestive tract or parts of a digestive tract of a sheep from a local butcher shop
- *Digestive System Worksheet* to reinforce content. Assist students who require assistance to complete worksheet. Further differentiate the worksheet in accordance with the needs and abilities of students
- Possible use of *Football Fever* game or *Keyword* game located in the *Classroom Activities* section of this resource pack to reinforce content and facilitate student understanding
- Review – whole class discussion/dissemination of ideas/extra information

### 3. Differentiate by outcome/product (How will the student demonstrate understanding?)

**See Worksheets, Classroom Activities and Experiments sections of this resource pack**
- Students may use the *Digestive System Worksheet* to demonstrate understanding in addition to answering questions during the PowerPoint presentation
- Poster or other project work (e.g. a model) showing how our digestive system works
- Whole class review work completed at end of class
- Homework: See textbook for suitable questions

### Finally - any other possibilities for this lesson?

- Collage of scenes showing different parts of the digestive system in action
- Other written activities e.g. write a story about what happens to food as it passes through our bodies
- Internet search for material on a digestion
- Suggested Internet links include [www.juniorscience.ie](http://www.juniorscience.ie), [www.kidshealth.org](http://www.kidshealth.org), [www.innerbody.com](http://www.innerbody.com), [www.scoilnet.ie](http://www.scoilnet.ie) and [www.skool.ie](http://www.skool.ie)
- For advice on enhancing curricular access through the use of mobile ICT, see [www.laptopsinitiative.ie](http://www.laptopsinitiative.ie)
- Cross-curricular links: SPHE, Home Economics
2.4 Respiration

(Learning Outcomes by Syllabus Reference: OB9, OB10 and OB12)

3 – 4 lessons

Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Keyword/term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic</td>
<td>Respiration Product Carbon dioxide</td>
</tr>
<tr>
<td>Windpipe</td>
<td>Bronchus Bronchiole Air sac/alveolus</td>
</tr>
<tr>
<td>Diaphragm</td>
<td>Cancer Bronchitis</td>
</tr>
</tbody>
</table>

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to recall the structure of the lungs and how our lungs are affected by smoking. To describe the effect of exercise on breathing.</td>
<td>To describe the process of aerobic respiration using a word equation.</td>
<td>To describe in detail how oxygen is taken into the lungs and how carbon dioxide is excreted.</td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of respiration. Allow students to relate personal experiences of respiration and energy usage. This could be facilitated by using the Respiration Introduction PowerPoint and encouraging student input during the presentation.
2. Students investigate the products of aerobic respiration. For resources, guidance and support related to facilitating student investigations, see www.juniorscience.ie
3. Respiration Worksheet to reinforce basic content.
4. Review – whole class discussion. Possibility of using Ranking Game to facilitate student understanding.
5. Further class work/homework and extension activities as required.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

(A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with respiration, e.g. equipment for experiments</td>
<td>Newspaper articles/personal experiences relating to respiration and smoking illustrations, images of lungs, damaged lungs</td>
<td>Appreciation of the significance of oxygen in our daily lives</td>
</tr>
</tbody>
</table>

(B) Variety of resources

As listed above. Also potential use of the Internet and/or school or community library for further exploration of material related to respiration and smoking.
(C) Variety of learning environments

Classroom, school laboratory, computer room/library in school (as indicated above)

2. Differentiate by process (How will I teach the lesson?)

Sequence of lesson as laid out above
- Introduction – using concrete or symbolic material or a general class discussion along with Respiration PowerPoint
- Teacher may demonstrate use of apparatus to the class, emphasising safety. Students may take notes on demonstrations using written or pictorial records
- Possible use of Ranking Game to facilitate discussion

3. Differentiate by outcome/product (How will the student demonstrate understanding?)

See Worksheets, Classroom Activities and Experiments sections of this resource pack
- Student input during PowerPoint presentation
- Students may take notes during teacher demonstrations
- Students may work in pairs to complete Respiration Worksheet
- Whole class review work completed at end of class
- Homework: See textbook for suitable questions. Specify time to be allocated to this work at home

Finally - any other possibilities for this lesson?

- Collage of scenes showing respiration or the effects of smoking
- Dramatisation e.g. possible use of role play to emphasize the impact of smoking on lungs and people’s lives
- Other written activities – What my body does with oxygen
- Visiting speaker on the effects of smoking
- Internet search for material on smoking
- For advice on enhancing curricular access through the use of mobile ICT, see www.laptopsinitiative.ie
- Cross-curricular links: SPHE, Mathematics, Physical Education (PE)
2.5 LIVING THINGS
(LEARNING OUTCOMES BY SYLLABUS REFERENCE: OB38, OB39 AND OB40)

4 – 5 lessons

Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Organisms</th>
<th>Respiration</th>
<th>Sensitivity</th>
<th>Stimuli</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excretion</td>
<td>Reproduction</td>
<td>Growth</td>
<td>Movement</td>
</tr>
<tr>
<td>Vertebrates</td>
<td>Invertebrates</td>
<td>Mammals</td>
<td>Characteristic</td>
</tr>
<tr>
<td>Key</td>
<td>Photosynthesis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to investigate the variety of living things by direct observation</td>
<td>To be able to identify the characteristics of all living things</td>
<td>To be able to describe a variety of organisms in terms of characteristics</td>
</tr>
<tr>
<td>To be able to classify living things as plants or animals using a key</td>
<td>To be able to classify animals as vertebrates or invertebrates</td>
<td></td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of life. Collect samples of living things outdoors and identify a range of organisms using keys.
2. Students record results and write up experiment using text and/or pictures.
3. Review – whole class discussion/dissemination of ideas/extra information. Possibility of using Living Things Quiz PowerPoint to facilitate student understanding.
4. Further class work/homework – see Living Things Worksheet. Devise extension activities as required.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

(A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with collecting and identifying living things as well as the organisms themselves</td>
<td>Keys and the images or descriptions of organisms that they contain</td>
<td>The identification of organisms using keys</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The description of organisms using the characteristics of living things</td>
</tr>
</tbody>
</table>

(B) Variety of resources

As listed above. Also potential use of the Internet and/or school or community library for further exploration of material related to organisms.
(c) Variety of learning environments

Classroom, school laboratory, computer room/library in school, local field, stream etc. (as indicated above)

2. Differentiate by process (How will I teach the lesson?)

Sequence of lesson as laid out above
- Introduction – using concrete material or a general class discussion
- Divide class into groups. Assist the students, as required, to plan, carry out the experiment, record results and draw conclusions as appropriate. Enable students to extend their thinking and language use. For resources, guidance and support related to facilitating student investigations, see www.juniorscience.ie
- Possible use of Living Things Quiz PowerPoint to facilitate discussion and understanding

3. Differentiate by outcome/product (How will the student demonstrate understanding?)

See Worksheets, Classroom Activities and Experiments sections of this resource pack
- Students may use a template from the Experiments section to assist them with the write-up
- Whole class review work completed at end of class
- Homework: Living Things Worksheet if not used for class work. Specify time to be allocated to this work at home

Finally - any other possibilities for this lesson?

See Differentiation in Action located in the Toolkit section of this resource pack – apply various steps to the learning environment in your classroom. For instance, allow students to show what they have learned in different ways by using any of the following ideas:
- Collage of scenes showing living things
- Dramatisation, e.g. possible use of role play to highlight the characteristics of living things
- Other written activities, e.g. a log of the different organisms encountered by students in one day
- Internet search for material on living things
- For advice on enhancing curricular access through the use of mobile ICT, see www.laptopsinitiative.ie
2.6 Cells

(Learning outcomes by syllabus reference: OB42 and OB43)

4 – 5 lessons

Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Cell</th>
<th>Microscope</th>
<th>Focus</th>
<th>Lens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnify</td>
<td>Image</td>
<td>Slide</td>
<td>Cover slip</td>
</tr>
<tr>
<td>Iodine</td>
<td>Cell membrane</td>
<td>Nucleus</td>
<td>Chloroplast</td>
</tr>
<tr>
<td>Cell wall</td>
<td>Vacuole</td>
<td>Cytoplasm</td>
<td></td>
</tr>
</tbody>
</table>

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to identify the main parts of a microscope</td>
<td>To be able to draw and label plant cells and animal cells</td>
<td>To be able to compare and contrast animal cells and plant cells</td>
</tr>
<tr>
<td>To be able to identify the main parts of a cell</td>
<td>To be able to identify the function of each part</td>
<td></td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of cells as building blocks. Seek level of prior knowledge of class. This could be facilitated by using the Cells Introduction PowerPoint.
2. Carry out experiments in groups to look at cells using a microscope. Discussion of key vocabulary, results and conclusions.
3. Students record results and write up experiment as they are doing the practical work using text and/or pictures.
4. Review – whole class discussion.
5. Further class work/homework – see Cells Worksheet.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

(A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with cells and observing cells, e.g. slides and a microscope</td>
<td>Images of cells</td>
<td>The way cells act as building blocks in multicellular organisms</td>
</tr>
</tbody>
</table>

(B) Variety of resources

As listed above. Also potential use of the Internet and/or school or community library for further exploration of material related to cells.
Lesson Plans / 2.6 Cells

(C) Variety of learning environments

Classroom, school laboratory, computer room/library in school.

2. Differentiate by process (How will I teach the lesson?)

Sequence of lesson as laid out above
- Introduction – using concrete material or a general class discussion
- Teacher may demonstrate use of apparatus to the class, emphasising safety. For resources, guidance and support related to facilitating student experiments and investigations, see www.juniorscience.ie
- Divide class into groups. Assist the students, as required, to plan, carry out the experiment, record results and draw conclusions as appropriate. Enable students extend their thinking and language use
- Possible use of Levels of Thinking information sheet located in the Toolkit section of this resource pack to create questions that promote higher-level thinking and facilitate student understanding

3. Differentiate by outcome/product (How will the student demonstrate understanding?)

See Worksheets, Classroom Activities and Experiments sections of this resource pack
- Students may use a template from the Experiments section to assist them with the write-up
- Whole class review work completed at end of class
- Homework: Cells Worksheet if not used for class work. Specify time to be allocated to this work at home

Finally - any other possibilities for this lesson?
- Collage of scenes showing cells
- Dramatisation, e.g. possible use of role play to highlight the function of each part of a plant cell
- Other activities, e.g. a poster comparing plant cells with animal cells
- Internet search for material on cells
- For advice on enhancing curricular access through the use of mobile ICT, see www.laptopsinitiative.ie
2.7

STATES OF MATTER

(LEARNING OUTCOMES BY SYLLABUS REFERENCE: OC1)

1 – 2 lessons

Keywords/terms to be taught

<table>
<thead>
<tr>
<th></th>
<th>Matter</th>
<th>Solid</th>
<th>Liquid</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mass</td>
<td>Melting</td>
<td>Compressed</td>
<td>Freezing</td>
</tr>
<tr>
<td></td>
<td>Particles</td>
<td>Condensing</td>
<td>Evaporating</td>
<td></td>
</tr>
</tbody>
</table>

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to identify solids, liquids and gases, and their main properties</td>
<td>To be able to identify all the properties of solids, liquids and gases To be able to identify changes of state</td>
<td>To be able to discuss changes of state in terms of the energy of molecules</td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of matter. Allow students to relate personal experiences of solids, liquids and gases. This could be facilitated by using the States of Matter Introduction PowerPoint and encouraging student input during the presentation.
2. Carry out experimental activities (changes of state) in groups with a focus on safety. Discussion of key vocabulary, risks and safety rules.
3. Review – whole class discussion. Possibility of using States of Matter Quiz PowerPoint to facilitate student understanding.
4. Further class work/homework – see States of Matter Worksheet.

1. Differentiate by content (in what ways can I vary the content of what I am teaching?)

(A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with matter (e.g. ice, water in a beaker, steam, wax, sand, blocks of wood or metal, air in a balloon)</td>
<td>Particle arrangements in solids, liquids and gases</td>
<td>Movement of particles in solids, liquids and gases and during changes of state</td>
</tr>
</tbody>
</table>

(B) Variety of resources

As listed above

(C) Variety of learning environments

Classroom, school laboratory, computer room
2. Differentiate by process (How will I teach the lesson?)

Sequence of lesson as laid out above
- Introduction – using concrete material or a general class discussion
- Teacher may demonstrate use of apparatus to the class, emphasising safety
- Closely observe students as they perform changes of state activities individually or in pairs. For resources, guidance and support related to facilitating student experiments and investigations, see www.juniorscience.ie
- Possible use of States of Matter Quiz PowerPoint to facilitate discussion

3. Differentiate by outcome/product (How will the student demonstrate understanding?)

See Worksheets, Classroom Activities and Experiments sections of this resource pack
- Students may draw particles representing solids, liquids and gases in their copies and/or short descriptions of how these molecules behave
- Offer students a choice of learning activities. Students may design a poster, write a poem/song or create a radio documentary on tape describing how molecules behave in solids, liquids and gases
- Whole class review work completed at end of class
- Homework: States of Matter Worksheet if not used for class work. Specify time to be allocated to this work at home

Finally - any other possibilities for this lesson?
- Common changes of state in everyday life
- Collage of scenes showing solids, liquids and gases
- Role play using students as individual particles in solids, liquids and gases
- Other written activities, e.g. a log of the different types of matter in the room
- Extension exercise: Where would you not find matter?
- For advice on enhancing curricular access through the use of mobile ICT, see www.laptopsinitiative.ie
2.8 ELEMENTS

(LEARNING OUTCOMES BY SYLLABUS REFERENCE: OC5, OC6, OC7, OC8 OC9)

2 – 3 lessons

Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Atom</th>
<th>Element</th>
<th>Properties</th>
<th>Conductivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>Sulfur</td>
<td>Aluminium</td>
<td>Copper</td>
</tr>
<tr>
<td>Zinc</td>
<td>Hydrogen</td>
<td>Nitrogen</td>
<td></td>
</tr>
</tbody>
</table>

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to identify everyday uses for elements</td>
<td>To be able to recall that metals conduct electricity and heat</td>
<td>To be able to list the properties of a range of metals and non-metals</td>
</tr>
<tr>
<td></td>
<td>To be able to recall the symbols for common metals and non-metals</td>
<td></td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of elements. Allow students to relate personal experiences of elements. This could be facilitated by using the Elements Introduction PowerPoint, or the Periodic Table in their textbook, and encouraging student input.
2. Discuss key vocabulary and definitions.
3. Review – whole class discussion. Possibility of using a co-operative group activity (see Co-operative Group Activity Sheet in the Classroom Activities section of this resource pack) to facilitate student understanding.
4. Further class work/homework – see Elements Worksheet.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

   (A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with elements (e.g. copper, iron, carbon, gold, silver etc.)</td>
<td>Symbols for elements</td>
<td>Location of elements on Periodic Table</td>
</tr>
</tbody>
</table>

   (B) Variety of resources

   As listed above.

   (C) Variety of learning environments

   Classroom, school laboratory, computer room
2. **Differentiate by process** (How will I teach the lesson?)

**Sequence of lesson as laid out above**

- Introduction – using concrete material or a general class discussion
- Explore concepts in textbook, using *Elements Introduction* PowerPoint or the Periodic Table
- Possible use of a co-operative group activity (see the *Classroom Activities* section of this resource pack) to facilitate discussion

3. **Differentiate by outcome/product** (How will the student demonstrate understanding?)

**See Worksheets, Classroom Activities and Experiments sections of this resource pack**

- Students may label elements (concrete objects) with their name and symbol
- Offer students a choice of learning activities. Students may design a poster on Elements, draw their own Periodic Table (containing only the elements that they must learn) or create a resource page for teaching other students about elements and their properties
- Whole class review work completed at end of class
- Homework: *Elements Worksheet*, if not used for class work. Specify time to be allocated to this work at home

Finally - any other possibilities for this lesson?

- Common elements in everyday life
- Collage of scenes showing elements and their uses
- Role play using students as elements
- Other written activities, e.g. a list of properties for common metals and non-metals
- Extension exercise: How many elements exist?
- Internet search for material on elements
- Suggested Internet links include [www.bbc.co.uk/schools](http://www.bbc.co.uk/schools), [www.juniorscience.ie](http://www.juniorscience.ie), [www.scoilnet.ie](http://www.scoilnet.ie), [www.skool.ie](http://www.skool.ie) and [http://classroom.jc-schools.net/sci-units/matter.htm](http://classroom.jc-schools.net/sci-units/matter.htm)
- For advice on enhancing curricular access through the use of mobile ICT, see [www.laptopsinitiative.ie](http://www.laptopsinitiative.ie)
2.9 Mixture and Compounds

(Learning Outcomes by Syllabus Reference: Part OC3 OC12)

3 – 4 lessons

<table>
<thead>
<tr>
<th>Keywords/terms to be taught</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atom</td>
</tr>
<tr>
<td>Mixture</td>
</tr>
<tr>
<td>Magnesium</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key concepts in the lesson (objectives)</th>
</tr>
</thead>
<tbody>
<tr>
<td>What students must know or be able to do</td>
</tr>
<tr>
<td>To be able to give examples of mixtures and compounds</td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of mixtures and compounds. Allow students to relate personal experiences of mixtures. This could be facilitated by using the Mixtures & Compounds Introduction PowerPoint and encouraging student input during the presentation.
2. Carry out experimental activities (compare iron sulphur mixture with the compound iron sulphide) in groups. Focus on safety: Discussion of key vocabulary, risks and safety rules.
3. Review – whole class discussion. Possibility of using Definition Game in Classroom Activities section of this resource pack to facilitate student understanding.
4. Further class work/homework – see Mixtures and Compounds Worksheet.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

<table>
<thead>
<tr>
<th>(A) Complexity of content: (concrete, symbolic, abstract)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
</tr>
<tr>
<td>Real materials associated with mixtures and compounds (e.g. sea water, air, iron, sulfur, iron sulfide)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(B) Variety of resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>As listed above.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(C) Variety of learning environments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom, school laboratory, computer room</td>
</tr>
</tbody>
</table>
2. **Differentiate by process** (How will I teach the lesson?)

**Sequence of lesson as laid out above**
- Introduction – using concrete material or a general class discussion
- Closely observe students as they perform the experiment. For resources, guidance and support related to facilitating student experiments and investigations, see [www.juniorscience.ie](http://www.juniorscience.ie)
- Possible use of Definition Game to facilitate discussion

3. **Differentiate by outcome/product** (How will the student demonstrate understanding?)

**See Worksheets, Classroom Activities and Experiments sections of this resource pack**
- Students may draw molecules representing the compounds water, carbon dioxide, iron sulphide and magnesium oxide in their copies with short descriptions of their properties
- Offer students a choice of learning activities. Students may design a poster, write a poem/song or create a radio documentary on tape describing the difference between properties of compounds and the elements that make them
- Whole class review work completed at end of class
- Homework: *Mixtures and Compounds Worksheet*, if not used for class work. Specify time to be allocated to this work at home

**Finally - any other possibilities for this lesson?**
- Common mixtures and compounds in everyday life
- Collage of scenes showing mixtures and compounds
- Role play using students as individual elements in mixtures and compounds
- Extension exercise: How do the elements that make up a compound become chemically combined?
- Internet search for material on mixtures and compounds
- Suggested Internet links include [www.juniorscience.ie](http://www.juniorscience.ie), [www.bbc.co.uk/schools](http://www.bbc.co.uk/schools), [www.scoilnet.ie](http://www.scoilnet.ie), [www.skool.ie](http://www.skool.ie) and [http://classroom.jc-schools.net/sci-units/matter.htm](http://classroom.jc-schools.net/sci-units/matter.htm)
- For advice on enhancing curricular access through the use of mobile ICT, see [www.laptopsinitiative.ie](http://www.laptopsinitiative.ie)
Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Nitrogen</th>
<th>Oxygen</th>
<th>Carbon dioxide</th>
<th>Mixture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cobalt chloride</td>
<td>Limewater</td>
<td>Magnesium</td>
<td>Water vapour</td>
</tr>
</tbody>
</table>

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to identify air as a mixture and oxygen as a component</td>
<td>To describe how to show the percentage of oxygen in air and what happens when a wooden splint or magnesium is burned in air</td>
<td>To be able to list the percentages of the gases in air</td>
</tr>
<tr>
<td>To be able to recall the tests for water vapour and carbon dioxide and show that these are present in air</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce air. Allow students to relate personal experiences of air. Seek level of prior knowledge of class. This could be facilitated by using the Air PowerPoint and encouraging student input.
2. Carry out experiments in groups. Discussion of key vocabulary, results and conclusions. Students record results and write up experiment as they are doing the practical work.
3. Review – whole class discussion. Possibility of using Air Quiz PowerPoint to facilitate student understanding.
4. Further class work/homework – see Air Worksheet.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

(A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with the study of air (e.g. syringe, tubing, lime water, cobalt chloride paper etc.)</td>
<td>Pie chart of the composition of air Diagrams of apparatus</td>
<td>Air is a mixture - how the composition of air varies etc.</td>
</tr>
</tbody>
</table>

(B) Variety of resources

As listed above. Also potential use of the Internet and/or school or community library for further exploration of material related to air.

(C) Variety of learning environments

Classroom, school laboratory, computer room
2. Differentiate by process (How will I teach the lesson?)

Sequence of lesson as laid out above
- Introduction – using concrete or symbolic material or a general class discussion
- Teacher may demonstrate use of apparatus to the class, emphasising safety. For resources, guidance and support related to facilitating student experiments and investigations, see www.juniorscience.ie
- Divide class into groups. Assist students, as required, to plan, carry out and write up experiments on their own and enable students to extend their thinking and language use
- Possible use of Air Quiz PowerPoint to facilitate discussion

3. Differentiate by outcome/product (How will the student demonstrate understanding?)

See Worksheets, Classroom Activities and Experiments sections of this resource pack
- Students may use a template from the Experiments section to assist them with the write-up
- Whole class review work completed at end of class
- Homework: Air Worksheet if not used for class work. Specify time to be allocated to this work at home

Finally - any other possibilities for this lesson?
- Use of air in everyday life
- Posters showing the composition of air and the tests for carbon dioxide and water vapour
- Other written activities, e.g. a graphic organiser revising the lesson
- Extension exercise: How would our planet be different without air?
- Internet search for material on air
- For advice on enhancing curricular access through the use of mobile ICT, see www.laptopsinitiative.ie
2.11 ACIDS AND BASES

(LEARNING OUTCOMES BY SYLLABUS REFERENCE: OC18, OC20 OC35)

4 – 5 lessons

Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Acid/Acidic</th>
<th>Corrosive</th>
<th>Hydrochloric acid (HCl)</th>
<th>Sulphuric acid (H₂SO₄)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbonic acid</td>
<td>Citric acid</td>
<td>Base/Basic</td>
<td>Alkaline/Alkaline</td>
</tr>
<tr>
<td>Sodium hydroxide</td>
<td>Calcium hydroxide</td>
<td>Caustic soda</td>
<td>Limewater</td>
</tr>
<tr>
<td>Universal indicator</td>
<td>Indicator</td>
<td>pH scale</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to identify common acids and bases and ways of testing them</td>
<td>To be able to state the formulas of common acids and bases</td>
<td>To be able to conduct and write up independently the experiment to investigate the pH of a variety of substances</td>
</tr>
<tr>
<td></td>
<td>To know that alkalis are bases soluble in water</td>
<td></td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of acids and bases. Allow students to relate personal knowledge of acids and bases. This could be facilitated by using the Acids and Bases Introduction PowerPoint and encouraging student input during the presentation.
2. Carry out experiments in groups. Discussion of key vocabulary, results and conclusions. Students record results and write up experiments as they are doing the practical work through the use of text and/or pictures.
3. Review – whole class discussion. Possibility of using Acids and Bases Quiz PowerPoint to facilitate student understanding.
4. Further class work/homework – see Acids and Bases Worksheet.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

(A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with acids and bases (e.g. lemons, toothpaste, soap, litmus, indicator etc.)</td>
<td>Diagrams of colour charts to read pH</td>
<td>How indicators work</td>
</tr>
</tbody>
</table>

(B) Variety of resources

As listed above

(C) Variety of learning environments

Classroom, school laboratory, computer room, outdoor trip to test pH of rainwater, soil etc.
### 2. Differentiate by process (How will I teach the lesson?)

**Sequence of lesson as laid out above**
- Introduction – using concrete or symbolic material or a general class discussion
- Divide class into groups. Assist students, as required, in completing the experiments to test acids and bases. For resources, guidance and support related to facilitating student experiments and investigations, see [www.juniorscience.ie](http://www.juniorscience.ie)
- Possible use of the *Who am I?* activity in the *Classroom Activities* section of this resource pack, to facilitate discussion

### 3. Differentiate by outcome/product (How will the student demonstrate understanding?)

**See Worksheets, Classroom Activities and Experiments sections of this resource pack**
- Whole class review work completed at end of class
- Homework: *Acids and Bases Worksheet* if not used for class work. Specify time to be allocated to this work at home

### Finally - any other possibilities for this lesson?

- Sorting game using pictures of common acids and bases
- Collage of scenes showing acids and bases with their approximate pH
- Extension exercise: How do indicators work?
- Suggested Internet links include [www.juniorscience.ie](http://www.juniorscience.ie), [www.bbc.co.uk/schools](http://www.bbc.co.uk/schools), [www.scoilnet.ie](http://www.scoilnet.ie), [www.skool.ie](http://www.skool.ie) and [http://classroom.jc-schools.net/sci-units/matter.htm](http://classroom.jc-schools.net/sci-units/matter.htm)
2.12 ATOMS
(LEARNING OUTCOMES BY SYLLABUS REFERENCE: FIRST PART OCC) 
1 – 2 lessons

Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Atom</th>
<th>Element</th>
<th>Compound</th>
<th>Molecule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>Negative</td>
<td>Orbit</td>
<td>Proton</td>
</tr>
<tr>
<td>Neutron</td>
<td>Electron</td>
<td>Neutral</td>
<td>a.m.u.</td>
</tr>
</tbody>
</table>

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to locate protons, neutrons and electrons on a diagram of an atom</td>
<td>To be able to draw the structure of the atom</td>
<td>To be able to describe the structure of the atom</td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of atoms. Allow students to relate personal knowledge of atoms (e.g. atomic bomb). This could be facilitated by using the Atoms Introduction PowerPoint and encouraging student input during the presentation.
2. Discuss key vocabulary.
3. Review – whole class discussion. Possibility of using the What am I? activity in the Classroom Activities section of this resource pack, to facilitate student understanding.
4. Further class work/homework – see Atoms Worksheet.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

(A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with elements (e.g. copper, iron, gold, silver etc)</td>
<td>Diagrams of atoms</td>
<td>Mass, charge and location of sub-atomic particles</td>
</tr>
</tbody>
</table>

(B) Variety of resources

As listed above.

(C) Variety of learning environments

Classroom, school laboratory, computer room
### 2. Differentiate by process (How will I teach the lesson?)

**Sequence of lesson as laid out above**
- Introduction – using concrete or symbolic material, or a general class discussion
- Divide class into groups. Assist students to complete the worksheet as required
- Possible use of What am I? activity to facilitate discussion

### 3. Differentiate by outcome/product (How will the student demonstrate understanding?)

**See Worksheets, Classroom Activities and Experiments sections of this resource pack**
- Students may draw a diagram of an atom in their copies
- Whole class review work completed at end of class
- Homework: Atoms Worksheet if not used for class work. Specify time to be allocated to this work at home

### Finally - any other possibilities for this lesson?

- Common elements in everyday life
- Collage of scenes showing elements and the atoms that make them up
- Role play using students as individual sub-atomic particles
- Extension exercise: How do atoms become chemically combined to form a compound?
- Internet search for material on atoms
- Suggested Internet links include [www.juniorscience.ie](http://www.juniorscience.ie), [www.bbc.co.uk/schools](http://www.bbc.co.uk/schools), [www.scoilnet.ie](http://www.scoilnet.ie), [www.skool.ie](http://www.skool.ie) and [http://classroom.jc-schools.net/sci-units/matter.htm](http://classroom.jc-schools.net/sci-units/matter.htm)
- For advice on enhancing curricular access through the use of mobile ICT, see [www.laptopsinitiative.ie](http://www.laptopsinitiative.ie) with a balanced diet
- Cross-curricular links: Geography, SPHE, Home Economics, Mathematics
### 2.13 Measurement

(LEARNING OUTCOMES BY SYLLABUS REFERENCE: OP1 PART OP2)

#### 4 – 5 lessons

**Keywords/terms to be taught**

<table>
<thead>
<tr>
<th>Length</th>
<th>Area</th>
<th>Volume</th>
<th>Mass/matter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metre (m)</td>
<td>Metres squared (m²)</td>
<td>Metres cubed (m³)</td>
<td>Kilogram (kg)</td>
</tr>
<tr>
<td>Metre stick</td>
<td>Callipers</td>
<td>Vernier callipers</td>
<td>Electronic balance</td>
</tr>
<tr>
<td>Opisometer</td>
<td>Trundel Wheel</td>
<td>Measuring cylinder</td>
<td>Overflow can</td>
</tr>
<tr>
<td>Beaker</td>
<td>Meniscus</td>
<td>Units</td>
<td>Regular/Irregular</td>
</tr>
</tbody>
</table>

**Key concepts in the lesson (objectives)**

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to give examples of measurement from everyday experience</td>
<td>To be able to select appropriate methods for measuring volume in a variety of circumstances</td>
<td>To be able to manipulate volume formulae to calculate an unknown quantity</td>
</tr>
</tbody>
</table>

**Sequence of lesson**

1. Introduce the concept of measurement. Seek level of prior knowledge of class. Allow students to relate personal experiences of measurement. This could be facilitated by using the Measurement Introduction PowerPoint, handing out concrete objects, performing measurements at appropriate slides and encouraging student input during the presentation.
2. Carry out experiments in groups to perform measurements. Discussion of key vocabulary, results and conclusions.
3. Students record results and write up experiment as they are doing the practical work.
4. Review – whole class discussion/dissemination of ideas/extra information. Possibility of using the strategies set out in Tackling Word Problems in Science and Mathematics in the Toolkit section of this resource pack, to help students to develop skills in solving word problems.
5. Further class work/homework – see Measurement Worksheet. Extension challenges for more able students.

**1. Differentiate by content** (In what ways can I vary the content of what I am teaching?)

**Concrete**

Real materials associated with measurement, e.g. rulers, metre sticks, opisometers, trundle wheels, callipers, vernier callipers, measuring cylinders, electronic balance

**Symbolic**

Units of measurement and their symbols, Illustrations, images of measurement

**Abstract**

Why do we measure? Appreciation of the significance of measurement in our daily lives and in science
(B) Variety of resources

As listed above. Also potential use of school grounds for further exploration of material related to measurement.

(C) Variety of learning environments

Classroom, school laboratory, school grounds, e.g. curved lines of basketball court

2. Differentiate by process (How will I teach the lesson?)

Sequence of lesson as laid out above

- Introduction – using concrete or symbolic material or a general class discussion
- Divide class into groups. Assist the students, as required, to plan, carry out the experiment, record results and draw conclusions as appropriate. Enable the extension of students’ thinking and language use. For resources, guidance and support related to facilitating student experiments and investigations, see www.juniorscience.ie

3. Differentiate by outcome/product (How will the student demonstrate understanding?)

See Worksheets, Classroom Activities and Experiments sections of this resource pack

- Students may use a template from the Experiments section to assist them with the write-up
- Whole class review work completed at end of class
- Homework: Measurement Worksheet if not used for class work. Specify time to be allocated to this work at home

Finally - any other possibilities for this lesson?

- Estimating various measurements and then measuring them
- Collage of scenes showing measurement
- Other written activities, e.g. a log of the different types of measurement and units encountered by students in one day
- Extension exercise: How can we measure something very big?
- Cross-curricular links: Maths
- Internet search for material on measurement
- For advice on enhancing curricular access through the use of mobile ICT, see www.laptopsinitiative.ie
2.14 FORCES
(LEARNING OUTCOMES BY SYLLABUS REFERENCE: OP4 OP5)
1 – 2 lessons

Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Force</th>
<th>Newton or N</th>
<th>Friction</th>
<th>Lubricant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnet</td>
<td>Attract</td>
<td>Repel</td>
<td>Gravity</td>
</tr>
<tr>
<td>Spring balance</td>
<td>Extension</td>
<td>Weight</td>
<td></td>
</tr>
</tbody>
</table>

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to identify forces from everyday experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To be able to give examples of friction from everyday experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To be able to carry out simple experiments to investigate friction and the effect of lubrication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To recall that Newton is the unit of force</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To identify weight as a force</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reinforcement: To be able to write up experiments in a systematic way and draw valid conclusions from experiment results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To find out more about forces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To be aware of how unseen forces affect our lives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To relate weight to acceleration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of a force. Seek level of prior knowledge of class. This could be facilitated by using the Forces Introduction PowerPoint and encouraging student input during the presentation.
2. Carry out short experiments in groups to show the effects of forces, i.e. magnetic forces, friction with and without a lubricant, gravity and weight. Discussion of key vocabulary, results and conclusions.
3. Review – whole class discussion/dissemination of ideas/extra information. Possibility of using Keyword Game (in the Classroom Activities section of this resource pack) to facilitate student understanding.
4. Further class work/homework – see Forces Worksheet. Devise extension challenges as required.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

(A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with forces, e.g. magnets, spring balances, blocks, oil, soles of shoes, football boots etc. Falling objects to demonstrate gravity</td>
<td>Units: Newton (N) Newspaper articles/personal experiences relating to forces, images of forces, e.g. rockets taking off</td>
<td>Weight as a force How do we know about unseen forces? Appreciation of the significance of forces in our daily lives, e.g. car design</td>
</tr>
</tbody>
</table>
(B) Variety of resources

As listed above. Also potential use of the Internet and/or school car park, e.g. car engine for further exploration of material related to forces.

(C) Variety of learning environments

Classroom, school laboratory, computer room/library in school (as indicated above), visit to a mechanic

2. Differentiate by process (How will I teach the lesson?)

Sequence of lesson as laid out above

- Introduction – using concrete or symbolic material or a general class discussion
- Divide class into groups to carry out simple experiments. Students may take notes or draw diagrams of any observations made
  For resources, guidance and support related to facilitating student experiments and investigations, see www.juniorscience.ie
- Work with more able students to extend their thinking and language use

3. Differentiate by outcome/product (How will the student demonstrate understanding?)

See Worksheets, Classroom Activities and Experiments sections of this resource pack

- Students may use a template from the Experiments section to assist them with the write-up
- Students may record their observations on tape
- Students could create a poster showing images of different forces with brief descriptions of the forces taking place, e.g. push, pull, turning
- More able students may come up with different ways of measuring invisible forces, e.g. gravity
- Whole class review work completed at end of class
- Homework: Forces Worksheet if not used for class work. Specify time to be allocated to this work at home

Finally - any other possibilities for this lesson?

- Collage of scenes showing forces
- DVD/Video of forces in action, e.g. volcano erupting, racing cars
- Other written activities, e.g. a log of the different forms of forces encountered by students in one day or an extended piece of writing entitled ‘Living with Forces’
- Visit to a playground to investigate swings, see-saws and turning forces
- Cross-curricular links: Geography
- Internet search for material on forces
- For advice on enhancing curricular access through the use of mobile ICT, see www.laptopsinitiative.ie
2.15 PRESSURE
(LEARNINGOUTCOMESBY SYLLABUSREFERENCE: OP10 OP11)
2 – 3 lessons

Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Force</th>
<th>Pressure</th>
<th>Area</th>
<th>Pascal (Pa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire extinguisher</td>
<td>Barometer</td>
<td>Atmospheric Pressure</td>
<td></td>
</tr>
</tbody>
</table>

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to give examples of pressure from everyday experience</td>
<td>To recall that Pascal is the unit of pressure To rearrange the formula to correctly calculate force, area or pressure</td>
<td>To find out more about pressure To be able to solve a variety of problems related to pressure, force and area.</td>
</tr>
<tr>
<td>To be able to use the basic formula to calculate pressure</td>
<td>To be able to carry out a simple experiment to investigate the relationship between pressure and depth</td>
<td></td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of pressure. Seek level of prior knowledge of class. Allow students to relate personal experiences of pressure, e.g. tyre pressure. This could be facilitated by using the Pressure Introduction PowerPoint and encouraging student input during the presentation.
2. Carry out basic sums to calculate pressure. Carry out a simple experiment (using plastic bottles) in groups to show the effects of depth in liquids on pressure. Discussion of key vocabulary, results and conclusions.
3. Review – whole class discussion/dissemination of ideas/extra information. Possibility of using Pressure Quiz PowerPoint to facilitate student understanding.
4. Further class work/homework – see Pressure Worksheet. Devise extension activities as required.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

(A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with pressure, e.g. thumb tacks, football boot, high-heeled shoe, flat shoe etc.</td>
<td>Units: Pascal (Pa) Newspaper articles/personal experiences relating to pressure, images of dams, scuba divers, submarines</td>
<td>Rearranging the formula to calculate force or area. Appreciation of the significance of pressure in our daily lives, e.g. fire extinguishers</td>
</tr>
</tbody>
</table>

(B) Variety of resources

As listed above. Also potential use of the Internet and/or school library.
### (C) Variety of learning environments

Classroom, school laboratory, computer room/library (as indicated above)

### 2. Differentiate by process (How will I teach the lesson?)

<table>
<thead>
<tr>
<th>Sequence of lesson as laid out above</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Introduction – using concrete or symbolic material or a general class discussion</td>
</tr>
<tr>
<td>• Divide class into groups to carry out simple calculations</td>
</tr>
<tr>
<td>• Divide class into groups to carry out the experiment. Students may take notes or draw diagrams of any observations made.</td>
</tr>
<tr>
<td>For resources, guidance and support related to facilitating student experiments and investigations, see <a href="http://www.juniorscience.ie">www.juniorscience.ie</a>.</td>
</tr>
<tr>
<td>• Possible use of Pressure Quiz PowerPoint to facilitate discussion</td>
</tr>
</tbody>
</table>

### 3. Differentiate by outcome/product (How will the student demonstrate understanding?)

<table>
<thead>
<tr>
<th>See Worksheets, Classroom Activities and Experiments sections of this resource pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Students may use a template from the Experiments section to assist them with the write-up of their observations</td>
</tr>
<tr>
<td>• Students could be given the opportunity to record their observations on tape</td>
</tr>
<tr>
<td>• Students could create a poster showing images of pressure with some basic calculations, e.g. high-heeled shoe etc</td>
</tr>
<tr>
<td>• Some students may come up with different ideas for measuring pressure in liquids</td>
</tr>
<tr>
<td>• Whole class review work completed at end of class</td>
</tr>
<tr>
<td>• Homework: Pressure Worksheet if not used for class work. Specify time to be allocated to this work at home</td>
</tr>
</tbody>
</table>

### Finally - any other possibilities for this lesson?

- DVD/Video of pressure in action, e.g. volcano erupting, a dam bursting
- Other written activities, e.g. an extended piece of writing entitled ‘Everyday uses of pressure’
- Cross-curricular links: Geography
- Internet search for material on pressure
- Suggested Internet links include [www.juniorscience.ie](http://www.juniorscience.ie), [www.bbc.co.uk/schools](http://www.bbc.co.uk/schools), [www.scoilnet.ie](http://www.scoilnet.ie), [www.skool.ie](http://www.skool.ie) and [http://classroom.jc-schools.net/sci-units/force.htm](http://classroom.jc-schools.net/sci-units/force.htm)
- For advice on enhancing curricular access through the use of mobile ICT, see [www.laptopsinitiative.ie](http://www.laptopsinitiative.ie)
Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Energy</th>
<th>Sound Energy</th>
<th>Chemical Energy</th>
<th>Light Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat Energy</td>
<td>Electrical Energy</td>
<td>Magnetic Energy</td>
<td>Work</td>
</tr>
<tr>
<td>Joules</td>
<td>Kinetic Energy</td>
<td>Potential Energy</td>
<td>Conservation</td>
</tr>
<tr>
<td>Law</td>
<td>Vibrations</td>
<td>Solar Energy</td>
<td></td>
</tr>
</tbody>
</table>

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to identify different forms of energy</td>
<td>To be able to write down the Law of Conservation of Energy Reinforcement. To be able to write up experiments in a systematic way and draw valid conclusions from experiment results</td>
<td>To find out more about energy To be aware of how everyday energy conversions can be made more efficient To relate energy conversions to nutrition and respiration in living things</td>
</tr>
<tr>
<td>To be able to carry out simple experiments to show energy conversions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To be able to give examples of energy conversion from everyday experience</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of energy. Seek level of prior knowledge of class. Allow students to relate personal experiences of energy usage. This could be facilitated by using the Energy Introduction PowerPoint and encouraging student input during the presentation.
2. Students carry out experiments in groups to show energy conversions. Discussion of key vocabulary, results and conclusions. For resources, guidance and support related to facilitating student experiments and investigations, see www.juniorscience.ie
3. Students record results and write up experiment as they are doing the practical work through the use of text and/or pictures.
5. Further class work/homework – see Energy Worksheet. Devise extension activities as required.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

   (A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with energy usage and energy conversion, e.g. bulbs, switches, Crooke's radiometer, batteries, solar cells, electrical leads, etc. Bunsen burner to explore fuel conversions</td>
<td>Circuit symbols for various apparatus and circuit drawings Newspaper articles/personal experiences relating to energy usage Illustrations, images of energy conversions</td>
<td>The Law of Conservation of Energy What is a law in science? How do we know about energy conversions throughout the universe? Significance of energy conversions in our daily lives</td>
</tr>
</tbody>
</table>
(B) Variety of resources

As listed above. Also potential use of the Internet and/or school or community library for further exploration of material related to energy and energy conversions

(C) Variety of learning environments

Classroom, school laboratory, computer room/library in school (as indicated above)
Visit to a power station

2. Differentiate by process (How will I teach the lesson?)

Sequence of lesson as laid out above
- Introduction – using concrete or symbolic material or a general class discussion
- Teacher may demonstrate use of apparatus to the class, emphasising safety
- Divide class into groups. Assist the students, as required, to plan, carry out the experiment, record results and draw conclusions as appropriate. Enable students to extend their thinking and language use
- Possible use of Energy Quiz PowerPoint to facilitate discussion

3. Differentiate by outcome/product (How will the student demonstrate understanding?)

See Worksheets, Classroom Activities and Experiments sections of this resource pack
- Students may use a template from the Experiments section to assist them with the write-up
- Whole class review work completed at end of class
- Homework: Energy Worksheet if not used for class work. Specify time to be allocated to this work at home

Finally - any other possibilities for this lesson?

- ‘Exploring Energy’ – A practical resource for teachers from Sustainable Energy Ireland
- Collage of scenes showing energy usage
- Dramatisation, e.g. possible use of role play to emphasise the impact of energy conversions on energy efficiency and energy loss
- Other written activities, e.g. a log of the different forms of energy encountered by students in one day
- Visit to a power station
- Cross-curricular links: Geography, CSPE
- Internet search for material on acids and bases
- For advice on enhancing curricular access through the use of mobile ICT, see www.laptopsinitiative.ie
2.17 HEAT

(LEARNING OUTCOMES BY SYLLABUS REFERENCE: OP22, OP23)

2 – 3 lessons

Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Thermometer</th>
<th>Medium</th>
<th>Expand</th>
<th>Contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor</td>
<td>Vacuum</td>
<td>Insulator</td>
<td></td>
</tr>
</tbody>
</table>

Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to identify heat as a form of energy</td>
<td>To be able to give joules as the unit of heat</td>
<td>To recall the Law of Conservation of Energy and apply it to examples involving heat</td>
</tr>
<tr>
<td>To be able to carry out simple experiments to investigate the effect of heat on solids, liquids and gases</td>
<td>To be aware of the issue of contraction and expansion in design, e.g. gaps in rail tracks etc.</td>
<td></td>
</tr>
</tbody>
</table>

Sequence of lesson

1. Introduce the concept of heat. This could be facilitated by using the Heat PowerPoint and encouraging student input during the presentation.
2. Carry out experimental activities in groups emphasising safety (identify risks and safety rules). Discussion of vocabulary, results and conclusion.
3. Review – whole class discussion/dissemination of ideas. Possibility of using Inflating Balloon Activity sheet in the Experiments section of this resource pack.
4. Further class work/homework – see Heat Worksheet.

1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

(A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with heat and the experiments, e.g. Bunsen burner and ball with ring</td>
<td>Drawings of equipment for experiments</td>
<td>Appreciation of how heat causes expansion at the molecular level</td>
</tr>
</tbody>
</table>

(B) Variety of resources

As listed above

(C) Variety of learning environments

Classroom, school laboratory, computer room, visit outside to measure gaps in concrete paths
2. Differentiate by process (How will I teach the lesson?)

Sequence of lesson as laid out above
- Introduction – using concrete or symbolic material or a general class discussion
- Teacher may demonstrate use of apparatus to the class, emphasising safety
- Divide class into groups. Assist the students, as required, to plan, carry out the experiment, record results and draw conclusions as appropriate. Enable students to extend their thinking and language skills. For resources, guidance and support related to facilitating student experiments and investigations, see www.juniorscience.ie
- Possible use of Inflating Balloon Activity to facilitate review and discussion

3. Differentiate by outcome/product (How will the student demonstrate understanding?)

See Worksheets, Classroom Activities and Experiments sections of this resource pack
- Students may use a template from the Experiments section to assist them with the write-up
- Whole class review work completed at end of class
- Homework: Heat Worksheet if not used for class work. Specify time to be allocated to this work at home

Finally - any other possibilities for this lesson?
- Collage of scenes showing objects being heated (with relevant labels)
- A choral reading, jingle or rap to help students remember ‘Solids, liquids and gases expand when heated and contract when cooled’
- Extension exercise: ‘Do all liquids expand when heated and contract when cooled?’ before introducing syllabus learning outcome OP24
- Cross-curricular links: Geography, Technology
- Internet search for material on heat
- For advice on enhancing curricular access through the use of mobile ICT, see www.laptopsinitiative.ie
### 2.18 Light

**LEARNING OUTCOMES BY SYLLABUS REFERENCE:** OP33, OP34, OP35

2 – 3 lessons

#### Keywords/terms to be taught

<table>
<thead>
<tr>
<th>Luminous</th>
<th>Non-luminous</th>
<th>Reflection</th>
<th>Shadow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Energy</td>
<td>Solar cells</td>
<td>Crooke’s Radiometer</td>
<td>Periscope</td>
</tr>
</tbody>
</table>

#### Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to identify light as a form of energy</td>
<td>To explain how shadows are formed</td>
<td>To find out more about light</td>
</tr>
<tr>
<td>To be able to carry out simple experiments with light</td>
<td>To explain how non-luminous objects are seen</td>
<td>To relate light energy to photosynthesis in living things</td>
</tr>
</tbody>
</table>

#### Sequence of lesson

1. Allow students to relate personal experiences of light. This could be facilitated by using the *Light Introduction* PowerPoint and encouraging student input during the presentation.
2. Carry out experiments in groups to show how light travels. Discussion of key vocabulary, results and conclusions.
3. Students record results and write up experiment.
4. Review – whole class discussion/dissemination of ideas.
5. Further class work – see *Light Worksheet*. Devise extension activities as required.

#### 1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

**(A) Complexity of content: (concrete, symbolic, abstract)**

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real materials associated with light, e.g. bulbs, Crooke’s radiometer, solar powered calculators, solar cells, etc. Students’ experiences of light and shadow</td>
<td>Newspaper articles/personal experiences relating to light illustrations, images of light and experimental equipment</td>
<td>Appreciation of the significance of light to all living things</td>
</tr>
</tbody>
</table>

**(B) Variety of resources**

As listed above. Also potential use of the Internet and/or school or community library for further exploration of material related to light and the importance of light

**(C) Variety of learning environments**

Classroom, school laboratory, computer room library in school (as indicated above)
2. **Differentiate by process** (How will I teach the lesson?)

**Sequence of lesson as laid out above**
- Introduction – using concrete or symbolic material or a general class discussion
- Divide class into groups. Assist students, as required, to plan, carry out the experiment, record results and draw conclusions as appropriate. Enable students to extend their thinking and language use. For resources, guidance and support related to facilitating student experiments and investigations, see [www.juniorscience.ie](http://www.juniorscience.ie)

3. **Differentiate by outcome/product** (How will the student demonstrate understanding?)

**See Worksheets, Classroom Activities and Experiments sections of this resource pack**
- Students may use a template from the *Experiments* section to assist them with the write-up
- Whole class review work completed at end of class
- Homework: *Light Worksheet* if not used for class work. Specify time to be allocated to this work at home

Finally - any other possibilities for this lesson?

- Saving energy posters related to light
- Dramatisation, e.g. possible use of role play to emphasise the importance of light to living things
- Intra-curricular links: Biology (photosynthesis)
- Internet search for material on light
- Suggested Internet links include [www.juniorscience.ie](http://www.juniorscience.ie), [www.bbc.co.uk/schools](http://www.bbc.co.uk/schools), [www.scoilnet.ie](http://www.scoilnet.ie), [www.skool.ie](http://www.skool.ie) and [http://classroom.jc-schools.net/sci-units/energy.htm](http://classroom.jc-schools.net/sci-units/energy.htm)
- For advice on enhancing curricular access through the use of mobile ICT, see [www.laptopsinitiative.ie](http://www.laptopsinitiative.ie)
**Lesson Plans / 2.19 Biology Revision Introduction**

**2 – 3 lessons**

### Key concepts in the lesson (objectives)

<table>
<thead>
<tr>
<th>What students must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to identify what topics they remember or enjoyed learning about</td>
<td>To be able to write down a range of notes related to revision</td>
<td>To write extended revision notes independently</td>
</tr>
</tbody>
</table>

### Sequence of lesson

1. Introduce the concept of revision. Seek level of prior knowledge of class. Allow students to relate personal experiences of biology from the curriculum. This could be facilitated by using keywords with appropriate images (see *Helping Students with Reading* in the Toolkit section of this resource pack).
2. Carry out basic writing exercises in groups. Each student must contribute at least one sentence to the revision story.
3. Review – whole class discussion/dissemination of ideas/extra information. Possibility of creating a presentation similar to *JC Biology Revision Story PowerPoint* to facilitate student learning.
4. Extension challenges for more able students.

### 1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

**(A) Complexity of content: (concrete, symbolic, abstract)**

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials associated with revision, the students’ own experiences, textbooks, exam papers etc.</td>
<td>Illustrations, images of keywords</td>
<td>The amalgamation of the sentences to form a coherent story</td>
</tr>
</tbody>
</table>

**(B) Variety of resources**

As listed above. Also potential use of the Internet and/or school or community library for further exploration of material related to biology revision.

**(C) Variety of learning environments**

Classroom, school laboratory, computer room/library in school (as indicated above)

### 2. Differentiate by process (How will I teach the lesson?)

**Sequence of lesson as laid out above**

- Introduction – using concrete or symbolic material or a general class discussion
- The class can be divided into groups. Assist students, as required, to form sentences based on what they enjoyed or remember learning about. Enable students to extend their thinking and language use
- Ask groups working quickly to start putting the sentences together to form a story
3. Differentiate by outcome/product  (How will the student demonstrate understanding?)

See Worksheets, Classroom Activities and Experiments sections of this resource pack
- See Helping Students with Reading located in the Toolkit section. See also the JC Biology Revision Story PowerPoint on the CD that accompanies this pack.
- Students may use a basic worksheet, tape recorder or computer to assist them with sentence construction.
- Whole class review work completed at end of class.
- Homework: Revise a specific area related to the story.

Finally - any other possibilities for this lesson?
- Collage of scenes showing sentences formed by students with relevant images.
- Dramatisation, e.g. possible use of role play where each students says aloud the sentence that they contributed to the story.
- Internet search for material on biology.
- For advice on enhancing curricular access through the use of mobile ICT, see www.laptopsinitiative.ie.
Worksheets 3
1. Match each safety hazard with the correct symbol. One has been done for you.

- flammable
- harmful
- corrosive
- toxic
- oxidising

2. Now, use the safety hazards in the list below to complete the following sentences.

- corrosive
- toxic
- oxidising
- flammable
- harmful

(i) Substances that release heat when heated are ____________________________

(ii) Substances that can cause sickness or rashes are ____________________________

(iii) Substances that can burn through materials are ____________________________

(iv) Poisonous substances are ____________________________

(v) Substances that can easily catch fire are ____________________________

3. Write down six important safety rules.

(i) ____________________________

(ii) ____________________________

(iii) ____________________________

(iv) ____________________________

(v) ____________________________

(vi) ____________________________

4. In the box below, draw a hazard symbol that you think could be used to warn people of broken glass.
5. Describe one dangerous accident that could take place in the school laboratory and outline ways in which it could have been avoided.

Dangerous accident: ____________________________________________

_________________________________________________________________

How it could have been avoided: ____________________________________

_________________________________________________________________

6. Draw the hazard symbol for a substance that can burn through skin.

7. Tick each statement below that you think is a safety hazard in the school laboratory and write down why you chose it.

Fire exit blocked with chairs ________________________________________

_________________________________________________________________

Gas tap on but the Bunsen burner is not lighting _________________________

_________________________________________________________________

An open window _____________________________________________________

_________________________________________________________________

A student wearing safety glasses _______________________________________

_________________________________________________________________

Spilled liquid on the floor ____________________________________________

_________________________________________________________________

A student running around _____________________________________________

_________________________________________________________________
1. List two reasons why we need food.
   (i) ______________________________
   (ii) ______________________________

2. Tick the foods in the following list that are a good source of carbohydrate.
   - Eggs
   - Milk
   - Pasta
   - Bread
   - Rice
   - Water

3. Tick the foods in the following list that are a good source of protein.
   - Eggs
   - Fish
   - Vegetables
   - Rice
   - Bread
   - Meat

4. Tick the foods in the following list that are a good source of fat.
   - Eggs
   - Vegetables
   - Oil
   - Butter
   - Rice
   - Fatty Meat

5. Match each food type below with its function in our diet.
   - fibre (i) (a) growth and repair of cells
   - water (ii) (b) for energy
   - protein (iii) (c) prevents constipation
   - vitamin C (iv) (d) to make red blood cells
   - sugar or starch (v) (e) strong bones and teeth
   - calcium (vi) (f) healthy skin and gums
   - Iron (vii) (g) transports substances
6. What constituents are found in milk? 

7. What is a balanced diet? 

8. In this question, you have a choice of three activities. Choose which one you prefer. You only have to complete (a) or (b) or (c).

(a) Draw a food pyramid and label it carefully.

OR

(b) Design a balanced meal and give reasons why it is balanced.

OR

(c) Create a rhyme or song to help you remember the function of each part of a balanced diet.

Diagram:
9. Using a diagram to show your idea, design an experiment to test if sports drinks are effective at improving an athlete’s performance.

(a) List what you need:

(b) What measurements will you make?

(c) Predict what will happen in your experiment?

(d) How accurate do you think your method will be?
1. Use the space below to draw a diagram of the digestive system. Label it using the words provided.

Mouth

Oesophagus

Stomach

Liver

Pancreas

Large intestine

Small intestine

2. Match each part of the digestive system with its function.

<table>
<thead>
<tr>
<th>Part</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>mouth</td>
<td>(i) Absorbs food into blood</td>
</tr>
<tr>
<td>oesophagus</td>
<td>(ii) Stores food and mixes it with digestive juices</td>
</tr>
<tr>
<td>stomach</td>
<td>(iii) Chews food and breaks it down</td>
</tr>
<tr>
<td>small intestine</td>
<td>(iv) Carries food to the stomach</td>
</tr>
<tr>
<td>large intestine</td>
<td>(v) Passes water back into blood</td>
</tr>
</tbody>
</table>

3. (i) Using the words below, circle the name of this tooth.

Incisor  Canine  Premolar

(ii) What is the function of this type of tooth? ____________________________
4. (i) Draw a diagram of a human canine tooth.

(ii) What is the function of this type of tooth?

5. Write down the function of each part of the digestive system below.

   (i) Liver

   (ii) Incisors

   (iii) Pancreas

   (iv) Molars

6. Describe what happens to food as it passes through our digestive system. Start with food entering the mouth.

   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
7. Using a diagram to show your idea, design an experiment to show the effect of hydrochloric acid on different foods.

(a) List what you need:

(b) What measurements will you make?

(c) Predict what will happen in your experiment?

(d) How accurate do you think your method will be?
3.4 Respiration

1. Use the space below to draw a diagram of the lungs. Label it using the words provided.

windpipe
bronchus
bronchiole
air sac
diaphragm

2. Match each part of the lungs with its function.

<table>
<thead>
<tr>
<th>Part</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>windpipe</td>
<td>(a) Gas exchange</td>
</tr>
<tr>
<td>diaphragm</td>
<td>(b) Brings gas into and out of the lungs</td>
</tr>
<tr>
<td>air sac</td>
<td>(c) Brings gas from windpipe to bronchioles</td>
</tr>
<tr>
<td>bronchus</td>
<td>(d) Carries gas into air sacs</td>
</tr>
<tr>
<td>bronchiole</td>
<td>(e) Muscle at the bottom of the lungs that pulls down to draw air into the lungs</td>
</tr>
</tbody>
</table>

3. Using the words below, complete the equation for respiration.

energy carbon dioxide oxygen

Food + __________ → __________ + ___________ + water vapour

4. Using a blank page, create an (i) information leaflet, (ii) poster or (iii) song to warn people of the dangers of smoking.

5. Describe what happens during gas exchange.

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
6. Using a diagram to show your idea, design an experiment to test the effects of smoking different brands of cigarette on lungs (Hint: You can use tissue paper instead of lung tissue).

(a) List what you need:

(b) What measurements will you make?

(c) Predict what will happen in your experiment?

(d) How accurate do you think your method will be?
3.5 Living Things

1. Underline the correct word in the following list to complete the sentence.

Vertebrates have ________________________________________________

- hair
- a backbone
- feathers
- legs

2. Using the list below underline which group fish belong to?

Invertebrates

Vertebrates

3. Animals can be divided into two groups based on whether they have a backbone or not. Which group do spiders belong to?

______________________________________________

4. You have been given a long twig with one rounded dry red bud at the tip. Now, use the key below to identify the plant.

1. Are the buds dry? NO Horse chestnut
   YES Go to 2

2. Are the buds black? YES Ash
   NO Go to 3

3. Is there a group of buds at the tip? YES Oak
   NO Go to 4

4. Are the buds thin? YES Beech
   NO Go to 5

5. Are the buds red? YES Lime
5. Match each characteristic of living things with its description.

<table>
<thead>
<tr>
<th>Movement</th>
<th>(i)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiration</td>
<td>(ii)</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>(iii)</td>
</tr>
<tr>
<td>Feeding</td>
<td>(iv)</td>
</tr>
<tr>
<td>Excretion</td>
<td>(v)</td>
</tr>
<tr>
<td>Reproduction</td>
<td>(vi)</td>
</tr>
<tr>
<td>Growth</td>
<td>(vii)</td>
</tr>
<tr>
<td>(a) Taking in food or making food</td>
<td></td>
</tr>
<tr>
<td>(b) Increasing in size or complexity</td>
<td></td>
</tr>
<tr>
<td>(c) Reacting to stimuli</td>
<td></td>
</tr>
<tr>
<td>(d) Moving towards food or light</td>
<td></td>
</tr>
<tr>
<td>(e) Increasing in number</td>
<td></td>
</tr>
<tr>
<td>(f) Releasing energy from food</td>
<td></td>
</tr>
<tr>
<td>(g) Getting rid of waste</td>
<td></td>
</tr>
</tbody>
</table>

6. Which characteristic(s) of living things is shown in this picture of a boy sweating?

7. In this question, you have a choice of four activities. Choose which one you prefer. You only have to complete one of them.

(a) Describe the seven characteristics of living things using one animal or plant as an example.

OR

(b) Design a new type of animal or plant using the seven characteristics of living things, e.g. how does it move, feed or excrete etc.?

OR

(c) Create a rhyme or song to help you remember the seven characteristics of living things.

OR

(d) Draw images on a poster to show the seven characteristics of life. Label each characteristic with a short sentence.
3.6 Cells

1. Identify the piece of equipment in the diagram.
   (i) What is it called? __________________________
   (ii) What is it used for? __________________________

2. Label the following parts on the diagram.
   Eyepiece
   Objective lens

3. Match each microscope part below with its function.

   eyepiece (i) (a) to magnify the image
   objective lens (ii) (b) where you put the slide
   stage (iii) (c) where you look through
   focus knob (iv) (d) to get a clearer image

4. Is the cell pictured below an animal cell or a plant cell? __________________________
   Give a reason for your answer. __________________________

   Draw a line from each label to the correct part on the diagram.

   cell membrane

   nucleus

   cytoplasm

5. Which part of an animal cell (i) controls its activities? __________________________
   (ii) holds the cell contents? __________________________
   (iii) controls what enters and leaves the cell? __________________________
6. Give a function for each of the following parts of a plant cell.

(i) cell wall ____________________________

(ii) chloroplast __________________________

(iii) large vacuole __________________________

7. In this question, you have a choice of three activities. Choose which one you prefer. You only have to complete one of them.

(a) Draw a plant cell and label each part.

OR

(b) Create a table to compare plant cells with animal cells.

OR

(c) Create a rhyme or song to help you remember the function of each part of a plant cell.

Diagram:
3.7 States of Matter

1. What takes up space and has mass? ____________________________________________

2. List the three states of matter. _______________________________________________

3. Draw particles in the spaces provided in the following diagram to show how molecules are arranged in the three states of matter.

   SOLIDS       LIQUIDS       GASES

   ![Diagram with particles drawn]

4. In which state of matter do the particles move most easily? ______________________

5. In which state of matter do the molecules move least easily? _____________________

6. Match each description below with the relevant change of state by drawing lines between them.

   Gas changing to a liquid (i) (a) freezing
   Liquid changing to a gas (ii) (b) melting
   Liquid changing to a solid (iii) (c) evaporation
   Solid changing to a liquid (iv) (d) condensation
7. Air is made up of a mixture of gases. Using a labelled diagram, describe how you would show that it takes up space and has mass.

8. Using a diagram to show your idea, design an experiment to test whether salt affects the rate at which ice melts.

(a) List what you need:

(b) What measurements will you make?

(c) Predict what will happen in your experiment?

(d) How accurate do you think your method will be?
1. Can copper be broken down into simpler substances by chemical means? _________________

2. What type of atoms is a nugget of gold made from? _________________

3. Which of the following is not an element? Underline the correct answers.

   wood  water  oxygen  sulfur  carbon dioxide

4. What two types of elements does the Periodic Table divide elements into? _________________
   and _________________

5. Metals conduct (allow to pass through) _________________ and _________________.

6. Match each property below with the relevant element by drawing lines between them.

   A reddish brown metal (i) (a) sulfur
   A grey-black non-metal (ii) (b) silver
   A silver-grey metal (iii) (c) copper
   A yellow solid non-metal (iv) (d) carbon
7. Give four uses for metals.

(i) ______________________________

(ii) ______________________________

(iii) ______________________________

(iv) ______________________________

8. Complete the following table of elements and their symbols. Please state whether each element is a metal or non-metal.

<table>
<thead>
<tr>
<th>Element</th>
<th>Symbol</th>
<th>Metal</th>
<th>Non-metal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>Zn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminium</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>Au</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. Using a diagram to show your idea, design an experiment to compare the hardness of iron and lead.

(a) List what you need:

_________________________________________________________________________

(b) What measurements will you make?

_________________________________________________________________________

(c) Predict what will happen in your experiment?

_________________________________________________________________________

(d) How accurate do you think your method will be?

_________________________________________________________________________
1. Underline the compounds in the following list.

water  iron sulfide  air  carbon dioxide  sea water

2. A ____________ is formed when two or more elements combine chemically.

3. Which of the following is not a compound? Underline the correct answer.

magnesium oxide  iron sulfide  carbon dioxide  sea water

4. What elements is water made from? ____________________ and ____________________

5. Write down the chemical symbol for water. ________________________________

6. Tick which of the following statements are true.

Compounds consist of two or more substances.

Compounds are difficult to separate.

The elements in a compound have a fixed ratio.

The properties of compounds are the same as the properties of the elements that make it up.
7. Using the following compounds: magnesium oxide, iron sulfide, carbon dioxide and water, complete the table to outline their properties and the properties of the elements that make it up.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Element</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>water</td>
<td></td>
<td>An explosive gas</td>
</tr>
<tr>
<td></td>
<td>carbon</td>
<td>A black solid</td>
</tr>
<tr>
<td>magnesium oxide</td>
<td></td>
<td>Needed for burning</td>
</tr>
<tr>
<td>iron</td>
<td>sulfur</td>
<td>A yellow solid</td>
</tr>
</tbody>
</table>

8. Using a diagram to show your idea, design an experiment to measure the amount of salt in sea water.

(a) List what you need:

(b) What measurements will you make?

(c) Predict what will happen in your experiment?

(d) How accurate do you think your method will be?
1. Using the list below, underline which gas is the least abundant in air?

- nitrogen
- carbon dioxide
- oxygen

2. Write down two reasons why air is a mixture?
   (i) 
   (ii)  

3. Using the percentages below, complete the following sentence. The percentage of oxygen in air is 

   41% 61% 21% 11%

4. Using a diagram, describe how you could find out the percentage of oxygen in air.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
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</tbody>
</table>

5. Using the words below complete the sentences to describe the tests for carbon dioxide and water vapour.

   - cobalt chloride
   - limewater
   - pink
   - milky
   - blue

   **Test for carbon dioxide.**
   Carbon dioxide turns __________________________ ____________________________

   **Test for water vapour.**
   Water turns __________________________ ____________________________ paper from _____________ to _____________
6. Using a diagram to show your idea, design an experiment to test whether water vapour is produced by a plant.

(a) List what you need:

(b) What measurements will you make?

(c) Predict what will happen in your experiment?

(d) How accurate do you think your method will be?
1. Underline the correct word in the following list to complete the sentence. Acids have a _________ taste:

hot    sweet    sour    salty

2. Using the list below, underline which acid is found in lemons?

Carbonic acid
Hydrochloric acid
Citric acid

3. What does corrosive mean?

__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________

4. Using some words from the list below complete the following sentence. Some words can be used more than once.

base    red    green    blue    alkalis

Acid turns litmus paper from _____________ to _____________. The opposite to an acid is a _____________ . A base that dissolves in water is called an _______________. Bases or _______________ turn litmus paper from _____________ to _____________.

Name: ________________________________
5. Match each substance below with the acid that it contains.

- car battery fluid (i) 
  - stomach acid (ii) 
  - fizzy drinks (iii)

   (a) carbonic acid
   (b) sulfuric acid
   (c) hydrochloric acid

6. List two common bases: ___________________________ and ___________________________

7. Universal indicator can be used to find the pH of a substance by matching a colour change to a colour chart. This tells us how strong an acid or a base is. Add numbers to the chart below to show the pH scale.

Now, match each pH range below with how strong an acid or base it is.

- pH 1 – pH 3 (i) (a) weak acid
- pH 5 – pH 7 (ii) (b) strong base
- pH 7 (iii) (c) strong acid
- pH 7 – pH 9 (iv) (d) neutral
- pH 10 – pH 14 (v) (e) weak base

8. Complete the table to list the elements in each of the following acids or bases.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Formula</th>
<th>Element 1</th>
<th>Element 2</th>
<th>Element 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric acid</td>
<td>H\textsubscript{2}SO\textsubscript{4}</td>
<td>H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium hydroxide</td>
<td>Ca(OH\textsubscript{2})</td>
<td></td>
<td>O</td>
<td></td>
</tr>
</tbody>
</table>
9. Using a diagram to show your idea, design an experiment to test whether cauliflower extract can act as a pH indicator.

(a) List what you need:

(b) What measurements will you make?

(c) Predict what will happen in your experiment?

(d) How accurate do you think your method will be?
1. Can gold be broken down into simpler substances by chemical means?

2. What type of atoms is a sheet of copper made from?

3. Underline the correct word in the following list to complete the sentence.
   Atoms are extremely ________________________________

   heavy  small  rare

4. The three types of sub-atomic particle are ________________________________,
   ________________________________ and ________________________________.

5. Which two sub-atomic particles are found in the nucleus of the atom?
   ________________________________ and ________________________________.

6. Match each sub-atomic particle below with its charge by drawing lines between them.
   neutrons (i)  (a) positive
   electrons (ii)  (b) neutral
   protons (iii)  (c) negative

7. Complete the following table to give the mass, charge and location of the three sub-atomic particles.

<table>
<thead>
<tr>
<th>Sub-atomic particle</th>
<th>Mass</th>
<th>Charge</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inside nucleus</td>
</tr>
<tr>
<td>neutrons</td>
<td></td>
<td></td>
<td>neutral</td>
</tr>
<tr>
<td></td>
<td>1/1840 a.m.u.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Draw lines to match the different types of measurements with their functions. One has been done for you.

- **Volume**: (a) the amount of surface covered
- **Length**: (b) the amount of space taken up
- **Mass**: (c) the distance between two points
- **Area**: (d) the amount of matter in the object

2. Circle the following pieces of equipment that can be used to measure the length of curved lines.

   - ruler
   - trundle wheel
   - metre stick
   - calipers
   - opisometer

3. This piece of equipment is commonly used in the lab.
   - ![Balance Scale]
   
   (i) What is it called? ____________________________
   
   (ii) What does it measure? _________________________
   
   (iii) How could you use this equipment at home? __________________________

4. Mass is the amount of matter in an object. Circle the units that it is measured in.

   - m
   - m³
   - m²
   - kg

   Where would you see this unit in your home? ____________________________
5. Volume is the amount of space an object takes up. Circle the units that it is measured in.

   m   m³   m²  kg

6. Using a diagram, briefly describe how you would find the volume of a large stone. You must use an overflow can and a measuring cylinder. Make sure you label your diagram.

   Method: ________________________________
           ________________________________
           ________________________________
           ________________________________
           ________________________________
           ________________________________
           ________________________________

7. Invent a world where people don’t know anything about measurement. Describe what life would be like there.

   ________________________________
   ________________________________
   ________________________________
   ________________________________
   ________________________________
   ________________________________
   ________________________________
   ________________________________
8. Using a diagram to show your idea, design an experiment to show how you would measure (or estimate) the volume of a large rock.

(a) List what you need:

(b) What measurements will you make?

(c) Predict what will happen in your experiment?

(d) How accurate do you think your method will be?
1. Using the words in the list, complete the sentence.

Newtons  push  direction  pull  speed

A force is a __________ or a __________ that changes the shape, __________ or __________ of an object. It is measured in __________.

2. Draw a diagram of a spring balance.

Describe how it is used: ____________________________
__________________________
__________________________

3. What is friction? ____________________________
__________________________
__________________________

4. (i) Give one everyday example of where friction is useful. ____________________________
__________________________

(ii) Why is friction useful in your example? ____________________________
__________________________
5. Rearrange the following letters to discover what we can use to reduce friction.

B U R N I T A L C

Answer: ________________________________

6. Using the list below, circle the surfaces with high friction.

- bus tyres
- sandpaper
- ice
- football boots
- wet soap

7. Describe two advantages and two disadvantages of living in a world without gravity.

Advantages: (1) ________________________________

(2) ________________________________

Disadvantages: (1) ________________________________

(2) ________________________________

8. Using a diagram to show your idea, design an experiment to show that forces often act in pairs.

| Diagram to show forces acting in pairs |
1. Using the words area and force, complete the following formula for pressure.

Pressure = __________

2. Pressure is a measure of how much force is acting over a certain area. It is measured in ______.

3. Draw a diagram of the equipment that you would use to show how the pressure in a liquid changes with depth. Please label your diagram.

4. Sandra is planning to walk across soft ground that is easy to sink in. Should she wear flat shoes or high heels?

Why? ________________________________

5. A box lies flat on the ground. The area touching the ground is 10 m². If the box weighs 50 N, what is the pressure it puts on the ground? (Hint: remember that weight is a force.)

______________________________

6. A box lies flat on the ground. Each side has a length of 2 m. If the box weighs 56 N, what is the pressure it puts on the ground?

______________________________
7. If an object weighing 100 N exerts a pressure of 5 Pa on a table, what is the area of the side of the object facing the table?

8. Outline from your own experience where you think pressure is important in everyday life.

9. Predict what might happen to the air in your space shuttle if you were travelling in space and a tiny meteor cut a hole right through your shuttle.

10. Using a diagram to show your idea, design an experiment to show how you could measure the effect of ball pressure on the height that it bounces.

(a) List what you need:

(b) What measurements will you make?

(c) Predict what will happen in your experiment?

(d) How accurate do you think your method will be?
1. Match the different forms of energy in the list with the correct diagram beneath. One has been done for you.

potential  chemical  light  kinetic  sound  electrical

a  b  c  d  e  f

2. Now, use the forms of energy in the list below to complete the following sentences. Each word can be used once.

potential  chemical  kinetic  sound  electrical

(i) Vibrations cause _____________ energy.
(ii) Energy stored in a battery or food (as well as fuel, such as oil and coal) is called _____________ energy.
(iii) Energy just waiting to do work is called _____________ energy.
(iv) We mainly use _____________ energy in our homes.
(v) Any moving object has _____________ energy.

3. Again, use the forms of energy in the list below to complete the following sentences about energy conversions (changing one form of energy into another). Each word can be used once.

potential  chemical  light  kinetic  sound  electrical

(i) A light bulb converts _____________ energy into _____________ and heat energy.
(ii) A moving car converts the chemical energy in fuel into _____________ energy.
(iii) A radio converts electrical energy into _____________ energy.
(iv) An object just about to fall converts _____________ energy into kinetic energy as it falls to the ground.
(v) The _____________ energy in fuel is converted into heat energy by burning.
4. Draw a diagram that you would use to show the conversion of chemical energy in a battery into heat energy. You should include a battery, a light bulb and a switch in your diagram. Make sure you label your diagram.

5. Energy is the ability to do __________________. It is measured in ________________.

6. Energy can neither be __________ nor __________ but it can be __________ from one form into another. This is called the Law of ______________ of Energy.

7. Most of the energy on our planet comes from the Sun. Plants use this energy to make food by a process called photosynthesis. We use plants in a variety of ways, e.g. food, fuel etc. Describe different ways in which energy from the sun is converted into other forms of energy.

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

8. When you turn a light on, all of the electrical energy is not converted into light energy because some of it is wasted as heat energy. In fact, most of the energy produced on earth ends up as wasted heat.

(a) Give another example of where energy is wasted as heat.

_________________________________________________________________
(b) How can we prevent some of this energy from being wasted?

(c) How would your answer to part (b) prevent energy from being wasted?

9. Using a diagram to show your idea, design an experiment to compare the amount of energy contained in different foods.

(a) List what you need:

(b) What measurements will you make?

(c) Predict what will happen in your experiment?

(d) How accurate do you think your method will be?
3.17 Heat

1. Heat is a form of ______________ and is measured in ______________.

2. Write down three safety rules that are important when working with the Bunsen burner.
   (i) ________________________________
   (ii) ________________________________
   (iii) ________________________________

3. Draw a diagram of the equipment that you would use to show the effect of heat on a solid. Please label your diagram.

![Diagram](image)

4. Which colour flame of a Bunsen burner is the hottest?
   ________________________________

   How would you make the coldest flame on a Bunsen burner?
   ________________________________
5. Which do you think changes the most when heated: solids, liquids or gases?

Why?

6. List five items of equipment that you would use to investigate the effect of heat on liquids.

(i) 

(ii) 

(iii) 

(iv) 

(v) 

7. Describe with the aid of a labelled diagram a method to show the effect of heat on gases.

Method: 

8. Outline two examples where engineers make allowances for expansion due to heat in everyday life.

10. What happens to the molecules inside a gas when it is heated?

11. Using a diagram to show your idea, design an experiment to show the effect of heat on the volume of an inflated balloon.

(a) List what you need:

(b) What measurements will you make?

(c) Predict what will happen in your experiment?

(d) How accurate do you think your method will be?
1. Light is a form of energy. What would you use to show that light is a form of energy?

2. The diagram below illustrates the Law of Conservation of Energy.

Light → Solar cell → Electricity

Complete the following sentence using the words in the list below.

changed  destroyed  form  another  created

Law of Conservation of Energy: Energy cannot be __________________ or __________________

but it can be __________________ from one __________________ into __________________.

3. What is this piece of equipment called?

What is it used for?

4. Underline which of the following are luminous.

moon  light bulb  fire  window  sun

5. What does luminous mean?
6. Draw a diagram of the equipment you would use to show that light travels in straight lines. Please label your diagram.

7. Describe using a diagram how a shadow is formed.

8. Using a diagram to show your idea, design an experiment to test what happens to plants without light.

(a) List what you need:

(b) What measurements will you make?

(c) Predict what will happen in your experiment?

(d) How accurate do you think your method will be?
Classroom Activities
### 4.1 What I like doing!

Name: __________________________

In each box, tick beside each activity that you like doing. You can tick as many as you like.

<table>
<thead>
<tr>
<th>Verbal (words)</th>
<th>Mathematical (numbers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Write a letter</td>
<td>- Draw a graph</td>
</tr>
<tr>
<td>- Write a report</td>
<td>- Design a puzzle</td>
</tr>
<tr>
<td>- Tell a story</td>
<td>- Use numbers in maths class</td>
</tr>
<tr>
<td>- Write an essay</td>
<td>- Count objects</td>
</tr>
<tr>
<td>- Write in your homework journal</td>
<td>- Solve puzzles</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Visual (pictures and charts)</strong></td>
<td><strong>Kinaesthetic (using your body)</strong></td>
</tr>
<tr>
<td>- Draw a picture</td>
<td>- Act in a play</td>
</tr>
<tr>
<td>- Paint something</td>
<td>- Do an experiment</td>
</tr>
<tr>
<td>- Make a poster</td>
<td>- Play a sport</td>
</tr>
<tr>
<td>- Take photographs</td>
<td>- Dance</td>
</tr>
<tr>
<td>- Make a map</td>
<td>- Make a model (e.g. car)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Musical (music)</strong></td>
<td><strong>Interpersonal (with people)</strong></td>
</tr>
<tr>
<td>- Listen to music</td>
<td>- Talk to people</td>
</tr>
<tr>
<td>- Write a song</td>
<td>- Organise an event</td>
</tr>
<tr>
<td>- Sing</td>
<td>- Work in a group or team</td>
</tr>
<tr>
<td>- Play an instrument</td>
<td>- Help people to work together</td>
</tr>
<tr>
<td>- Hum</td>
<td>- Do voluntary work</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Intrapersonal (on your own)</strong></td>
<td><strong>Naturalistic (adapting to change)</strong></td>
</tr>
<tr>
<td>- Think about your life</td>
<td>- Make a prediction</td>
</tr>
<tr>
<td>- Keep a diary</td>
<td>- Solve a problem</td>
</tr>
<tr>
<td>- Think about what happened that day</td>
<td>- Collect objects (e.g. stamps)</td>
</tr>
<tr>
<td>- Set goals for yourself</td>
<td>- Organise things in a certain way</td>
</tr>
<tr>
<td>- Think about your opinions</td>
<td>- Figure out how something works</td>
</tr>
</tbody>
</table>

Now count the number of ticks you made in each box and enter the number for each category below. This tells you a little bit about how you think and learn.

Verbal __________ Mathematical __________

Visual __________ Kinaesthetic __________

Musical __________ Interpersonal __________

Intrapersonal ______ Naturalistic __________

4.2 Definition Game

Name: ____________________________

Introduction
Keywords and their definitions are an essential component of a differentiated lesson and are useful for revision and exam preparation. This activity encourages students to check their understanding of definitions and also provides students with a game which is very motivational.

Resources
A set of cards (different colours can be effective) showing different correct definitions or statements with one statement on each card. Laminated cards can be used repeatedly.

Class set-up
1. Divide your students into groups of four.
2. Give each group an identical set of definition cards.
3. Allow students ten minutes to check their definitions and look up associated keywords.
4. Say a keyword. Students have to hold up the corresponding definition card.
5. The first team to hold up a correct statement receives a point. If more than one card is relevant, the first hand up wins.

This is a great activity to promote co-operative learning as students have to work together to achieve scores. It is difficult for one student within a team to quickly sort through definitions in order to hold the correct one up. Students quickly realise that each team member needs to hold some statements and be ready to hold one of them up. Therefore, all students within a team have to get involved. Once students become familiar with the game, they become very good at checking each others’ understanding in the ten-minute preparation phase.

Extension: This game could be extended by asking students to give real examples of how the definitions apply to everyday life.
**4.3 Football Fever**

**Name:** ________________________________

**Introduction**
This activity emphasises teamwork and encourages students to revise for the sake of their team. Students enjoy the game and it encourages them to listen carefully to questions and to each other.

**Resources**
A set of questions and two cards (one yellow and one red)

**Class set-up**
1. Divide your students into two teams. They can come up with their own team names. Nominate a captain for each team.
2. Allow students time (e.g. fifteen minutes in class or even the weekend) to train for the game, which involves revising a topic.
3. At the start of the game, toss a coin to see which side has kick-off.
4. Ask a question of the team who won kick off. Anyone from that team can answer within five seconds. If a student answers correctly, the team are asked another question. If they answer incorrectly, the question is passed over to the other team who then have three seconds to answer. If neither team can answer a question, then the next question is open to both teams.
5. A team must answer three consecutive questions to score a goal but the same student can not answer more than one of the questions. Therefore, a goal must involve three different students from a team.

**Variation**
A variation of this game is to ask students to stand up at the start of the game. As each student correctly answers a question, they sit down and do not answer again until everybody has answered a question.

**Rules**
Any student who fouls (answers out of turn or whispers the answer to another team mate) receives a yellow card or a red card if it’s a repeat offence.
4.4 Cooperative Group Activity

Introduction
Cooperation is working together to accomplish shared goals. Within cooperative learning activities, students pursue learning outcomes that are beneficial to themselves as well as to all other members of the group. This encourages students to work together to maximise their own and each other’s learning. Cooperative learning groups do not refer to the use of loosely structured group work in which students might conduct experiments in science classes. Cooperative groups can be so highly structured that the working groups are usually referred to as teams.

‘Nothing new that is really interesting comes without collaboration.’
James Watson, co-discoverer of DNA, referenced by ‘The Cooperative Link’ the newsletter of The Cooperative Learning Institute Vol. 12(1)

Research suggests that all students benefit from cooperative group activities. Students who are already successful show small gains in achievement, while students who have previously been unsuccessful typically show enormous gains as a result of cooperative learning. Cooperative grouping lets students organise their learning in a less threatening manner than individual questioning or whole-class discussions. It also prepares students for sharing their ideas with other students.

To establish effective cooperative groups within the classroom, students have to learn how to work with other students, share ideas and analyse information. They need to listen and encourage each other, ask appropriate questions, manage shy or dominant personalities and communicate effectively.

There are many ways to incorporate cooperative structures within your classroom. An easy way to begin is to try out paired work.

Resources
Several blank A4 or A3 sheets.

Class set-up
1. Divide students into pairs.
2. Ask each group to develop a resource page for teaching a particular topic. This should take about ten minutes. Both students must create their own copy of the resource.
3. Rearrange the pairs so that each student is now sitting with a different student. Ask them to review their resource page and create a new resource page combining the best ideas from each of their previous pages. This should take about ten minutes. Again, each student must create their own copy.
4. Ask students to discard their original resource page.
5. Rearrange the pairs again and ask one student from each pair to spend five minutes teaching the other student, using the resource page that they have just created. It doesn’t really matter who begins. It could just be the student within the pair with the longest hair or the person sitting on the right. After five minutes, the students swap roles so that the other student now uses their resource to teach the topic.
In this activity, the paired teams change three times so a student cannot become too dependent on another student. Each student must become as independent as possible. Furthermore, this activity gives students time to organise their learning, raises their confidence levels and is great for revision. Another way to incorporate cooperative structures within your classroom is to give each student a distinct role when they are carrying out an activity, such as an experiment or investigation.

Roles could include:

a) reader who reads and interprets any written instructions;

b) motivator who encourages all members of the group to get involved;

c) checker who makes sure that all group members understand the work being carried out;

d) recorder who writes notes on how the group is performing; and

e) reporter who reports back key findings to the teacher/whole class.

It is the social element offered by cooperative learning that is extremely motivational for students. Cooperative learning is particularly useful for covering parts of the course that do not have experiments or to learn content that students traditionally find tedious.

4.5 Keyword Game

Name: ____________________________

**Introduction**
Keywords are an essential component of a differentiated lesson and are useful for revision and exam preparation. This activity encourages students to check their understanding of key terms and also provides students with a game which is very motivational.

**Resources**
A set of cards (different colours can be effective) showing keywords with one word on each card. Laminated cards can be used repeatedly.

**Class set-up**
1. Give each student cards that they cannot show to anyone else. *If there are not enough keywords in the unit, you can reuse some keywords or otherwise add relevant words from earlier units that could be re-inforced.*
2. Allow students ten minutes to check the meaning of their keywords.
3. Divide your students into groups of five or six.
4. Students take turns to **describe** their keyword to the other members of their group until somebody guesses correctly what the word is.
5. A variation of this game allows students to **draw** pictures related to their keyword until somebody within their group guesses correctly what the word is.

**Rules**
Students are well used to rules as part of games and they can create extra excitement and motivation. Rules can be adjusted to suit specific classes or just to provide variety.

**Rule 1:** The team must guess the keyword within a certain time limit (30 seconds).

**Rule 2:** The students describing or drawing the keyword cannot say the word. If they mention the word, that word is cancelled from the game and the team are penalised by cancelling points.

**Rule 3:** Keywords can carry a point score on them. Difficult keywords are worth more points.
4.6 Ranking Game

Name: ____________________________

Introduction
Asking students their opinions is an essential component of a differentiated lesson. Getting them to rank information in order of importance encourages them to think about the concepts involved in an interactive way, which is also useful for revision and exam preparation. Students also become interested in other students’ opinions. This activity appeals to auditory, visual and kinaesthetic learners.

Resources
A set of cards (different colours can be effective) showing different statements on each card. Each statement card can be enhanced with a visual cue. Laminated cards can be used repeatedly.

Class set-up
• Divide your class into groups of three.
• Give each group an identical set of statement cards.
• Ask your students to spend five minutes ranking the statements in order of importance.
• To sum up the activity, ask your students to stick the statement that they felt was the most important onto the wall. Different statements are placed side by side at a specific location on top of identical statements so that they form a bar chart.
• For instance, a class with eight groups of students with three statements each may form the following bar chart. It is easy to see which statement the class thought was the most important.

Example: There could be three statement cards for ways to keep your heart healthy.

Avoid fatty food  Exercise regularly  Do not smoke

<table>
<thead>
<tr>
<th>Statement B</th>
<th>Statement A</th>
<th>Statement C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statement B</td>
<td>Statement A</td>
<td></td>
</tr>
<tr>
<td>Statement B</td>
<td>Statement A</td>
<td></td>
</tr>
<tr>
<td>Statement B</td>
<td>Statement A</td>
<td></td>
</tr>
</tbody>
</table>
4.7 What am I?

Name: ____________________________

Introduction
Encouraging students to question is a useful component of a differentiated lesson. This activity encourages students to ask appropriate questions so that they can discover an answer. This allows them to check their understanding of important concepts and also provides them with a game which is very motivational.

Resources
A set of cards showing keywords with one word on each card. Laminated cards can be used repeatedly.

Class set-up
- Keep the cards in front of you.
- Take one card at a time.
- Encourage your students to ask you questions.
- You can only answer YES or NO.
- Students who make a correct guess receive the card as one point.
- Students must listen to each other so that they can ask useful questions.
- It can be beneficial to have a penalty system for incorrect answers to prevent an over-eager student from repeatedly guessing.
- Once students become familiar with this game, they can be divided into groups of about six so that they can play it themselves.

Benefits
This game is a really useful variation of the Keyword Game or the Definition Game. One of the advantages of this game is that it is less threatening than directing specific questions at individual students. Some students, particularly creative ones prefer to ask questions rather than answer them and the fact that students receive instant feedback is an added bonus. Furthermore, this game gives all students an opportunity to engage actively in the lesson.
5 Toolkit
5.1 Differentiation in Action

1. Adjust curricular aims to suit the needs and abilities of all students.

2. Promote creative thinking and encourage students to apply their learning as much as possible.

3. Use a variety of instructional approaches, such as whole-class teaching, small group work, paired work, co-operative learning, individual teaching and team teaching.

4. Use a variety of instructional strategies (e.g. demonstrations, role plays, video, active learning etc.) to appeal to visual, auditory and kinaesthetic learners.

5. Group students for learning within the classroom based on their needs rather than always relying on the same groups.

6. Offer students a choice of learning activities based on their needs, strengths, interests or learning preferences.

7. Promote higher-level thinking rather than just focussing on recall of basic content.

8. When revising a topic, use different instructional strategies to the ones used originally to teach the topic.

9. Use whole-class discussion (or pre-assessment) when beginning a new topic to determine what students already know.

10. Allow students to show what they have learned in different ways.
5.2 Strategies to Support Students with Special Educational Needs

There are many resources available to help a teacher adapt learning activities. The following list is based on the work of Berta & Blaisedell (1998), Borrows (2000) and Fetters, Pickard & Pyle (2003).

Strategies to support all students
- Call on the student by name.
- Discuss with the student about what types of adaptations they prefer.
- Ensure students have an easy and efficient method for seeking help (journal, special signal etc.).
- Refer to scientists who have disabilities, whenever possible.
- Allow students to familiarise themselves with the room or school lab prior to their first lesson.
- Speak clearly and naturally, but be aware of the volume of your voice.
- Write clearly in large writing on the board.
- Make worksheets using a computer so font size can be increased if needed.
- Give one direction at a time.
- Provide safety instructions in both verbal and written form (large print with a graphic – 14 point font) for every experiment.
- Ensure everybody (including adults) adheres to safety rules, e.g. wearing safety glasses.
- Use concrete objects, diagrams, and pictures as often as possible.
- Demonstrate the steps of an experiment prior to an activity (if appropriate).
- Use co-operative learning strategies, as appropriate, and assign individual roles within groups.
- Encourage students to use computers to organise information and submit typed material if this proves helpful.
- Provide students with the option of audio recording their responses where necessary.
- Use materials with strong textures and primary colours.
- Use whole-class discussion at the end of a lesson.
- Write homework clearly on the board five minutes before the end of class.
- Give clear instructions for homework (e.g. spend ten minutes on these questions).
- Allow students adequate time for carrying out activities.
- Provide explanations of new and specialist vocabulary along with visual/kinaesthetic/auditory cues as appropriate.

References

See also Signposts: A Resource Pack for Teachers (2008) compiled by the SESS for useful information on specific special educational needs.
5.3 Readability

Can your students read the textbook you have chosen for them?

Readability is concerned with the
- interest and motivation of the reader;
- legibility of print and images;
- reading level of the text.

Differentiation attempts to match learning and instruction with the interest and motivation of the students. A first step in this process is to ensure that students can access written elements of learning activities. Modern worksheets, textbooks and exam papers tend to have a high level of legibility. However, it is the reading level of written text that commonly prevents students from accessing learning activities.

There are a number of tests which you can apply to estimate the reading level of textbooks, such as Gunning ‘FOG’ Readability Test, Flesch-Kincaid Formula or the McLaughlin ‘SMOG’ Formula.

It is easy to check the readability of worksheets, handouts or tests that you prepare yourself using Microsoft Word because it can apply the Flesch-Kincaid Formula for you. When you are finished typing your document, click on the Tools menu, select Options, and then click the Spelling & Grammar tab. Select the Check grammar with spelling check box. Select the Show readability statistics check box, and then click OK.

To check the readability of a document, click on the Tools menu and select Spelling and Grammar. When Microsoft Word finishes checking spelling and grammar, it displays information about the reading level of the document.

To convert the grade levels provided by this test to the reading age add five. Therefore, a text with a Flesch-Kincaid Grade Level of 8.1 has a reading level of 13.1 years of age.

In most mixed-ability classes, the reading age varies considerably. A general rule of thumb is that the reading age of a class of 13 year olds can vary from 9 years to 17 years. It may be difficult to choose a textbook with a suitable reading age for your class, so it is very important that all other written materials (worksheets etc.) have a suitable reading age particularly if you want your students to use the text independently.

Science is a technical subject with many words and terms that raise the reading level. Therefore, it is important that sentences are kept short using plain English to counteract the difficulty of the scientific terms.

The worksheets used in this resource pack have reading ages (calculated using the Flesch-Kincaid Formula in Microsoft Word) of 8.8 years to 12.6 years.
5.4 Helping Students with Reading

John comes to my science class every day but he can’t read the textbook. What do I do with this student who can’t read?

Teachers can use the Language Experience Approach to help students improve their reading and writing skills while learning science. This approach is useful for students who can understand the basic content but lack the literacy skills to work independently.

The Language Experience Approach uses students’ oral language to develop basic vocabulary and key concepts about written language. Students are asked to discuss what they know about subject material while the teacher writes down what the students say.

Research has shown the Language Experience Approach to be effective in many class settings from helping students in a remedial setting (Sharp, 1989) to assisting second language learners in a mainstream classroom (Perez, 2000).

Resources
A set of cards showing keywords with one word on each card with a relevant picture. Laminated cards can be used repeatedly. (Additional resources may include a laptop, data projector and access to the Internet for images.)

Class set-up
1. Divide the class into groups.

2. Give out keywords to your students. In the beginning, it is easier if these keywords cover a particular topic rather than large sections of the curriculum.

3. Ask your students to talk to you and each other in small groups about anything that they have learned (using the keywords as a prompt).

4. Identify students that have reading and writing difficulties and, as you wander around the room, quickly jot down exactly what these students tell you. Recite their own words back to them as you write them down. Other students can write their own sentences.

5. Transfer the students’ exact speech from your note pad to the white board keeping each sentence on its own line. This can also be done on a laptop connected to a data projector so that students can see their own sentences. You can then easily print out each sentence and give it to the relevant student.

6. As you print each sentence, read it aloud and ask students to do the same when you give it to them. Sentences from students who do not have writing difficulties should also be included to avoid concentrating attention on those students with literacy difficulties.
Reinforcement

This activity can be considerably enhanced (and the subject matter reinforced) by creating a PowerPoint presentation using the sentences from the students and asking them to locate images on the Internet related to their sentences. The student’s name can be included with their sentence. In this way, you can build a revision story that is unique to the class. The appearance of sentences can be timed to ensure an easy reading speed. The revision story can be printed so that the students can revise the content. Students demonstrate high levels of attention as they see their sentences appear on the screen and are eager to learn a story that includes their input. As the PowerPoint presentation plays automatically, students can be asked to read the sentence that they contributed out loud. With practice, students can also be asked to read out other students’ sentences aloud.

In addition, this activity promotes reading skills and reinforces subject content in a way that includes all students. It is motivational and adheres strongly to the principles of differentiated teaching and learning. With continued practice, it also becomes faster to implement and more fluid for both teachers and students.

For an example of this activity, see the JC Biology Revision Story PowerPoint presentation in the Lesson Plans (Revision Lesson) section of this resource pack.

This activity, which is adapted from the Language Experience Approach, is successful because it is based on students’ own language and learning experiences and encourages active participation in activities.

References


5.5 Levels of Thinking

Introduction
Analysing the level of thinking required for a certain activity is a crucial component of a differentiated lesson. Bloom’s taxonomy (Bloom, 1984) provides us with a framework for categorising learning activities by their level of challenge.

Bloom’s taxonomy contains six levels:
1. Basic recall
2. Demonstrating understanding
3. Using knowledge
4. Examining information
5. Assessing value based on criteria
6. Creating something new

Some students may spend longer acquiring basic facts while others quickly move onto higher-level thinking. It is important to note that Bloom’s higher levels of thinking simply reinforce basic facts. Therefore, all students can engage in learning content at an appropriate level within a differentiated lesson. Some students who have difficulties with basic recall have no problems engaging creatively in higher-order thinking. All students can benefit from being exposed to all levels of challenge.

Bloom’s taxonomy applied to worksheet questions:
1. Label the parts of a plant cell and an animal cell.
2. Identify the functions of each part of a plant cell and an animal cell.
3. Create a poster showing both a plant cell and an animal cell and indicate which parts are only found in the plant cell.
4. Examine the differences and similarities between plant cells and animal cells.
5. Determine why animal cells do not need or have a cell wall.
6. Design a new type of cell using at least three parts of a plant cell. Describe each part and give a reason for selecting it.

Reference
5.6 Solving Word Problems in Science and Mathematics

Solving word problems in mathematics or science can be a very complex task because

- mathematics and reading are combined;
- words may be used instead of numbers (e.g. half, dozen);
- the actual mathematical operation may not be obvious; and
- several mathematical operations may be required.

Furthermore, assuming that the word problem is correctly transcribed into mathematical language, the student still has to carefully calculate the correct answer to achieve full marks. Solving word problems involves a variety of thinking skills, but many students with (and without) special educational needs lack basic strategies for working out word problems.

**How to solve word problems**

1. Read the entire problem slowly.

2. Underline all numbers with a pencil or highlighter including numbers written as words (e.g. half, dozen).

3. Read the whole problem again and try to draw a diagram or picture that may help you to solve the problem.

4. Read the problem for the third time and try to identify what the problem is asking for.

5. Determine what steps you need to calculate the answer (e.g. addition, multiplication).

6. Estimate or guess what the answer might be.

7. Calculate the answer by writing down each step and check your answer to make sure that it makes sense.

This process can be summarised using RUDE: Read, Underline, Draw, Estimate.
5.7 Ways of Learning

Providing a variety of learning activities is a key component of a differentiated lesson. Gardner’s model of multiple intelligences\(^1\) provides us with a framework for developing a variety of learning activities for our students. Every student has strengths in thinking. Students learn more easily when they are using an area of strength. Nevertheless, all students benefit from being given opportunities to use different intelligences or strengths.

Gardner’s model of multiple intelligences\(^1\) includes:
1. Verbal/linguistic
2. Logical/mathematical
3. Visual/spatial
4. Bodily/kinaesthetic
5. Musical
6. Interpersonal
7. Intrapersonal
8. Naturalistic

Gardner’s model applied to a lesson on magnetism:
1. Write a report on the ‘Attraction and Repulsion of magnets’.

2. Complete the following table to show what happens when magnetic poles come into contact.

<table>
<thead>
<tr>
<th>Poles</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>North and North</td>
<td>Repels</td>
</tr>
<tr>
<td>North and South</td>
<td></td>
</tr>
<tr>
<td>South and South</td>
<td></td>
</tr>
<tr>
<td>South and North</td>
<td></td>
</tr>
</tbody>
</table>

3. Design a poster to show that ‘Like poles repel each other, unlike pole attract’.

4. Demonstrate what happens when magnetic poles come into contact.

5. Create a jingle, chant or rap song to help you remember ‘Like poles repel each other, unlike pole attract’.

6. In groups, plan an experiment to show what happens when magnetic poles come into contact.

7. Outline from your own experience, where you think magnetism is important in everyday life.

8. Predict what might happen if the earth lost its magnetic poles.

5.8 Assessment

Introduction
As teachers, assessment helps us to provide feedback to students on their learning, to guide and reward students, to motivate students to improve their learning, to evaluate student attainment and also to evaluate the effectiveness of our teaching. We are very familiar with summative assessment which attempts to measure student attainment and contribute to students’ grades. However, we should also regularly use formative assessment to provide feedback to students on their learning. We can also use continuous assessment to keep students regularly informed of their progress and to motivate their learning. Such continuous assessment could be used in addition to formative and summative assessment.

Homework plays an important role in formative assessment and in learning. It encourages students to revise material and considerably aids memory. However, it must be planned wisely and always corrected or marked so that students receive appropriate feedback.

What else can I assess?
It is useful to think about the different skills that you would like your students to achieve based on the syllabus learning outcomes. Some of the learning outcomes in the science syllabus involve students carrying out an experiment or investigation. For these learning outcomes, assessment could help students develop a wide range of extremely valuable skills, such as manipulative skills that are transferable. This could also help to make assessment more useful and interesting for your students. Scoring grids that identify assessment criteria can be used to provide feedback to students on a variety of learning outcomes. For an example of a scoring grid that highlights assessment criteria, see http://www.juniorscience.ie/jsss/Files/SE_Rubric.doc.

It is clear that both the psychomotor and cognitive domains of learning are necessary to complete an experiment or investigation in a meaningful way. Therefore, you may want to assess students’ psychomotor skills during practical work. In the beginning, when students first begin to conduct experiments, you may just want to assess the students’ manipulative skills and safety procedures. As students develop appropriate practical skills, you will also want to assess students’ ability to plan, design, make observations, interpret data and explain results. By doing this, you can provide a continuum of assessment criteria for your students and emphasise the importance of experiments and investigations to your students. You can differentiate within the continuum for individual students so that all students can experience success.

For more information on assessment, see www.ncca.ie and, for more comprehensive information on homework, read http://www.juniorscience.ie/jsss/Files/se_homework.pdf.
5.9 Classroom Climate

An open and non-threatening atmosphere is essential for all students. It is important that teachers treat all students with respect and encourage students to respect each other by modelling good behaviour and manners in the classroom.

Begin each lesson by welcoming students into the classroom. Use inclusive language. Say ‘our classroom’ instead of ‘my classroom’. Give positive feedback to students without being patronising.

**Be supportive.** Real learning cannot take place if students do not feel accepted and safe. One way to achieve a safe environment for students is to recognise their experience and abilities by emphasising every student’s strengths.

**Be firm.** It is important to always be firm and fair especially when dealing with discipline issues. Students respect fairness and want to learn in a safe and ordered atmosphere. If you treat one student unfairly, you risk losing other students’ support and it will be more difficult to establish a good learning environment.

**Be a good leader.** Keep students informed of your actions. If you want to spend time attending to another matter, e.g. disciplining a student, answering a query at the door, ask the rest of the class to continue the task and tell them you’ll be back to them shortly. Emphasise respect.

**Be inclusive.** Show interest in all of your students. Greet them by name. Encourage all of your students to participate in the lesson by engaging in whole-class discussion, co-operative learning or any other activity that promotes inclusion.

**Be peaceful.** Set aside time in each lesson (at least five minutes) where students are quiet and work independently (with no questions or interruptions). It may involve reading, highlighting material, drawing diagrams or writing. It allows students to work at their own pace and reflect on what they are learning about. It is also very useful for focusing students particularly after a noisy activity.

**Be humorous.** Use humour as appropriate but never use sarcasm.
5.10 Lesson Evaluation

This type of evaluation could help you to support students with special educational needs in your classroom. Alternatively, it could be carried out periodically for any individual students whom you feel are not progressing adequately.

There are four key considerations for evaluating the effectiveness of differentiated lessons.

Greater access to the curriculum
1. Can the student follow instructions and complete tasks?

2. What barriers prevent the student from accessing the curriculum (e.g. inappropriate language in the worksheet)?

Student experiences
3. Does the student participate in the learning activities?

4. Does the student enjoy the learning activities?

Student progress
5. Is the student interacting well in the classroom?

6. Is the student settling into the learning environment?

Student attainment
7. Is the student contributing more readily in lessons?
   - Answering questions:
   - Completing class work:
   - Submitting homework:

8. Is the student achieving in class tests?
Graphic organisers are a great way to bring different concepts together and they can be particularly useful for revision. There are several advantages to using graphic organisers in class. It is fast because it does not waste time and energy noting down irrelevant words in long sentences. It also helps students to organise their thoughts and connect relevant ideas in a very accessible way by using keywords and images. In addition, students can find graphic organisers easier to remember than long paragraphs. Graphic organisers can be drawn by hand or designed using software, such as Inspiration and Kidspiration (http://www.inspiration.com/home.cfm). Students can be given an incomplete map and asked to finish the map through adding text, pictures or colour coding.
5.12 How Differentiated is my Teaching

For each question, circle the appropriate score.


1. I adjust curricular aims to suit the needs and abilities of all students.
   1 2 3 4 5 6 7 8 9 10

2. I promote higher-level and creative thinking that encourages students to optimise the application of their learning.
   1 2 3 4 5 6 7 8 9 10

3. I use a variety of instructional approaches, such as whole-class teaching, small group work, paired work, co-operative learning and individual teaching.
   1 2 3 4 5 6 7 8 9 10

4. I use a variety of instructional strategies (e.g. demonstrations, role plays, video, active learning etc.) to appeal to visual, auditory and kinaesthetic learners.
   1 2 3 4 5 6 7 8 9 10

5. I group students for learning within the classroom based on their needs rather than always relying on the same groups.
   1 2 3 4 5 6 7 8 9 10

6. I offer students a choice of learning activities based on their needs, strengths, interests or learning preferences.
   1 2 3 4 5 6 7 8 9 10

7. When revising a topic, I use different instructional strategies to the ones used originally to teach the topic.
   1 2 3 4 5 6 7 8 9 10

8. When beginning a new topic, I use whole-class discussion (or pre-assessment) to determine what students already know.
   1 2 3 4 5 6 7 8 9 10

9. I allow students to show what they have learned in different ways.
   1 2 3 4 5 6 7 8 9 10

10. I use appropriate assessment modes to assess what students have learned.
    1 2 3 4 5 6 7 8 9 10
Experiments
6.1 Safety Contract

This safety contract is to ensure everybody’s safety in the school laboratories.


1. **DO NOT** enter the laboratory without permission.

2. **DO NOT** use any equipment unless permitted to do so by the teacher.

3. Make sure you know exactly what you are supposed to do. If in doubt, ask the teacher.

4. Long hair **MUST** always be tied back securely.

5. **ALWAYS** wear eye protection when instructed to do so.

6. **ALWAYS** check that the label on the bottle is **EXACTLY** the same as the material you require. If in doubt, ask the teacher.

7. **NOTHING** must be tasted, eaten or drunk in the laboratory.

8. Any substance accidentally taken into the mouth must be spat out **IMMEDIATELY** and the mouth washed out with plenty of water. The incident must be reported to the teacher.

9. Any cut, burn or other accident **MUST** be reported at once to the teacher.

10. Any chemicals spilled on the skin or clothing **MUST** be washed at once with plenty of water and reported to the teacher.

11. Always **WASH** your hands after practical work.
I agree to follow safety rules in the school laboratories.

Student name: ___________________________  Date: ___________________________

Class: ___________________________  Year: ___________________________

Parent’s signature: ___________________________________________
6.2 How to Differentiate Experiments and Investigations

Experiments and investigations form an extremely valuable component of learning about science. Experiments and investigations offer students concrete learning experiences, opportunities to develop manipulative skills and safe work practices, while also encouraging the development of skills in observing, measuring, recording, calculating, analysing, testing and presenting information.

The Skills Pathways approach outlined here enables students to record their experiments and investigations at whatever level they are working at. This approach can be used with individuals, groups or whole-classes within special settings and within mainstream schools.

All students are provided with one of four templates (available in the Experiments section of this resource pack). The first template is suitable for introducing students to experiments and investigations. As a student becomes proficient, they can progress onto the next sheet when carrying out experiments. This stepped approach gradually introduces scientific terms to students and finally culminates with template D, which prepares students for carrying out and completing coursework B of the syllabus.

On the four templates, there are spaces in which students can enter their answers. You will have to decide on the best way for your students to fill out the template, which allows your students to work at a range of levels.

Students can be provided with typed answers and diagrams, which they can stick onto the template. An extension of this approach is to offer your students a range of possible answers for each question. This supports students who are not ready to offer their own ideas. It also supports students that may experience problems with writing. Students who experience difficulties with reading could have the answer choices read to them. Alternatively, your students may write or word-process their answers as appropriate. These approaches can also be used to support students to complete the worksheets in this resource pack.

This gradual skills pathways approach of introducing the four templates to students, as appropriate, and providing alternative formats for students to complete the templates, enables every student to progress to a stage where they require less support and are encouraged to generate their own ideas and answers.

The learning outcomes outlined in the syllabus cannot be achieved by students all at once. This is particularly true in the case of experiments and investigations, which rely on students developing a range of specific skills. The use of the four experiment templates (and use of alternative formats for template completion) acknowledges the progression in skill acquisition that students may experience. Table 1 identifies the skills pathways that students may follow as they learn to investigate.
<table>
<thead>
<tr>
<th>Skills</th>
<th>Progression</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planning</strong></td>
<td><strong>Responsibilities</strong></td>
</tr>
<tr>
<td></td>
<td>Respond to questions</td>
</tr>
<tr>
<td></td>
<td>Brainstorm</td>
</tr>
<tr>
<td></td>
<td>Use concrete experience</td>
</tr>
<tr>
<td><strong>Obtaining Evidence</strong></td>
<td>Use equipment with support</td>
</tr>
<tr>
<td></td>
<td>Use everyday terms</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Analysing Evidence</strong></td>
<td>Draw/discuss work in everyday terms</td>
</tr>
<tr>
<td></td>
<td>Record (with support) in tables provided by the teacher</td>
</tr>
<tr>
<td><strong>Evaluating Evidence</strong></td>
<td>Make comments about the results</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

A skills pathway is an approach to student development that identifies key skill areas for carrying out investigations. The pathway is designed to help teachers to support students at various stages of the pathway. The essence of using this approach is that all students are encouraged and supported to extend their skills and knowledge by being provided with opportunities to progress along the various skills pathway as appropriate. A skills pathway may form a focus for creating student roles during co-operative learning or could even be used for target setting or formative assessment with individual students.

Table 1: Skills Pathways in Investigations
6.3 Experiment Write-up Template A

Experiment Title: ________________________________________________

Date: __________________________________________________________

My group: ______________________________________________________

Planning: How will we observe or measure during the experiment? ________________

____________________________________________________________________

____________________________________________________________________

Procedure: How can we make the experiment safe? ________________

How we did the experiment: __________________________________________

____________________________________________________________________

____________________________________________________________________

Diagram (including labels):

____________________________________________________________________

Result: What happened in the experiment? ________________________________

____________________________________________________________________

Conclusion: What have we found out? ________________________________

____________________________________________________________________

Signed: ___________________________ Date: ____________________________
6.4 Experiment Write-up Template B

Experiment Title: ________________________________

Date: ________________________________

My group: ________________________________

Planning: What will we use in the experiment? ________________________________

What will we observe or measure during the experiment? ________________________________

Procedure: How can we make the experiment safe? ________________________________

Method: ________________________________

Diagram (including labels):
Result: What happens when we carry out the experiment? 

Conclusion: What have we found out? 

How can we improve this experiment? 

Signed: ____________________ Date: ____________________
### 6.5 Experiment Write-up Template C

<table>
<thead>
<tr>
<th>Experiment Title:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td></td>
</tr>
<tr>
<td><strong>My group:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Planning:</strong></td>
<td></td>
</tr>
<tr>
<td>Apparatus:</td>
<td></td>
</tr>
<tr>
<td>What are we going to change (independent variable)?</td>
<td></td>
</tr>
<tr>
<td>What are we going to measure (dependant variable)?</td>
<td></td>
</tr>
<tr>
<td>What tasks will we carry out during the experiment?</td>
<td></td>
</tr>
<tr>
<td><strong>Procedure:</strong></td>
<td></td>
</tr>
<tr>
<td>Suitable safety precautions:</td>
<td></td>
</tr>
<tr>
<td>Method:</td>
<td></td>
</tr>
</tbody>
</table>

Diagram (including labels):
**Result:**
What happens when we carry out the experiment?

**Conclusion:**
Why do I think we got this result?

What are the possible sources of error in our experiment?

How can we improve this experiment?

**Signed:**

**Date:**
6.6 Experiment Write-up Template D

Experiment Title: ____________________________________________

Date: ______________________________________________________

My group: __________________________________________________

Planning:

Apparatus: __________________________________________________

What are the variables? ________________________________________

What are we going to keep the same (fixed variables)? ______________

What are we going to change (Independent variable)? ______________

What are we going to measure (dependant variable)? ______________

What tasks will we carry out during the experiment? ________________

What control are we going to use? ________________________________

Procedure:

Suitable safety precautions: ____________________________________

Method: ______________________________________________________

________________________________________________________________
Diagram (including labels):

Result: What happens when we carry out the experiment? (How does the dependent variable change when you change the independent variable?)

Conclusion: Why do I think we got this result? What are the possible sources of error in our experiment? How can I improve this experiment?

Signed: ___________________________ Date: ___________________________
You have learned that heat causes solids, liquids and gases to expand (get bigger) and cold causes solids, liquids and gases to contract (get smaller). Gases expand a lot when heated and contract a lot when cooled. Try the following experiment.

First read the method and predict what will happen:

List suitable safety precautions:

Method:

1. Fill the bottle with hot water.
2. Fill the basin with ice-cold water.
3. Let both sit for three minutes.
4. Empty out the hot water from the bottle and quickly stretch a balloon over the mouth of the bottle.
5. Set the bottle in the basin of ice-cold water.

Result:

Diagram:

Explanation:
# 7.1 Lesson Template

<table>
<thead>
<tr>
<th>Topic:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year Group:</td>
</tr>
<tr>
<td>How Many Lessons?</td>
</tr>
</tbody>
</table>

## Keywords / Terms to be taught

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Term 2</th>
<th>Term 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

## Key concepts in the lesson (Objectives)

<table>
<thead>
<tr>
<th>What student must know or be able to do</th>
<th>What students should know or be able to do</th>
<th>What students could know or be able to do</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

## Sequence of lesson

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>

Appendix / 7.1 Lesson Template
## 1. Differentiate by content (In what ways can I vary the content of what I am teaching?)

(A) Complexity of content: (concrete, symbolic, abstract)

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Symbolic</th>
<th>Abstract</th>
</tr>
</thead>
</table>

(B) Variety of resources

(C) Variety of learning environments

## 2. Differentiate by process (How will I teach the lesson?)
### 3. Differentiate by outcome / product (How will the student demonstrate understanding?)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>

### Finally - Any other possibilities for this lesson?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
Your feedback is valuable. Please take a few minutes to complete this questionnaire and return it to Sean O’Leary, Special Education Support Service, Cork Education Support Centre, The Rectory, Western Road, Cork.

Your name: ______________________________________ Number of years teaching: __________

School address: __________________________________________

E-mail:______________________________________________

1. Do you think your use of this resource pack is beneficial for your students? If so, in what way?

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

2. Does this resource pack support your professional development? If so, in what way?

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________
3. Did all of your students benefit from your use of this resource pack? If so, in what way?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

4. Are there individuals or specific groups of students in your classes that this resource pack benefited in particular?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

5. What were the most useful elements of this resource pack, e.g. PowerPoint presentations, worksheets, activities, toolkit etc.?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
6. What elements of this resource pack did you find difficult to use?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

I give permission for my feedback to be used in publications, in presentations and on the SESS website www.sess.ie

Signed:________________________________________

Please return to Sean O’Leary, Special Education Support Service, Cork Education Support Centre, The Rectory, Western Road, Cork.