## SUMMARY OF AMENDMENTS

<table>
<thead>
<tr>
<th>Version</th>
<th>Description</th>
<th>Page number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Learners are allowed <strong>two</strong> resits of each external unit</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>For internal assessment please consult WJEC’s ‘instructions for conducting controlled assessment’.</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Clarification of the ‘near pass’ rule</td>
<td>15</td>
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<tr>
<td></td>
<td>Clarification of resit rules</td>
<td>15</td>
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</tbody>
</table>
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1 INTRODUCTION

1.1 Qualification title and code

WJEC Level 3 Applied Diploma in Medical Science  QAN code: 601/7644/1

1.2 Statement of purpose

Medical Science is the science of dealing with the maintenance of health and the prevention and treatment of diseases. The Level 3 Applied Diploma in Medical Science is for learners who are interested in careers related to healthcare and medical research. Medical scientists are at the forefront of healthcare services, as they are vital in the diagnosis of disease, determining the effectiveness of treatments and searching for new cures.

The Level 3 Applied Diploma in Medical Science is for post 16 learners who have already enjoyed and been successful in science. Typically learners starting this qualification will already have science qualifications at level 2, e.g. GCSEs in science subjects or GCSE Applied Science (Double Award).

The main purpose of the qualification is to provide learners with the knowledge, understanding and skills in key scientific principles to support progress to higher education or employment in areas of Medical science, such as job roles in physiological sciences or clinical laboratory services. The qualification covers the key topic areas of health, physiology and disease, as well as providing the opportunity to study the areas of pharmacology, physiological measurement, clinical testing and medical research. In order to achieve the Level 3 Applied Diploma in Medical Science learners are required to complete 6 units:

- Human health and disease
- Physiological measurement techniques
- Medical Science research methods
- Medicines and treatment of disease
- Clinical laboratory techniques
- Medical case study

Each unit has a clear medical science purpose which focuses the learning of scientific knowledge, understanding and skills into a meaningful context.

This qualification equips learners with scientific knowledge and understanding, as well as practical skills that would support progression to a range of job roles within health care. Job roles such as those within the areas of life sciences, i.e. carrying out a range of laboratory and scientific tests to support the diagnosis and treatment of disease, this could include microscopic examination of tissue samples, analysis of blood cells to investigate anaemia or analysis of samples to identify the cause of an infection. Alternatively there would also be opportunities to progress to job roles within the physiological sciences, working directly with patients, measuring and evaluating particular organ and systems, such as scientists working in neurophysiology recording the electrical activity in the brain.
A significant proportion of career opportunities in this sector are at degree level. When supported by other appropriate qualifications, the Level 3 Applied Diploma in Medical Science will enable progression to higher education to a range of Applied Science programmes, such as biomedical science, life sciences, and physiology.

The Level 3 Applied Diploma in Medical Science is one of two qualifications offered by WJEC in this subject area. The level 3 Applied Diploma is equivalent in size to one A level. WJEC also offers a Certificate in Medical Science which is equivalent to half an A level.

Studying the Level 3 Applied Diploma in Medical Science allows time in the curriculum for other qualifications to be studied alongside it, these would typically be A levels such as Psychology or Chemistry or another Applied General qualification in an area such as Health and Social Care or Environmental Science.

The Level 3 Applied Diploma in Medical Science is intended to be an Applied General qualification.

The Level 3 Applied Diploma in Medical Science is supported by a number of Higher Education Institutions including:

- Bangor University
- Bristol University of the West of England
- Cardiff Metropolitan University
- Swansea University
- University of Chester

These universities recognise this qualification for entry to a specified degree programmes. Copies of the letters of support can be found on the qualification page of the WJEC and WJEC Eduqas websites.
## 2 QUALIFICATION STRUCTURE

**WJEC Level 3 Applied Diploma in Medical Science**

The units are summarised in the table below.

<table>
<thead>
<tr>
<th>Unit number</th>
<th>WJEC entry code</th>
<th>Unit title</th>
<th>Mandatory/optional</th>
<th>Assessment (external/internal)</th>
<th>GLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>4463U1</td>
<td>Human health &amp; disease</td>
<td>mandatory</td>
<td>external</td>
<td>90</td>
</tr>
<tr>
<td>2.</td>
<td>4463U2</td>
<td>Physiological measurement techniques</td>
<td>mandatory</td>
<td>internal</td>
<td>45</td>
</tr>
<tr>
<td>3.</td>
<td>4463U3</td>
<td>Medical Science research methods</td>
<td>mandatory</td>
<td>internal</td>
<td>45</td>
</tr>
<tr>
<td>4.</td>
<td>4463U4</td>
<td>Medicines and treatment of disease</td>
<td>mandatory</td>
<td>internal</td>
<td>100</td>
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<tr>
<td>5.</td>
<td>4463U5</td>
<td>Clinical laboratory techniques</td>
<td>mandatory</td>
<td>external</td>
<td>45</td>
</tr>
<tr>
<td>6.</td>
<td>4463U6</td>
<td>Medical case study</td>
<td>mandatory</td>
<td>external</td>
<td>35</td>
</tr>
</tbody>
</table>

Learners need to complete the **six** units to achieve the WJEC Level 3 Applied Diploma in Medical Science. Unit 6 is synoptic for the qualification. Unit 1 also contains a synoptic component for units 2 and 3.

Cash in Certificate: 4463QC  
Cash in Diploma: 4463QD
3 ASSESSMENT

WJEC Level 3 Applied Diploma in Medical Science is assessed using a combination of internal and external assessment.

3.1 Relative weighting of assessment

The relative weighting of the internal and external assessment is shown in the table below.

<table>
<thead>
<tr>
<th>Unit no.</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>12.5</td>
<td>12.5</td>
</tr>
<tr>
<td>3</td>
<td>12.5</td>
<td>12.5</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>1*</td>
<td>25</td>
<td>12.5</td>
</tr>
<tr>
<td>5</td>
<td>12.5</td>
<td>12.5</td>
</tr>
<tr>
<td>6**</td>
<td>12.5</td>
<td>12.5</td>
</tr>
</tbody>
</table>

* The unit 1 exam will also be synoptic for units 2 & 3
** The unit 6 exam will also be synoptic for units 1, 2, 3, 4 & 5

3.2 External assessment

In order to appropriately assess skills, knowledge and understanding, the specification uses two types of external assessment:
- written examinations for unit 1 and unit 6 (sections 3.2.1 to 3.2.4)
- an externally set and marked, task based assessment for unit 5 (section 3.2.5).

3.2.1 Unit 1

This examination is synoptic and will include questions based upon content from unit 2 and unit 3 as well as unit 1 of the qualification. Synoptic questions will require the learner to integrate the knowledge, understanding and skills from unit 2 and 3 in the context of human health and disease (unit 1 content). It will consist of one written two hour (90 marks) examination available in the summer of each year.

Assessment criteria from each learning outcome from unit 1, and content from unit 2 and unit 3 will be assessed in the examination. Marks will be apportioned as follows:

<table>
<thead>
<tr>
<th>Learning</th>
<th>Unit 1</th>
<th>Unit 2</th>
<th>Unit 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>LO1</td>
<td>LO2</td>
<td>LO3</td>
<td>LO4</td>
</tr>
<tr>
<td>Allowed</td>
<td>18-23</td>
<td>18-23</td>
<td>18-23</td>
<td>10-15</td>
</tr>
</tbody>
</table>

Each paper will consist of two sections (Section A and B). All questions in both sections will be compulsory.

Section A
- Questions will be based upon a pre-release article and connected specification content.
- The pre-release article is intended to provide a medical context for questions in section A. It will also contain medical data and information for analysis and/or evaluation.
- Between 22 and 25 marks will be available for Section A.
Section B
- Questions set within a medical context. All questions will require the learner to engage with stimulus material. Stimulus material may include images, diagrams, photographs, graphs and information.

3.2.2 Administration of pre-release material (unit 1)

The pre-release article will be available for centres to download from the WJEC website 4 weeks before the exam. Teachers can use the pre-release material in lessons with learners after it has been released on the WJEC website.

Learners will be issued with a clean copy of the pre-release article for the examination. Learners are not permitted to take an annotated copy of the pre-release article into the examination.

3.2.3 Unit 6

This is a synoptic assessment based upon the content of all units in the qualification. The assessment will take the form of a written examination with questions based upon three different case studies. The case studies will provide a medical context for questions in this paper and will change each year. The case studies will require candidates to integrate the knowledge, understanding and skills developed through units 1 to 5. No other learning other than that gained in the specification will be examined although learners are required to be familiar with terms specified in the case study background information sheets.

The examination will consist of one written 90 minute (75 marks) examination available in the summer of each year. All questions in the paper will be compulsory. All questions will also require the learner to engage with stimulus material. Stimulus material may include images, diagrams, photographs, graphs and information.

Assessment criteria from each learning outcome will be assessed in the examination. Marks will be apportioned as follows:

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>LO1</th>
<th>LO2</th>
<th>LO3</th>
<th>LO4</th>
<th>LO5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowed range</td>
<td>20-25</td>
<td>8-12</td>
<td>8-12</td>
<td>20-25</td>
<td>8-12</td>
<td>75</td>
</tr>
</tbody>
</table>
3.2.4 Administration of case studies (unit 6)

Background information relating to the case studies will be available for centres to download from the WJEC website 4 weeks before the exam. The information sheet for each case study will be no more than one A4 page in length. Teachers can use the case studies in lessons with learners after they have been released on the WJEC website.

Candidates need to be familiar with the information in the case studies and the related specification content.

Learners will be issued with a clean copy of the case studies for the examination. They will not be permitted to take an annotated copy of the case studies into the examination.

3.2.5 Unit 5

This unit is externally assessed by an assignment which is set and marked by WJEC. The assessment for the unit will be provided annually by WJEC in September of the academic year in which they are to be taken via the WJEC secure website. The assessment must be completed and submitted for marking in the same academic year as it is set. Centres are not allowed to modify the provided assignment for unit 5.

The assessment is carried out by the learners under controlled conditions. The controls (time, supervision, resources and collaboration) for task taking are described within the assessment. The general principles for the control of the external assessment of unit 5 are outlined below.

Controls for task taking (external assessment)

There are five areas of task taking that are controlled: time, resources, supervision, collaboration and resubmission.

Time

Each assessment will specify the total amount of time available for summative external assessment.

Resources

The supervisor should ensure suitable resources are provided to all learners to ensure fair and valid assessment takes place. Where specific resource controls must be in place, these will be stated in the assignment.

Supervision

Learners must be supervised whilst completing externally set assessment tasks. Assessments will specify the level of supervision required. Centres must have in place systems to ensure learners cannot access evidence they have been developing outside of supervised activities.
**Authentication**

Supervision is in place to ensure the authenticity of evidence produced for summative assessment. Supervisors should **not** provide input or guidance to learners during the controlled assessment time. This includes providing formative feedback on the evidence being produced. Supervisors can provide guidance on the requirements of the task and remind learners of the performance bands and how they can be interpreted. Assessors must intervene where there a health and safety issue is observed.

Learners can review and redraft evidence independently within the time controls for the assessment.

Learners must sign a declaration to confirm that all evidence submitted for marking by WJEC is their own work and that any sources used have been acknowledged.

Supervisors must sign a declaration to confirm that evidence submitted for marking by WJEC was completed under the controlled conditions set out in the assignment.

**Collaboration**

The assessment will indicate whether:

- group work may take place;
- group work is forbidden.

### 3.2.6 Resitting external assessment

Learners are allowed **two** resits of each external unit. The highest grade will contribute towards the overall grade for the qualification.

### 3.3 Internal assessment

These units are internally assessed and externally moderated:

- Unit 2
- Unit 3
- Unit 4

For internal assessment please consult ‘WJEC’s Instructions for conducting controlled assessment’. This document can be accessed through the WJEC website (www.wjec.co.uk). Each centre must ensure that internal assessment is conducted in accordance with these controls.

The following principles apply to the assessment of each internally assessed unit.

- Units are assessed through summative controlled assessment.
- Controls for assessment of each internally assessed unit are provided in a model assignment.
Each internally assessed unit must be assessed independently. Learners may produce a piece of evidence that contributes to assessment criteria for more than one unit. This is acceptable provided it can be clearly attributed to a specified assessment criterion and has been produced under the appropriate controlled conditions for each unit.

Performance bands are provided to enable centres to mark the controlled assessment. There are three stages of assessment that will be controlled:

- task setting;
- task taking;
- task marking.

**Controls Task setting**

For internal assessment, WJEC has produced model assignments for each unit. Centres are, however, allowed to modify the assignment within specified parameters. This will allow centres to tailor the assessment to local needs.

The model assignment has been written to ensure the following controls are in place.

- Each unit is assessed through one assignment.
- Each assignment must have a brief that sets out an applied purpose. An applied purpose is a reason for completing the tasks that would benefit society, a community, organisation or company. Further details are in the rationale in Section 1.2.
- The assignment can specify a number of tasks but tasks must be coherent, i.e. show how the assessment requirements all contribute to the achievement of the applied purpose of the assignment.
- The assignment must provide each learner with the opportunity to address all assessment criteria and all performance band requirements.
- The assignment must indicate the acceptable forms of evidence. These must conform to those forms set out in the model assignment.
- Where a centre has adapted the model assignment, there must be evidence of quality assuring its fitness for purpose. Sample documentation for this activity is provided with each model assignment.

Model assignments are available from the WJEC secure website.

**Task taking**

There are five areas of task taking that are controlled: time, resources, supervision, collaboration and resubmission.

**Time**

Each model assignment will specify the total amount of time available for summative assessment. Centres have the discretion for how that time is allocated to each task.

**Resources**

The assessor can determine which resources should be provided to all learners to ensure fair and valid assessment takes place. Where specific resource controls must be in place, these will be stated in the model assignment.
Supervision

Learners must normally be supervised by an assessor whilst completing controlled assignment tasks. Model assignments will specify if supervision is not required. Centres must have in place systems to ensure learners cannot access evidence they have been developing outside of supervised activities.

Authentication

Supervision is in place to ensure the authenticity of evidence produced for summative assessment. Assessors are not expected to provide input or guidance to learners during the controlled assessment time. This includes providing formative feedback on the evidence being produced. Assessors can provide guidance on the requirements of the task and remind learners of the performance bands and how they can be interpreted. Assessors must intervene where there is a Health and Safety hazard observed.

Learners can review and redraft evidence independently within the time controls for the assessment.

Learners must sign a declaration to confirm that all evidence submitted for moderation is their own work and that any sources used have been acknowledged.

Assessors must sign a declaration to confirm that evidence submitted for moderation was completed under the controlled conditions set out in the model assignments.

Collaboration

The model assignment will indicate whether:

• group work must take place;
• group work is forbidden;
• centres can elect to complete tasks through group work.

Where group work takes place, the following principles must be applied.

• Tasks should allow each member of the group to have full access to all performance bands for all assessment criteria;
• Learners must provide an individual response as part of any task outcome;
• Evidence of individual response may include written evidence (e.g. notes, evaluations, mind maps, etc.) and/or audio-visual evidence (e.g. recordings, photographs, drawings, designs, etc.);
• Evidence must be clearly attributable to each individual member of the group;
• Individual contributions must be clearly identified and stated on the accompanying authentication sheet which must be signed by both the teacher and the candidate;
• Assessment of the individual must be based on the individual contribution to the evidence produced;
• Learners’ achievement must not be affected by the poor performance of other group members;
• Learners’ achievement must not benefit from the performance of other group members.
Resubmission

Learners may resubmit internally assessed units. The learner must submit a new assessment, completed within the same levels of control. They cannot improve previously submitted work.

Learners have one resit opportunity for each internally assessed unit.

Where an individual learner who has previously submitted group work for assessment wishes to resit an internally assessed unit, one of the following options **must** be taken:

- the candidate must create a new piece of work within the same group;
- the candidate must create a new piece of work within a new group;
- the candidate must create a new piece of work with non-assessed candidates;
- the candidate must create an individual piece of work.

The same levels of control for group work, as outlined above, will apply to candidates who choose to re-sit.

Task marking

All marking of evidence must be made against the assessment criteria and performance band statements given in each unit specification. Evidence marked must comply with the controlled requirements set out in the model assignment.

Written evidence must be annotated to show how it relates to the assessment criteria and performance band requirements.

Performance evidence, for example of giving a presentation, must be made on observation records. Observation records will include a description of learner performance as well as a summative statement on the quality of that performance. Where performance is observed by someone other than an assessor, the ‘witness’ must complete a witness statement.

Assessors will need to authenticate the statement either through scrutiny of supporting evidence and/or questioning of the learner and/or witness. If the statement is authenticated, it can be allowed to contribute to the evidence for assessment. Evidence of authentication will also need to be included. Each model assignment that allows performance evidence will include a sample observation record and witness statement.

Marking should only be undertaken by a designated assessor. An assessor should have appropriate expertise in the subject and level for a specified unit. The assessor is responsible for ensuring that:

- Assessment is conducted under specified controlled conditions;
- They are clear about the requirements of the learning outcomes, assessment criteria and performance band statements prior to commencing controlled assessment;
- Evidence presented for assessment is authentic;
- Assessment decisions are accurately recorded;
- Evidence is appropriately annotated;
- Observation records contain sufficient detail for objective corroboration of decisions;
- Judgements are only made against the performance band statements.
3.4 Synoptic assessment

Synoptic assessment ‘requires a candidate to identify and use effectively in an integrated way an appropriate selection of skills, techniques, concepts, theories, and knowledge from across the course content.’


Unit 6

Unit 6, in the WJEC Level 3 Applied Diploma in Medical Science, is an externally assessed synoptic unit that examines learners understanding of key underpinning scientific principles used in the qualification. It has been designed to enable learners to identify and use skills, techniques, concepts, theories, and knowledge from across the specification content. The unit assessment is based around three case studies. Background information to the three case studies is released just before the examination (details of the management of the case study background information sheets can be found in Section 3.2.4). No other learning other than that gained in the specification will be examined although learners are required to be familiar with terms specified in the case study background information sheets.

This assessment (externally set examination) requires learners to apply the knowledge, understanding and skills they have acquired to questions based upon three case studies. These questions are designed to draw together the learning from the entire specification.

This questions based around the case studies are intended to allow learners to:

- show links and holistic understanding between all units in the specification
- demonstrate the interrelationship between overarching concepts and issues
- draw together and integrate knowledge, understanding and skills
- apply scientific knowledge and approaches to different medical contexts
- put forward explanations to support statements they have made
- apply knowledge, understanding and a range of scientific skills from across different units to different medical contexts
- transfer skills learnt in one context to a different context
- evaluate and justify decisions, choices and recommendations.

Each examination will test knowledge, understanding and skills from across the qualification.

Section 3 describes the weighting each unit makes to the questions in the external assessment.

Although unit 6 does not introduce new content, learners will need time to synthesise and integrate their learning in order to demonstrate synoptic learning.

Unit 1

Unit 1, in the WJEC Level 3 Applied Diploma in Medical Science, is also an external unit with a synoptic component that requires learners to integrate their knowledge, understanding and skills from units 2 and 3 in the context of human health and disease (context of learning in unit 1). The assessment will require the learner to show holistic understanding between the content of unit 1, unit 2 and unit 3, and requires learners to transfer knowledge, understanding and skills learnt in one context to another.
3.5 Standardisation

Centres are expected to standardise internal assessment decisions. This is the process by which centres ensure that all learners are judged to the same standard across different assessors, teaching groups and from year to year. Evidence of standardisation should be submitted with learner evidence.

Where more than one assessor is involved, the centre must appoint a Lead Assessor. The role of the Lead Assessor is to:

- Document all activities;
- Ensure that the assignment presented to learners is fit for purpose and complies with all controls;
- Ensure all assessors have appropriate documentation in place to support fair and valid assessment decisions;
- Ensure all assessment activities are in accordance with the task taking controls for the unit;
- Sample assessment judgements at appropriate times to ensure the performance bands are correctly and consistently applied;
- Provide feedback to assessors;
- Provide support to assessors on interpretation of performance band requirements.
4 GRADING

This is a unitised specification which allows for an element of staged assessment. Learners can only resit an internally assessed unit once but may resit an externally assessed unit twice (with the better result counting) before aggregation for the qualification award. Results for a unit have a shelf-life limited only by the shelf-life of the specification.

Unit grades will be awarded to give a general indication of the standards of achievement shown by learners. Unit grades will be awarded as shown in the table below. The descriptions must be interpreted in relation to the content specified by the unit; they are not designed to define that content. The grade awarded will depend in practice upon the extent to which the candidate has met these overall. Shortcomings in some aspects of the assessment may be balanced by better performances in others. Learners who fail to achieve an E grade in a particular unit will be awarded a U (unclassified grade) for that unit.

A 'near pass' rule has been introduced for all external units. A candidate will achieve a pass (or higher) grade for the qualification if they meet the following two requirements:

i) Achieve the total UMS required at the relevant grade for the qualification
ii) Obtained at least the minimum UMS for the relevant external units

Individual unit results are reported on a uniform mark scale (UMS). The grade equivalences for the Level 3 Applied Diploma in Medical Science are given in the following tables.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Assessment type</th>
<th>Raw Mark</th>
<th>weighting %</th>
<th>UMS mark</th>
<th>UMS grade boundaries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>1</td>
<td>External</td>
<td>90</td>
<td>25</td>
<td>240</td>
<td>192</td>
</tr>
<tr>
<td>2</td>
<td>Internal</td>
<td>80</td>
<td>12.5</td>
<td>120</td>
<td>96</td>
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<tr>
<td>3</td>
<td>Internal</td>
<td>92</td>
<td>12.5</td>
<td>120</td>
<td>96</td>
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<td>4</td>
<td>Internal</td>
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<td>120</td>
<td>96</td>
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<tr>
<td>6</td>
<td>External</td>
<td>75</td>
<td>12.5</td>
<td>120</td>
<td>96</td>
</tr>
</tbody>
</table>

The Level 3 Applied Diploma in Medical Science qualification is reported on a six point scale: E, D, C, B, A & A*. The attainment of learners who do not reach the minimum standard for an E grade will receive a U (unclassified) grade and will not receive a qualification certificate.

Candidates may resit internally assessed units once only, and externally assessed units twice. The best grade will be used for aggregation. If a candidate wishes to resit an internal unit more than once or an external unit more than twice, no results from units taken previously may be used in aggregating the new grade and all units in the qualification must be taken again.
To achieve an A, B, C, D or E grade, learners must obtain:

- the minimum UMS mark for the qualification grade (see Table: UMS and qualification grade);

**and**
- a pass in all units.

To achieve an A* grade, learners must obtain:

- the minimum UMS mark for the qualification grade (see Table: UMS and qualification grade);

- a minimum of an E grade in all units.

**and**
- 90% of the UMS marks available on units 4, 5, and 6.

**Table: UMS and qualification grade**

<table>
<thead>
<tr>
<th>Grade</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>Max. Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark</td>
<td>768</td>
<td>672</td>
<td>576</td>
<td>480</td>
<td>384</td>
<td>960</td>
</tr>
</tbody>
</table>

Units 1 to 3 are common to the WJEC Certificate in Medical Science.
5 UNITS

Unit 1  Human health and disease

WJEC unit entry code

Guided learning hours  90

Aim and purpose

This unit develops knowledge and understanding of human anatomy and physiology. The unit will develop an understanding of the function of organ systems and some problems that can occur in these systems.

The unit will enable learners to understand the normal functioning of the body at a cellular and physiological system level. They will learn how these systems react in different situations, and how these systems can go wrong in order to report on health of individuals.

Unit introduction

What systems are fundamental to maintenance of human life? How do these systems work normally? How do systems influence each other? How do these systems compensate when our activities change? Why do these systems sometimes go wrong?

Healthcare professionals and scientists working in the healthcare sector need to understand the anatomy and physiology of the human body. An understanding of how physiological systems work under normal circumstances is fundamental to maintain good health. This understanding is also crucial to enable treatment of individuals when injury or disease occurs. There are a huge number of healthcare professionals that deliver care and treatment to a diverse range of patients. Scientists also work in the healthcare sector, as well as in universities, government agencies and in the pharmaceutical and bioscience industries.

Some of the features and characteristics of healthcare professionals and medical scientists such as meeting deadlines, attention to detail, methodical approach and analytical thinking are important transferable skills, applicable in all aspects of life and work. They must have good communication skills as liaison with patients, other scientists and healthcare workers, and other agencies is often necessary.

This unit is designed to help you understand the ways that healthcare professionals and scientists involved within the medical sector work so that you will be able to tackle problems and answer questions in a medical context. This will involve you examining the key principles that underlie the functioning of our body systems, how they are maintained and how problems can arise.
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LO1 understand biological principles</strong></td>
<td><strong>AC1.1</strong> describe the function of main classes of biological molecules in humans</td>
<td><strong>Classes of biological molecules</strong>&lt;br&gt;• carbohydrates&lt;br&gt;  o monosaccharides, disaccharides, polysaccharides&lt;br&gt;• lipids&lt;br&gt;  o triglycerides, phospholipids, steroids&lt;br&gt;• proteins and enzymes&lt;br&gt;  o mechanisms of action (lock and key, induced fit)&lt;br&gt;  o factors affecting enzyme reactions (temperature, pH, substrate concentration, enzyme concentration, inhibitors)&lt;br&gt;• nucleotides&lt;br&gt;  o ATP&lt;br&gt;• nucleic acids&lt;br&gt;  o DNA&lt;br&gt;  o RNA</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.2</strong> describe structure of human cells</td>
<td><strong>Human cellular structure</strong>&lt;br&gt;• plasma membrane&lt;br&gt;• nucleus&lt;br&gt;• nucleolus&lt;br&gt;• endoplasmic reticulum&lt;br&gt;• golgi apparatus&lt;br&gt;• mitochondria&lt;br&gt;• nuclear envelope</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.3</strong> explain transport systems in cells</td>
<td><strong>Movement into and out of cells</strong>&lt;br&gt;• simple diffusion&lt;br&gt;• osmosis&lt;br&gt;• facilitated diffusion&lt;br&gt;• active transport&lt;br&gt;• endo/exocytosis</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.4</strong> explain how cells process information</td>
<td><strong>DNA mechanisms</strong>&lt;br&gt;• semi conservative replication&lt;br&gt;• transcription&lt;br&gt;• translation&lt;br&gt;• 'one gene one protein' hypothesis&lt;br&gt;• triplet code</td>
</tr>
<tr>
<td>Learning outcomes</td>
<td>Assessment criteria</td>
<td>Content</td>
</tr>
<tr>
<td>-------------------</td>
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</tr>
</tbody>
</table>
| **LO2 understand function of human physiological systems** | **AC2.1 describe structure of human physiological systems** | **Systems**  
• endocrine, nervous system, musculoskeletal system, digestive system, cardiovascular system, lymphatic system, respiratory system, integumentary system, immune system  
**Endocrine system**  
• pancreas, pituitary, kidney  
**Nervous system**  
• CNS  
• PNS  
**Musculoskeletal system**  
• spinal column, joints, muscles  
**Digestive system**  
• mouth, oesophagus, stomach, pancreas, liver, duodenum, ileum, colon  
**Cardiovascular system**  
• blood vessels  
  • arteries, veins, capillaries  
• heart  
  • coronary arteries, chambers, aorta, pulmonary artery, vena cava, pulmonary vein, cardiac muscle, valves  
• blood  
  • plasma, platelets, red blood cells, white blood cells, blood group  
**Lymphatic system**  
• vessels, nodes  
**Respiratory system**  
• lung, trachea, bronchi, bronchioles, alveoli, pleural membranes, ribs, diaphragm  
**Integumentary system**  
• structure of skin  
**Immune system**  
• white blood cells  
• antibodies  
• basic complement system |
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The learner will:</strong></td>
<td><strong>The learner can:</strong></td>
<td><strong>Endocrine System</strong>&lt;br&gt;• purpose of system&lt;br&gt;• role of the pancreas&lt;br&gt;• action of insulin, action of glucagon&lt;br&gt;• role of the kidney&lt;br&gt;• action of ADH&lt;br&gt;&lt;br&gt;<strong>Nervous system</strong>&lt;br&gt;• purpose of system&lt;br&gt;• voluntary and involuntary responses&lt;br&gt;&lt;br&gt;<strong>Musculoskeletal system</strong>&lt;br&gt;• purpose of system&lt;br&gt;• sliding filament theory&lt;br&gt;&lt;br&gt;<strong>Digestive system</strong>&lt;br&gt;• purpose of system&lt;br&gt;• chemical digestion&lt;br&gt;• mechanical digestion&lt;br&gt;• bile production&lt;br&gt;• glucose metabolism&lt;br&gt;• absorption&lt;br&gt;&lt;br&gt;<strong>Cardiovascular system</strong>&lt;br&gt;• purpose of system&lt;br&gt;• control of heartbeat&lt;br&gt;&lt;br&gt;<strong>Lymphatic system</strong>&lt;br&gt;• formation of tissue fluid&lt;br&gt;• formation of lymph&lt;br&gt;&lt;br&gt;<strong>Respiratory system</strong>&lt;br&gt;• purpose of system&lt;br&gt;• control of breathing&lt;br&gt;• role of pulmonary surfactant&lt;br&gt;&lt;br&gt;<strong>Integumentary system</strong>&lt;br&gt;• purpose of system&lt;br&gt;• thermoregulation&lt;br&gt;&lt;br&gt;<strong>Immune System</strong>&lt;br&gt;• purpose of system</td>
</tr>
<tr>
<td>LO2 cont.</td>
<td>AC2.2 explain function of human physiological systems</td>
<td><strong>Endocrine System</strong>&lt;br&gt;• purpose of system&lt;br&gt;• role of the pancreas&lt;br&gt;• action of insulin, action of glucagon&lt;br&gt;• role of the kidney&lt;br&gt;• action of ADH&lt;br&gt;&lt;br&gt;<strong>Nervous system</strong>&lt;br&gt;• purpose of system&lt;br&gt;• voluntary and involuntary responses&lt;br&gt;&lt;br&gt;<strong>Musculoskeletal system</strong>&lt;br&gt;• purpose of system&lt;br&gt;• sliding filament theory&lt;br&gt;&lt;br&gt;<strong>Digestive system</strong>&lt;br&gt;• purpose of system&lt;br&gt;• chemical digestion&lt;br&gt;• mechanical digestion&lt;br&gt;• bile production&lt;br&gt;• glucose metabolism&lt;br&gt;• absorption&lt;br&gt;&lt;br&gt;<strong>Cardiovascular system</strong>&lt;br&gt;• purpose of system&lt;br&gt;• control of heartbeat&lt;br&gt;&lt;br&gt;<strong>Lymphatic system</strong>&lt;br&gt;• formation of tissue fluid&lt;br&gt;• formation of lymph&lt;br&gt;&lt;br&gt;<strong>Respiratory system</strong>&lt;br&gt;• purpose of system&lt;br&gt;• control of breathing&lt;br&gt;• role of pulmonary surfactant&lt;br&gt;&lt;br&gt;<strong>Integumentary system</strong>&lt;br&gt;• purpose of system&lt;br&gt;• thermoregulation&lt;br&gt;&lt;br&gt;<strong>Immune System</strong>&lt;br&gt;• purpose of system</td>
</tr>
<tr>
<td>Learning outcomes</td>
<td>Assessment criteria</td>
<td>Content</td>
</tr>
<tr>
<td>-------------------</td>
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<td>---------</td>
</tr>
<tr>
<td>The learner will:</td>
<td>The learner can:</td>
<td></td>
</tr>
</tbody>
</table>
| LO3 understand how external factors impact on the body | AC 3.1 explain how lifestyle may affect major body systems | Affects  
  • physiological and psychological effects  
  **Physiological effects**  
  • coronary heart disease  
  • diabetes  
  • nutrient deficiencies  
  • obesity  
  • alcohol/drug dependency  
  • lung disease  
  **Psychological effects**  
  • stress  
  • depression |
|                   | AC3.2 assess how lifestyle may impact health | Lifestyle  
  Examples  
  • diet, alcohol and recreational drugs  
  • smoking  
  • exercise/physical activity  
  • housing  
  • type of employment |
|                   | AC3.3 explain how pathogens can affect body systems | Pathogens  
  • viruses  
  • bacteria  
  • protozoan  
  • fungal  
  • worms  
  • prions |
|                   | AC3.4 explain how non-infectious diseases affect body systems | Non-infectious conditions  
  • allergies  
  • autoimmune diseases  
  • cancer  
  • Inherited diseases e.g. dominant, recessive and sex-linked |
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
</table>
| LO4, be able to report on human health | AC4.1 analyse data | Qualitative  
  - e.g. interviews, observation, diaries (link to unit 3)  
Quantitative  
  - physiological methods (link to unit 2) |
| AC4.2 process data | Process data |  
  - graphical methods, calculations  
Graphical methods  
  - scatter diagrams, line graphs, trend lines  
  - bar charts  
Calculations  
  - expressions in decimal and standard form  
  - interchange ratios, fractions and percentages  
  - find arithmetic means  
  - make order of magnitude calculations  
  - substitute numerical values into algebraic equations and solve them using appropriate units for physical quantities  
  - translate information between graphical and numeric form  
  - determine the slope of a linear graph  
Significant figures  
  - expresses information to appropriate number of significant figures |
| AC4.3, make evidence based conclusions | Conclusions |  
  - comparison of data  
  - linking of ideas  
  - uncertainty in conclusions |
| AC4.4, report on health | Report  
Communication |  
  - language style and accuracy  
Language |  
  - spelling, grammar, structure  
Style |  
  - formal, informal  
  - appropriateness for audience  
Audience |  
  - individual  
  - technical, non-technical |
Assessment

This unit is assessed through a written examination set each summer. Details relating to the external assessment and the management of the pre-release article accompanying the examination can be found in section 3.2.1 and 3.2.2 of the specification.

Guidance for Delivery

Making teaching vocationally relevant

It is important that learners recognise the knowledge and understanding they develop are vocationally relevant. There are a number of ways in which this can be achieved:

- arranging visits to work places, e.g. clinical laboratories or healthcare establishments.
- arranging talks by visiting speakers, e.g. healthcare professionals, clinical scientists or scientists working in the pharmaceutical industry.
- using data from websites such as Public Health Wales/England to look at causes and spread of disease.
- Developing learning activities in conjunction with universities or healthcare professionals.

This unit is closely related to the content and context of units 2 and 3. The content is therefore best integrated into the delivery of units 2 and 3.
Resources

Textbooks

A level Biology Textbooks

Websites

Biochemical Society – resources for teaching concepts at Level 3
http://www.biochemistry.org/Education/Teachers.aspx

apbi – resources for teaching cell biology
http://abpischools.org.uk/page/modules/cellbiology/.cfm?age=Age%20range%2016-19&subject=Science

The A level Biologist – resources for many parts of this unit
http://www.thealevelbiologist.co.uk/the-passage-of-water-through-a-plant

S-cool – resources for many topics covered by this unit
http://www.s-cool.co.uk/a-level/biology

Society of biology – resources available for teaching this unit
http://www.societyofbiology.org/education/teaching-resources

Office of National Statistics – useful for obtaining data to study nationwide prevalence of disease
http://www.ons.gov.uk/ons/index.html

NHS Choices – useful to study how lifestyle and disease affects health
http://www.nhs.uk/Pages/HomePage.aspx

Nuffield Foundation – a number of practical activities available to support the teaching of this unit
http://www.nuffieldfoundation.org/practical-biology/health-and-disease

Society for General Microbiology – many resources for teaching infectious diseases and microbiology
http://www.sgm.ac.uk/

Public Health Wales- a useful website for information on health problems in Wales
http://www.publichealthwales.wales.nhs.uk/
## Unit 2  Physiological measurement techniques

**WJEC unit entry code**

Guided learning hours  45

<table>
<thead>
<tr>
<th>Aim and purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>This unit develops knowledge and understanding about the physiological measurements that can be made to assess the function of major body systems. It relates anatomy and physiology to physiological measurement test results, through an understanding of the principles of the measurement techniques.</td>
</tr>
</tbody>
</table>

The unit will enable learners to perform tests which will accurately measure a range of physiological functions. They will be able to interpret the results of these tests and other tests and link this to possible physiological disorders.

<table>
<thead>
<tr>
<th>Unit introduction:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiological measurements play a very important role in the diagnosis and treatment of patients in a range of clinical settings. What simple clinical measurements can be carried out? How are complex measurements carried out? How do we know what measurement to select?</td>
</tr>
</tbody>
</table>

When physiological measurements are carried out - such as measuring temperature, pulse rate or respiration rate – healthcare professionals are monitoring for signs of abnormality (i.e. anything that falls outside of the ‘normal’ range). Health professionals will then be able to draw conclusions about the health status of the individual and evaluate any treatments they may require. Most healthcare scientists involved with physiological measurement work in hospital clinics and departments or as part of surgical teams.

This unit is designed to help you understand how healthcare scientists who work in physiological sciences, investigate the function of body systems by undertaking physiological measurements. This involves using specialist equipment, advanced technologies and a range of different procedures.
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
</table>
| **LO1** understand the function of physiological measurement tests | **AC1.1** explain principles of physiological measurement tests | **Physiological measurement tests**
| | | • cardiac physiology (e.g. electrocardiograms (ECG): ambulatory and stress, echocardiography, exercise tolerance testing, blood pressure)
| | | • respiratory physiology (e.g. respiratory rate, peak expiratory flow, spirometry, oximetry)
| | | • neurophysiology (e.g. nerve conduction studies, electromyography, electroencephalography, evoked potentials)
| | | • audiology (otoscopic examination, pure tone audiometry, tympanometry tuning fork tests)
| | | • GI physiology (endoscopy, measurement of muscle and sphincter function)
| | | • ophthalmic physiology (ophthalmic imaging, intra-ocular pressure measurements)
| | | • urodynamics (free flow rate, cystometry)
| | | • vascular function (scans: carotid, peripheral arterial, peripheral venous)
| | **Principles** | • how does the test work |
| | **AC1.2** explain significance of data obtained from physiological measurements | **Significance**
| | | • normal range
| | | • outside normal range
| | | • indicators of disease/ disorders
| | **Examples** | • cardiovascular disease such as coronary heart disease, congenital heart disease, arrhythmias
| | | • hearing impairment/loss
| | | • eye disease, vision disorders
| | | • conditions affecting the central and peripheral nervous system
| | | • conditions affecting upper and lower GI tract
| | | • conditions affecting bladder and lower urinary tract function
| | | • conditions affecting arteries and veins e.g. DVT |
| | **AC1.3** describe limitations of physiological measurement testing | **Limitations**
| | | • precision & accuracy
| | | • artefacts
| | | • sensitivity
<p>| | | • measurement errors |</p>
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learner will:</td>
<td>The learner can:</td>
<td></td>
</tr>
</tbody>
</table>
| LO2 understand how to deal with patients | AC2.1 explain importance of patient confidentiality | **Confidentiality**  
  - codes of practice (e.g. NHS code of practice)  
  - protect information, inform, provide  
  - Disclosure of information |
|                   | AC2.2 describe conduct towards patients | **Conduct**  
  - empathy  
  - tone  
  - use of language |
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The learner will:</strong></td>
<td><strong>The learner can:</strong></td>
<td><strong>Key aspects of plan</strong></td>
</tr>
</tbody>
</table>
| **AC3.1** plan to perform physiological measurement tests | | • identifies information to collect  
• procedures and equipment  
• location  
• timing  
• informing individuals |
| **Procedures and equipment** | | • identifies procedures  
• informs technician of required equipment and times |
| **Informing individuals** | | • patients  
• other personnel affected (e.g. facilities) |
| **AC3.2** use physiological testing equipment | **Equipment** | **e.g.**  
• peak flow meter  
• equipment for hearing tests (e.g. otoscope, pure tone audiometer, tympanometer)  
• equipment for ophthalmic tests (e.g. visual acuity, field of vision and colour vision)  
• cardiovascular equipment (e.g. electrocardiogram-ECG, echocardiography (Echo) blood pressure monitor, pulse oximeter) |
| **AC3.3** record results from physiological measurement tests | **Recording documentation** | **laboratory notebook**  
**proforma**  
**LMS/database records** |
| **Records made** | | • information recorded  
• precision of recorded data  
• legible entries |
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The learner will:</strong></td>
<td><strong>The learner can:</strong></td>
<td><strong>Physiological measurement tests</strong></td>
</tr>
</tbody>
</table>
| LO4 be able to report on physiological measurement testing | AC4.1 process data from physiological measurement tests | - primary data  
- secondary data  
**Process data**  
- graphical methods  
- calculations  
**Comparisons**  
- comparison of data to expected norms, considering age, gender, ethnicity  
- comparison of data to previous test results: patient history  
**Physiological basis of findings**  
- link findings to expected physiology and possible pathology  
- any uncertainty in conclusions |
| | AC4.2 make evidence based conclusions about the “health” of individuals | **Evaluation**  
- validity of data  
- presence of artefacts  
- variables affecting data |
| | AC4.3 evaluate information from physiological measurement tests | **written communication**  
- technical and scientific language  
- spelling, punctuation and grammar  
- clarity  
- relevance of included material  
- structure of communication  
**Audiences**  
- colleagues, patients  
**Style of language/format used**  
- scientific and technical  
- semi technical, non-technical  
- illustrations |
## Learning Outcome
The learner will:

**LO1** understand the function of physiological measurement tests

### Assessment criteria

**The learner can:**

<table>
<thead>
<tr>
<th>AC1.1 explain principles of physiological measurement tests</th>
<th>Band 1</th>
<th>Band 2</th>
<th>Band 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gives an explanation of the principles of a specified physiological measurement test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low level explanations may not always clearly show reasoning</td>
<td>Test 1 1-2</td>
<td>Test 1 3-4</td>
<td>Test 1 5-6</td>
</tr>
<tr>
<td>Test 2 1-2</td>
<td>Test 2 3-4</td>
<td>Test 2 5-6</td>
<td></td>
</tr>
<tr>
<td>Test 3 1-2</td>
<td>Test 3 3-4</td>
<td>Test 3 5-6</td>
<td></td>
</tr>
</tbody>
</table>

*Three different tests to be individually marked against performance descriptors*

### Performance bands

<table>
<thead>
<tr>
<th>Band 1</th>
<th>Band 2</th>
<th>Band 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low level explanations may not always clearly show reasoning</td>
<td>Test 1 1-2</td>
<td>Test 1 3-4</td>
</tr>
<tr>
<td>Test 2 1-2</td>
<td>Test 2 3-4</td>
<td>Test 2 5-6</td>
</tr>
<tr>
<td>Test 3 1-2</td>
<td>Test 3 3-4</td>
<td>Test 3 5-6</td>
</tr>
</tbody>
</table>

Max. mark available 18

### AC1.2 explain significance of data obtained from physiological measurement tests

| Test 1 1-2 | Test 2 3-4 | Test 3 5-6 |
| Low level explanations may not always clearly show reasoning | Test 2 1-2 | Test 2 3-4 |
| Test 3 1-2 | Test 3 3-4 | Test 3 5-6 |

### AC1.3 describe limitations of physiological measurement testing

| Test 1 1-2 | Test 2 3-4 | Test 3 5-6 |
| Low level explanations may not always clearly show reasoning | Test 2 1-2 | Test 2 3-4 |
| Test 3 1-2 | Test 3 3-4 | Test 3 5-6 |

Zero marks to be awarded where there is insufficient evidence to achieve a mark at band 1
<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Assessment criteria</th>
<th>Performance bands</th>
</tr>
</thead>
<tbody>
<tr>
<td>LO2 understand how to deal with patients</td>
<td>AC2.1 explain importance of patient confidentiality</td>
<td>Band 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gives an explanation of the importance of patient confidentiality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low level explanations may not always clearly show reasoning 1-2</td>
</tr>
<tr>
<td></td>
<td>AC2.2 describe conduct towards patients</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LO3 be able to carry out physiological measurement tests</td>
<td>AC3.1 plan to perform physiological measurement tests</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AC3.2 use physiological testing equipment</td>
<td>Correctly uses some physiological testing equipment 1-2</td>
</tr>
<tr>
<td></td>
<td>AC3.3 record results from physiological measurement tests</td>
<td>Most key data is recorded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Entries are generally legible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some data recorded to appropriate precision</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Zero marks to be awarded where there is insufficient evidence to achieve a mark at band 1
<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Assessment criteria</th>
<th>Band 1</th>
<th>Band 2</th>
<th>Band 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>LO4 be able to report on physiological testing</td>
<td>AC4.1 process data from physiological measurement tests</td>
<td>Processes data from physiological measurement tests using appropriate techniques. Some aspects of graphs/calculations are clearly and logically presented Makes a limited use of significant figures.</td>
<td>Accurately processes data from physiological measurement tests using appropriate techniques. Graphs/calculations are mostly clearly and logically presented Makes some appropriate and accurate use of significant figures.</td>
<td>Consistently, systematically and accurately processes data from physiological measurement tests using appropriate techniques. Graphs/calculations are clearly and logically presented Consistently makes appropriate and accurate use of significant figures.</td>
</tr>
<tr>
<td></td>
<td>AC4.2 make evidence based conclusion about the “health” of individuals</td>
<td>Makes some simple and mostly appropriate conclusions based upon evidence Some conclusions are linked to the evidence</td>
<td>Makes valid conclusions based upon evidence (with some detail) The conclusions are clearly linked to the evidence</td>
<td>Makes valid and detailed conclusions based upon evidence The conclusions are clearly and logically linked to the evidence</td>
</tr>
<tr>
<td></td>
<td>AC4.3 evaluate information from physiological measurement tests</td>
<td>Makes some valid judgements about information from physiological measurement tests with some reasoning</td>
<td>Makes mainly valid judgements about information from physiological measurement tests, showing clear reasoning</td>
<td>Makes valid judgements about information from physiological measurement tests, showing clear reasoning</td>
</tr>
<tr>
<td></td>
<td>AC4.4 communicate in writing</td>
<td>Communicates some information from physiological measurement tests Uses some scientific and technical language appropriate to the audience Uses some appropriate styles and structure Uses some accurate spelling, punctuation and grammar</td>
<td>Mostly clearly communicates information from physiological measurement tests Mostly uses scientific and technical language appropriate to the audience Uses mostly appropriate styles and structure Uses mostly accurate spelling, punctuation and grammar</td>
<td>Clearly communicates information from physiological measurement tests Consistently uses scientific and technical language appropriate to the audience. Uses appropriate styles and structure Uses accurate spelling, punctuation and grammar</td>
</tr>
</tbody>
</table>

Zero marks to be awarded where there is insufficient evidence to achieve a mark at band 1.
Assessment

This unit is internally assessed and externally moderated through a summative controlled assessment. All assessment must be conducted under controlled assessment conditions. Section 3.3 of the specification details the principles involved in internal assessment. WJEC has produced a model assignment for this unit which is available through the WJEC secure website.

The unit 1 examination will also contain a synoptic component that includes content from unit 1. Details of the examination and the contribution of unit 2 to the assessment can be found in section 3.2.1.

Guidance for Delivery

Making teaching vocationally relevant

It is important that learners recognise the knowledge and understanding they develop are vocationally relevant. There are a number of ways in which this can be achieved:

- Arranging visits to work places with physiological measurement testing equipment, this could include; hospitals departments, opticians, GP surgeries and Health centres;
- Providing work experience with organisations that perform physiological measurement tests to assess health. This could be in a hospital or health care setting, but could also include health and leisure centres or private gyms. This work experience could be just a one or two day experience or could form part of a planned school work placement scheme;
- Arranging talks by visiting speakers from a range of Health Care professions: clinicians, technicians, doctors and nurses;
- Developing learning activities in conjunction with individuals/organisations that perform physiological measurement tests or use the results of tests;
- Using real life data from physiological measurement tests. For example local hospitals or gyms may be able to provide anonymised data from the last 20 individuals that undertook lung function tests, or they may be able to provide ECG traces.

The following are examples of approaches to delivery which could be used to enhance the learners’ understanding of the vocational importance of physiological techniques.

Example 1

Learners will need to be provided with formative opportunities to undertake the physiological measurements required as part of the summative assessment for this unit before they undertake the controlled assessment. A local sports team, such as a local amateur football or rugby team could be contacted to act as “subjects” for the tests, in a “Who is the healthiest member of the team competition”. Work stations could be set up to test “Who in the team has the greatest lung capacity?” “Who has the lowest blood pressure?” “Who has the slowest recovery rate?” Groups of learners would run each work station and collect all results. These results could then be pooled into a class set of results, which could be presented to the team to award “the healthiest member of the team”.
Example 2

Learners could be provided with a range of actual patient results from hospital departments—ECG traces, 24 hour blood pressure measurements, peak flow measurements, EEG results, and audiology measurements. Learners could then work in teams to discuss results, interpret these against accepted health ranges, considering normal and abnormal results. Each group could then present their findings to other groups.

Example 3

Learners could take on the role of a sales team for a physiological measurement equipment company. Each “sales team” could take on the responsibility for specific areas of equipment—one team for example specialises in cardiovascular equipment, another specialises in equipment for audiology etc. A local private hospital is thinking about investing in physiological measurement equipment across 5 clinical areas: cardiovascular, respiratory, audiology, neurophysiology and gastrointestinal physiology. Each sales team must give a presentation about the equipment their company could supply, this equipment must include the principles of how the equipment works and what it’s main purpose would be.

Making Contacts

Examples of organisations that may be approached to provide help include:

- hospitals and Health Care Trusts;
- other health care settings and individuals (e.g. doctors, practice nurse, health centres);
- opticians;
- private health care facilities;
- council run leisure facilities;
- private gyms and leisure facilities;
- university medical and human biology departments.
Resources

Textbooks

Any general physiology text books aimed at level 3 learners will support understanding for this unit, text books aimed at Physical Education students and Human Biology students would support underlying principles. There are also some specific texts available, but it should be noted that these may go beyond the expected level of understanding for this unit.


Websites

NHS confidentiality Code of Practice

Information from institute of Physics and Engineering in Medicine on Physiological Measurement:
http://www.ipem.ac.uk/CareersTraining/Whatdoourmembersdo/PhysiologicalMeasurement.aspx

PowerPoint on Physiological measurement testing:

Information on High blood pressure and hypertension
http://www.bpassoc.org.uk/

Information on Peak flow measurement and recording
http://patient.info/health/asthma-peak-flow-meter

Information on Electrocardiogram:
https://www.bhf.org.uk/heart-health/tests/ecg

Information on Pulse Oximetry:
http://www.hopkinsmedicine.org/healthlibrary/test_procedures/pulmonary/oximetry_92_P077_54/

Information leaflet from North Lincolnshire and Goole hospitals trust on EEG:

Information on audiology tests:
http://www.nhs.uk/Conditions/Hearing-tests/Pages/How%20it%20is%20performed.aspx
The National STEM centre e-library has a range of resources which would support the delivery of this unit, for example:

http://www.nationalstemcentre.org.uk/elibrary/resource/7519/electrocardiagrams

This resource from the Institute of Physics, describes how electrocardiagrams (ECGs) record the activity of the heart through electrodes placed on a patient's skin. The teacher's notes contain an introduction to ECGs and lesson notes for the associated PowerPoint file. A mark scheme for the worksheet is also included. The worksheet contains questions that could be used as a summative test on the topic (10 marks). The animated PowerPoint shows how blood flow and muscle contraction within the heart is related to the ECG trace. The graphs show how heart rate can be calculated by measuring the period between successive peaks on the ECG.

http://www.nationalstemcentre.org.uk/elibrary/resource/2689/blood-pressure

This is an article about fainting in the “Catalyst” magazine. Although aimed initially at GCSE students, this would be a useful article for self directed study and subsequent class discussion.

http://www.nationalstemcentre.org.uk/dl/30dbf2418345a221623158fc61f6ed409c6308dc/8664-catalyst_17_3_311.pdf

This article again from the Catalyst magazine, discusses the basic functioning of the eye as well as physiological measurements that are undertaken to diagnosis eye problems.
Unit 3 Medical Science research methods

WJEC unit entry code

Guided learning hours 45

Aim and purpose

This unit develops knowledge and understanding of planning, conducting and reporting of research in medical sciences using a range of methodologies and techniques. It is intended to enable the acquisition of the necessary knowledge and skills to carry out research in order to obtain meaningful information. It also seeks to promote an understanding of the processes involved in drawing meaningful inferences from research data.

Learners will use their knowledge and understanding of research methods to conduct their own research. They will process the data they have collected and make evidence based conclusions.

Unit introduction

How can we find out if lifestyle affects health? How has medical science research been carried out to show that MMR is not connected to autism? Is there a meaningful connection between alcohol consumption and life expectancy? How could research be carried out to find if eating ‘five-a-day’ of fruit and vegetables is linked to good health? How can we improve the way in which ulcers are managed in hospital? Are sedentary children more likely to get ME? Why do people start smoking?

Medical research methods are intended to help answer questions like the ones outlined above. Real-life studies can be complex because of the many variables that need to be taken into account and controlled. This unit is designed to help you think through the issues involved in research so that we can have confidence in the conclusions that have been made.

In this unit, you will be introduced to the methods of scientific enquiry which are used to answer questions such as those proposed above. The unit has been designed to develop your knowledge and understanding of planning, conducting, analysing and reporting research in medical sciences. It will do this by introducing you to a range of methodologies and techniques that are used. It will also encourage the acquisition of a range of evaluative concepts for reviewing and discussing the design and outcome of research. All of this will be done through a hands-on approach where you will plan and collect information to answer questions connected to medical science.
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>The learner will:</em></td>
<td><em>The learner can:</em></td>
<td></td>
</tr>
<tr>
<td><strong>LO1 understand research methods</strong></td>
<td>AC1.1 describe variables affecting research</td>
<td>Variables</td>
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<tr>
<td></td>
<td></td>
<td>• variables (independent variables, dependent variables)</td>
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<td></td>
<td></td>
<td>• extraneous variables</td>
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<td></td>
<td>AC1.2 justify the research hypothesis</td>
<td>Hypothesis</td>
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<td></td>
<td></td>
<td>• null hypotheses</td>
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<td>• alternative hypotheses</td>
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<td></td>
<td>• one-tailed (directional) hypotheses</td>
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<td></td>
<td></td>
<td>• two-tailed (non-directional) hypotheses.</td>
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<td></td>
<td></td>
<td><strong>Justification</strong></td>
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<tr>
<td></td>
<td></td>
<td>• relevance to research question</td>
</tr>
<tr>
<td></td>
<td>AC1.3 justify selection of sampling methods</td>
<td>Sampling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• target population and sample</td>
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<td>• random sampling</td>
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<td>• snowball sampling</td>
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<td>• opportunity sampling</td>
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<td></td>
<td>• self-selected sampling</td>
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<td></td>
<td>AC1.4 explain selection of research methods</td>
<td>Research methods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• quantitative methods (e.g. laboratory experimentation, epidemiological, closed questionnaires)</td>
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<td></td>
<td></td>
<td>• qualitative methods (e.g. participant observation, non-participant observation, structured interview, unstructured interview)</td>
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<td></td>
<td><strong>Justification</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• relevance to research question and hypothesis</td>
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<td></td>
<td></td>
<td>• type of information required</td>
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<tr>
<td><strong>AC1.5 evaluate how ethical issues affect research</strong></td>
<td>Ethical review</td>
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<tr>
<td></td>
<td></td>
<td>• ethical review of research and methods</td>
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<td><strong>Evaluation in terms of:</strong></td>
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<td>• social / scientific value</td>
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<td>• care and protection of research participants</td>
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<td>• confidentiality</td>
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<td>• informed consent</td>
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<td></td>
<td>• working with vulnerable individuals (including children)</td>
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<td><strong>Health review committees</strong></td>
</tr>
<tr>
<td>Learning outcomes</td>
<td>Assessment criteria</td>
<td>Content</td>
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<tr>
<td>The learner will:</td>
<td>The learner can:</td>
<td></td>
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</tbody>
</table>
| LO2 be able to collect data | AC2.1 plan to collect data | Procedures  
- quantitative  
- qualitative  
Plan  
- sequencing  
- timing |
|                   | AC2.2 produce documentation to collect data | Documentation  
- documents e.g. questionnaires, interviewer documentation  
- clarity  
- suitability and relevance for purpose  
- completeness |
|                   | AC2.3 obtain data    | Data  
- suitable  
- sufficient |
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The learner will:</strong></td>
<td><strong>The learner can:</strong></td>
<td><strong>Terms</strong></td>
</tr>
</tbody>
</table>
| **LO3** understand data analysis | AC3.1 explain significance of terms used in data analysis | • type I errors, type II errors  
• demand characteristics  
• reliability (internal reliability, external reliability)  
• validity (internal validity, external validity)  
• bias (including researcher/observer bias)  
• confidence limits  
• significance levels  
• correlation (positive correlation, negative correlation, no correlation)  
• dispersion |
| | | **Statistical methods** |
| | | • descriptive statistics  
  o measures of central tendency (mode, median, mean)  
  o measures of dispersion (variance, range, standard deviation)  
• inferential statistics  
  o normal distribution curves, skewed distribution curves  
  o probability  
  o significance levels  
  o parametric test  
  o specific non-parametric inferential test (e.g. t-test, Chi-square, Mann-Whitney U test and Spearman’s Rho) |
| | | **Explanation** |
| | | • data type and methodology  
• sampling method and size |
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
</table>
| LO4 be able to process data | AC4.1 analyse data using statistical methods | **Statistical methods**  
  - mean, mode, median  
  - measures of dispersion (variance, range, standard deviation)  
  - normal distribution curves, skewed distribution curves  
  - probability  
  - significance levels  
  - confidence limits  
  - parametric test  
  - specific non-parametric inferential test  
  - correlation
|                  |                     | **Application**  
  - appropriateness  
  - accuracy  
|                  |                     | **Conclusions**  
  - conclusions based upon data / data analysis
| AC4.2 make conclusions from data |                     | **Evaluation**  
  In terms of  
  - sufficiency, suitability, quality data produced (e.g. validity etc)  
  - limitations of data  
  - cost, time, effectiveness procedures
| AC4.3 evaluate procedures |                     | **Mathematical notation**  
  - ratios, percentages, fractions  
  - symbols: $=, <, <<, >, >, \propto, \sim$  
  - significant figures
<p>| AC4.4 use mathematical notation |                     |</p>
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The learner will:</strong></td>
<td><strong>The learner can:</strong></td>
<td><strong>Visual methods</strong></td>
</tr>
</tbody>
</table>
| **LO5 be able to communicate information** | **AC5.1 present data visually** | - tables  
- graphs  
  - line graph  
  - pie charts  
  - bar charts  
  - histograms  
  - scatter diagrams |
|                     | **AC5.2 communicate outcome of research** | **Customer** |
|                     |                     | - individual (scientifically literate, basic scientific understanding)  
- groups (scientifically literate, basic scientific understanding)  
**Information** |
|                     |                     | - clarity  
- language style  
- spelling, punctuation and grammar  
- language including technical and scientific  
- evidence based  
- relevance information to customer |
<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Assessment criteria</th>
<th>Performance bands</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LO1 understand research methods</strong></td>
<td><strong>AC1.1</strong> describe variables affecting research</td>
<td><strong>Band 1</strong></td>
</tr>
<tr>
<td></td>
<td><strong>AC1.2</strong> justify the research hypothesis</td>
<td><strong>Band 2</strong></td>
</tr>
<tr>
<td></td>
<td><strong>AC1.3</strong> justify selection of sampling methods</td>
<td><strong>Band 3</strong></td>
</tr>
<tr>
<td></td>
<td><strong>AC1.4</strong> explain selection of research methods</td>
<td><strong>Performance bands</strong></td>
</tr>
<tr>
<td></td>
<td><strong>AC1.5</strong> evaluate how ethical issues affect research</td>
<td></td>
</tr>
<tr>
<td><em>The learner will:</em></td>
<td><em>The learner can:</em></td>
<td><strong>Band 1</strong></td>
</tr>
<tr>
<td>Band 1</td>
<td>Band 2</td>
<td>Band 3</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td><strong>LO1 understand research methods</strong></td>
<td><strong>AC1.1</strong> describe variables affecting research</td>
<td>Gives a description of some variables affecting research</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.2</strong> justify the research hypothesis</td>
<td>Provides a justification of the research hypothesis</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.3</strong> justify selection of sampling methods</td>
<td>Provides justification for the selection of sampling methods</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.4</strong> explain selection of research methods</td>
<td>Gives an explanation of the selection of research methods</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.5</strong> evaluate how ethical issues affect research</td>
<td>Gives a brief evaluation of how some ethical issues affect research</td>
</tr>
<tr>
<td><em>The learner can:</em></td>
<td></td>
<td><strong>1-2</strong></td>
</tr>
<tr>
<td><strong>Band 1</strong></td>
<td><strong>Band 2</strong></td>
<td><strong>Band 3</strong></td>
</tr>
<tr>
<td>------------------</td>
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</tr>
<tr>
<td><strong>LO1 understand research methods</strong></td>
<td><strong>AC1.1</strong> describe variables affecting research</td>
<td>Gives a mainly clear description of variables affecting research</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.2</strong> justify the research hypothesis</td>
<td>Provides a reasoned justification of the research hypothesis</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.3</strong> justify selection of sampling methods</td>
<td>Provides a reasoned justification for the selection of sampling methods</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.4</strong> explain selection of research methods</td>
<td>Gives a mainly accurate and coherent explanation for the selection of research methods</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.5</strong> evaluate how ethical issues affect research</td>
<td>Gives a brief evaluation of how some ethical issues affect research.</td>
</tr>
<tr>
<td><em>The learner can:</em></td>
<td></td>
<td><strong>3-4</strong></td>
</tr>
<tr>
<td><strong>Band 1</strong></td>
<td><strong>Band 2</strong></td>
<td><strong>Band 3</strong></td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>LO1 understand research methods</strong></td>
<td><strong>AC1.1</strong> describe variables affecting research</td>
<td>Gives a clear and detailed description of the variables affecting research</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.2</strong> justify the research hypothesis</td>
<td>Provides justification of the research hypothesis with relevant and detailed reasoning</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.3</strong> justify selection of sampling methods</td>
<td>Provides justification for the selection of sampling methods with relevant and detailed reasoning</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.4</strong> explain selection of research methods</td>
<td>Gives an accurate and coherent explanation showing detailed reasoning for the selection of research methods</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.5</strong> evaluate how ethical issues affect research</td>
<td>Gives a clear, detailed and relevant evaluation of how ethical issues affect research</td>
</tr>
<tr>
<td><em>The learner can:</em></td>
<td></td>
<td><strong>5-6</strong></td>
</tr>
</tbody>
</table>

Zero marks to be awarded where there is insufficient evidence to achieve a mark at band 1
<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Assessment criteria</th>
<th>Performance bands</th>
</tr>
</thead>
<tbody>
<tr>
<td>LO2 be able to collect data</td>
<td><strong>AC2.1</strong> plan to collect data</td>
<td>Band 1</td>
</tr>
<tr>
<td></td>
<td>Produces a plan with a sequence of steps with some indication of timing</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td>Produces documents that will capture some suitable/relevant data</td>
<td>1-2</td>
</tr>
<tr>
<td>AC2.2 produce documentation to collect data</td>
<td>Obtains some suitable data</td>
<td>1</td>
</tr>
<tr>
<td>AC2.3 obtain data</td>
<td><strong>AC3.1</strong> explain significance of terms used in data analysis</td>
<td>Gives an accurate and coherent explanation showing detailed reasoning of the significance of some terms used in data analysis</td>
</tr>
<tr>
<td>LO3 understand data analysis</td>
<td><strong>AC3.2</strong> explain selection of statistical methods used to analyse data</td>
<td>Gives an explanation for the selection of statistical methods used to analyse data</td>
</tr>
</tbody>
</table>

Zero marks to be awarded where there is insufficient evidence to achieve a mark at band 1
<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Assessment criteria</th>
<th>Performance bands</th>
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<tbody>
<tr>
<td>The learner will:</td>
<td>The learner can:</td>
<td>Band 1</td>
</tr>
<tr>
<td><strong>LO4 be able to process data</strong></td>
<td><strong>AC4.1 analyse data using statistical methods</strong></td>
<td>Correctly uses some appropriate statistical methods to analyse data</td>
</tr>
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<td></td>
<td></td>
<td>Band 2</td>
</tr>
<tr>
<td></td>
<td><strong>AC4.2 make conclusions from data</strong></td>
<td>Makes some valid conclusions from data</td>
</tr>
<tr>
<td></td>
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<td>Band 3</td>
</tr>
<tr>
<td></td>
<td><strong>AC4.3 evaluate procedures</strong></td>
<td>Gives an appropriate evaluation of some aspects of the data and procedures</td>
</tr>
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<td></td>
<td></td>
<td>Band 4</td>
</tr>
<tr>
<td></td>
<td><strong>AC4.4 use mathematical notation</strong></td>
<td>Uses some mathematical notation correctly and appropriately</td>
</tr>
</tbody>
</table>

Zero marks to be awarded where there is insufficient evidence to achieve a mark at band 1
<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Assessment criteria</th>
<th>Performance bands</th>
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</thead>
<tbody>
<tr>
<td><strong>The learner will:</strong></td>
<td><strong>The learner can:</strong></td>
<td><strong>Band 1</strong></td>
</tr>
<tr>
<td>LO5 be able to communicate information</td>
<td>AC5.1 present data visually</td>
<td>Uses some suitable table/graph styles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uses some suitable sizes and scales to construct graphs</td>
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<tr>
<td></td>
<td></td>
<td>Labels some graphs correctly</td>
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<tr>
<td></td>
<td>AC5.2 communicate outcome of research</td>
<td>Communicates some relevant information to the customer</td>
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<tr>
<td></td>
<td></td>
<td>Uses some appropriate scientific and technical language</td>
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<tr>
<td></td>
<td></td>
<td>Use some appropriate styles and structure</td>
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<tr>
<td></td>
<td></td>
<td>Uses some accurate spelling, punctuation and grammar</td>
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Zero marks to be awarded where there is insufficient evidence to achieve a mark at band 1
Assessment

This unit is internally assessed and externally moderated through a summative controlled assessment. All assessment must be conducted under controlled assessment conditions. Section 3.3 of the specification details the principles involved in internal assessment. WJEC has produced a model assignment for this unit which is available through the WJEC secure website.

The unit 1 examination will also contain a synoptic component that includes content from unit 3. Details of the examination and the contribution of unit 3 to the assessment can be found in section 3.2.1.

Guidance for Delivery

Making teaching vocationally relevant

It is important that learners recognise the knowledge and understanding they develop are vocationally relevant. There are a number of ways in which this can be achieved:

- arranging visits to a university Medical Science / Medical School / Nursing department with particular reference to how they use research to improve medical care. This could be broadened to link with concepts taught in other medical science units;
- arranging talks by visiting speakers from Health agencies / pressure groups e.g. ASH to speak on how medical research has changed attitudes to smoking over the last 60 years.

The following are examples of approaches to delivery which could be used to enhance the learners’ understanding of the vocational importance of the role of research methods in Medical Science:

Example 1

Invite a speaker from a pressure group such as ASH to discuss with learners the trends in young people who take up smoking and also attitudes of young people in general to smoking. Learners could be set a task to find attitudes to smoking / reasons why smoking is taken up in their school. The learners could then present their findings to the representative from the pressure group / ASH.

Example 2

A representative from a local Medical School / hospital/GP practice could be invited to speak to learners on the MMR vaccine and the alleged (erroneous) links with autism and how this could lead to a low uptake of vaccines for measles and consequently outbreaks of measles in several parts of the UK. Learners could be asked to conduct quantitative and qualitative research on current perceptions of autism in the locality. The learners could then in small groups present their findings.

Example 3

Invite a dietician to speak about what makes a healthy diet and the problems associated with a poor diet. Learners could then be asked to conduct qualitative/quantitative research on attitudes to a healthy diet. Data from the research could then be pooled among all the learners and appropriate techniques used to analyse the data. Their findings and significance of their research could then be communicated to the school through an article in the school magazine.
Making Contacts
Examples of organisations that may be approached to provide help include:

- Medical Science/Medicine departments/Nursing Schools at local Universities;
- Hospitals, GP practices;
- Health campaign groups e.g. ASH.

Resources

Websites


http://www.thejournalofdiabetesnursing.co.uk/media/content/_master/1902/files/pdf/jdn8-9-329-34.pdf


http://www.nursingtimes.net/nursing-practice/leadership/understanding-qualitative-research-and-its-value-in-healthcare/201703.article

http://www.simplypsychology.org/qualitative-quantitative.html

http://www.snapsurveys.com/qualitative-quantitative-research/

https://explorable.com/research-designs


http://www.hra.nhs.uk/research-ethics-committee-members/guidance-on-ethical-review-for-members/

http://adc.bmj.com/content/82/2/177.full

http://holah.co.uk/investigations/correlation/
Unit 4  Medicines and treatment of disease

WJEC unit entry code

Guided learning hours:  100

Aim and purpose

This unit develops knowledge and understanding about the science of medicines, and how they work through their interactions with body systems. It also introduces cancer, its relationship to genetics, and the range of therapeutic treatments available.

The unit will enable learners to provide information to a range of audiences on how medicines work, to bring about effective treatment of diseases and disorders.

Unit introduction

Medicines are the most common therapeutic intervention in healthcare. How are medicines used to treat diseases? How do medicines work? What are the possible side effects? Do medicines have the same effect on all patients? Can medicines lose their effectiveness?

What needs to be considered when medicines are prescribed? What is cancer and how is it treated? What role do genes and mutation play in cancer? These are some of the questions that this unit is intended to answer.

The pharmaceutical industry is the UK's top research sector. One-quarter of the world's top medicines were developed in the UK. The pharmaceutical industry spends around £8.8 billion on UK research and development, and employs around 26,000 people. A further 250,000 people work in related industries. The past twenty years has seen an unprecedented increase in both the number and in the range of activity of drugs used in the treatment of human disease. For medicines and treatments to be most effective, those responsible for prescribing and administering them, as well as patients themselves, need advice and information. This unit focuses on providing information and advice on medicines and treatment.

In this unit you will consider the basic science of pharmacology, i.e. the study of medicine action combined with an added focus on the application to the real world - i.e. what medicines are used in the treatment of what disorders and diseases. You will also learn about cancer, what it is and the combination of therapeutic interventions that may be used; which include medicines but may also include new and developing therapies as more is understood about the disease.
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
</table>
| LO1 understand management of medicine | AC1.1 explain factors to be considered when prescribing medicines | **Factors**  
- establishing an accurate diagnosis  
- patient history (other medicines that are already been taken)  
- overall benefit  
- side effects/risks  
- individual patient factors altering benefits/risks (e.g. age, impaired kidney function, pregnancy)  
- cost-effectiveness  
- patient choice |
| AC1.2 suggest strategies to improve adherence of patients taking prescriptions | **Reasons for non-adherence**  
- unintentional  
- intentional  
  **Unintentional**  
- barriers outside patient control e.g. difficulty understanding instructions  
  **Intentional**  
- patient perception e.g. beliefs about drug effectiveness, side effects, media claims  
- patient motivation  
  **Improving adherence**  
- e.g. patient education, consultation, involving patients in decision making, support |
| AC1.3 compare options for administering medicines | **Administration routes**  
- oral, sublingual, rectal, topical e.g. eye drops, inhalation bronchodilators, parenteral e.g. intravenous, intramuscular, subcutaneous injection  
  **Administration**  
- self-administration, health care specialist  
  **Comparison**  
- patient preference, comfort  
- ease of administration  
- speed of action, duration of action  
- predictability of absorption, reproducible effects, side effects  
- need to bypass hepatic metabolism  
- target of action (e.g. local eye drops in treatment of glaucoma, paracetamol in pain relief)  
- cost |
<table>
<thead>
<tr>
<th>Learning outcomes</th>
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<th>Content</th>
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</thead>
<tbody>
<tr>
<td>The learner will:</td>
<td>The learner can:</td>
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</tbody>
</table>
| LO2 understand how medicines work | AC2.1 explain the molecular basis of the action of medicines | Drug-receptor interactions  
  • agonists: full and partial  
  • antagonists: competitive or irreversible  
  • specificity: ability to combine with one particular receptor  
Possible ways in which medicines work  
  • action on transmitter substances  
  • action on hormones  
  • action on membrane transport systems  
  • action on enzymes |
| AC2.2 explain how medicines affect body systems | | Body systems  
  • cardiovascular & respiratory; gastro-intestinal tract; endocrine system; kidneys and central nervous system  
Cardiovascular & respiratory  
  • treatment of hypertension, angina, arrhythmias, asthma  
  • e.g. beta-blockers, vasodilator drugs, centrally acting drugs, drugs acting at cholinergic synapses, drugs acting on sympathetic nervous system, calcium antagonists, opening/blocking ion channels  
Gastro-intestinal tract  
  • treatment of indigestion, ulcers, constipation, diarrhoea, antacids and acid secretion reducers, medicines affecting motility and secretions  
  • e.g. antacids: sodium bicarbonate, acid secretion reducers (cimetidine), mucosal strengtheners (sucralfate), anti-diarrhoeal drugs  
Endocrine system  
  • treatment of overactive/underactive thyroid, diabetes  
  • e.g. competitive inhibitors, replacement therapy, antidiabetic agents  
Kidneys  
  • treatment of oedema, in a range of disorders and diseases, e.g. congestive heart failure and hypertension  
  • action on the kidney to increase urine flow; diuretics - thiazides, loop diuretics, potassium sparing  
Central nervous system  
  • treatment of depression, insomnia, psychotic states e.g. schizophrenia, motor disorders, Parkinson’s disease and epilepsy  
  • control of pain and general anaesthetics  
  • mechanisms of action through modifying synaptic transmission of central transmitter substances such as GABA, acetylcholine, dopamine, and serotonin |
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
</table>
| **LO2 cont.**     | AC2.3 explain how medicines affect causative agents of infectious diseases | **Causative agents**  
  - bacterial infections  
  - viral infections  
**Mechanisms**  
  - bacterial infections (medicines that inhibit nucleic acid synthesis: e.g. sulphonamides; medicines that inhibit cell wall synthesis, e.g. penicillins; medicines that inhibit protein synthesis, e.g. chloramphenicol and erythromycin)  
  - viral infections (medicines that stop a virus entering host cells, e.g. amantadine; medicines that inhibit nucleic acid synthesis, e.g. acyclovir) |
| AC2.4 explain why medicines may lose their effectiveness | **Loss of effectiveness**  
  - “loss” of receptors for drug-receptor interaction  
  - drug “side effects”  
  - antibiotic resistance |
| AC2.5 compare the effects of the interaction of medicines | **Interaction of medicines**  
  - polypharmacy (concurrent use of multiple medications by one individual)  
  - interactions between more than one medication or drug-food interactions  
**Positive effects**  
  - improves the effects of medicines (synergistic effect) e.g. use of codeine with paracetamol, combinations of drugs in the treatment of cancer  
  - produces a new effect  
**Negative effects**  
  - antagonistic effect, side effects, overdose |
<table>
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<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
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<td>The learner will:</td>
<td>The learner can:</td>
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</table>
| LO2 cont.         | AC2.6 explain how factors affect the distribution of medicines in the body | **Distribution of medicine in body**  
  - movement of medicines to and from the blood and various tissues of the body  
  - relative proportion of medicines in the tissues  
  **Factors affecting distribution**  
  - water-soluble drugs  
  - fat-soluble drugs  
  - ability to cross membranes  
  - binding to proteins  
  - accumulation in particular tissue types |
|                   | AC2.7 explain how adverse reactions to medicines can occur | **Adverse reactions**  
  - extension of the medicines intended action  
  - action of medicine on more than one receptor/transmitter  
  - production of toxic metabolites e.g. paracetamol  
  - immunological responses |
|                   | AC2.8 explain fate of medicines in the body | **Fate**  
  - metabolism: by liver, types of reaction  
  - elimination and excretion: renal excretion, biliary excretion  
  - importance of half-life |
<table>
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<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
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<tbody>
<tr>
<td><strong>The learner will:</strong></td>
<td><strong>The learner can:</strong></td>
<td><strong>Cancer</strong></td>
</tr>
</tbody>
</table>
| **LO3 understand principles of treatment of cancer** | **AC3.1 describe what is meant by the term cancer** | • abnormal cell division  
  - alteration of cell cycle  
  - uncontrolled proliferation of cells  
• primary, secondary  
• difference between cancer cells and normal cells  
• types of cancer: carcinoma, sarcoma, leukaemia, lymphoma and melanoma |
| | **AC3.2 explain the genetic basis of cancer** | **Genetic basis** |
| | | • genes are short pieces of DNA that carry specific genetic information  
• gene mutations (inherited, environmental)  
• risk factors for mutation |
| | | **Genetics and cancer** |
| | | • genetic changes (proto-oncogenes, tumour-suppressor genes and DNA-repair genes) |
| | **AC3.3 describe possible treatment options for cancer** | **Treatment options** |
| | | • surgery  
• chemotherapy (cytotoxic drugs)  
• radiation therapy  
• combination therapy  
• blood transfusion |
| | **AC3.4 assess the potential impact of new treatments for cancer** | **New treatments** |
| | | • targeted therapy  
• immunotherapy  
• photodynamic therapy |
<p>| | | <strong>Impact</strong> |
| | | • potential benefits (e.g. improved life expectancy) |</p>
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learner will:</td>
<td>The learner can:</td>
<td></td>
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</tbody>
</table>
| LO4 be able to provide information about medicines | AC4.1 communicate information to an audience | Communication method  
- written information e.g. leaflet, website, media article  
- face-to-face  
- other e.g. radio, podcast  
- formal, informal  
- technical, non-technical |
|                   |                     | Communication  
- clarity  
- style  
- level (accessibility, level of language for target audience)  
- structure |
|                   |                     | Audience  
- patients  
- medical staff |
|                   | AC4.2 justify approach to communicate information | Justification  
- audience addressed  
- issue(s) addressed  
- suitability of approach |
|                   | AC4.3 work as part of a team | Part of a team  
- flexible  
- reliable  
- takes responsibility  
- relationships  
  - contributes to team  
  - listens to view points  
  - treats others in a respective and supportive manner  
  - makes constructive contributions |
<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Assessment criteria</th>
<th>Performance bands</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LO1 understand management of medicine</strong></td>
<td><strong>AC1.1 explain factors to be considered when prescribing medicines</strong></td>
<td><strong>Band 1</strong></td>
</tr>
<tr>
<td></td>
<td>Gives an explanation of the factors to be considered when prescribing medicines. Low level explanations may not always clearly show reasoning.</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.2 suggest strategies to improve adherence of patients taking prescriptions</strong></td>
<td>Gives some strategies to improve adherence of patients taking prescriptions. Strategies show some awareness of the main reasons for non-adherence. Some parts may be in detail.</td>
</tr>
<tr>
<td></td>
<td><strong>AC1.3 compare options for administering medicines</strong></td>
<td>Makes a comparison with some valid points of the advantages and disadvantages of different options of administration. Some parts of the comparison are in detail, with examples given.</td>
</tr>
</tbody>
</table>

Zero marks to be awarded where there is insufficient evidence to achieve a mark at band 1.
<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Assessment criteria</th>
<th>Performance bands</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LO2 understand how medicines work</strong></td>
<td><strong>AC2.1 explain the molecular basis of the action of medicines</strong></td>
<td><strong>Band 1</strong></td>
</tr>
<tr>
<td>The learner can:</td>
<td>Gives an explanation of the molecular basis of the action of medicines&lt;br&gt;<em>Low level explanations may not always clearly show reasoning</em></td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td><strong>AC2.2 explain how medicines affect body systems</strong></td>
<td>Gives an explanation of how medicines affect body systems.&lt;br&gt;<em>Low level explanation covers a limited number of body systems, with limited examples to support explanations</em></td>
</tr>
<tr>
<td></td>
<td><strong>AC2.3 explain how medicines affect causative agents of infectious diseases</strong></td>
<td>Gives an explanation of how medicines affect causative agents of infectious diseases&lt;br&gt;<em>Low level explanations may not always clearly show reasoning</em></td>
</tr>
<tr>
<td></td>
<td><strong>AC2.4 explain why medicines may lose their effectiveness</strong></td>
<td>Gives an explanation of why medicines may lose their effectiveness&lt;br&gt;<em>Low level explanations may not always clearly show reasoning</em></td>
</tr>
<tr>
<td></td>
<td><strong>AC2.5 compare the effects of the interaction of medicines</strong></td>
<td>Makes some suitable comparisons of the effects of the interaction of medicines&lt;br&gt;<em>Low level comparisons may not always show clear reasoning</em></td>
</tr>
<tr>
<td></td>
<td><strong>AC2.6 explain how factors affect the distribution of medicines in the body</strong></td>
<td>Gives an explanation of how factors affect the distribution of medicines in the body</td>
</tr>
<tr>
<td>Learning Outcome</td>
<td>Assessment criteria</td>
<td>Performance bands</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>The learner will:</strong></td>
<td></td>
<td>Band 1</td>
</tr>
<tr>
<td><strong>LO2 cont.</strong></td>
<td><strong>AC2.7</strong> explain how adverse reactions to medicines can occur</td>
<td>Gives an explanation how adverse reactions to medicines can occur</td>
</tr>
<tr>
<td></td>
<td>1-2</td>
<td>3-4</td>
</tr>
<tr>
<td><strong>AC2.8</strong> explain fate of medicines in the body</td>
<td>Gives an explanation of the fate of medicines in the body</td>
<td>Gives a mainly accurate and coherent explanation of the fate of medicines in the body</td>
</tr>
<tr>
<td></td>
<td>Low level explanations may not always clearly show reasoning</td>
<td>Some relevant examples are given</td>
</tr>
<tr>
<td></td>
<td>1-2</td>
<td>5-6</td>
</tr>
</tbody>
</table>

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<th>Performance bands</th>
</tr>
</thead>
<tbody>
<tr>
<td>LO3 understand principles of treatment of cancer</td>
<td><strong>AC3.1</strong> describe what is meant by the term cancer</td>
<td><strong>Band 1</strong></td>
</tr>
<tr>
<td></td>
<td>Gives a mostly clear description of the term cancer</td>
<td>1</td>
</tr>
<tr>
<td>AC3.2 explain the genetic basis of cancer</td>
<td>Gives an explanation of the genetic basis of cancer</td>
<td>Low level explanations may not always clearly show reasoning</td>
</tr>
<tr>
<td>AC3.3 describe possible treatment options for cancer</td>
<td>Gives a description of some possible treatment options for cancer</td>
<td>1-2</td>
</tr>
<tr>
<td>AC3.4 assess the potential impact of new treatments for cancer</td>
<td>Gives an assessment of the potential impact of new cancer treatments with reference to a limited range of treatments and some reasoned judgements</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td>Gives an assessment of the potential impact of new cancer treatments with reference to some treatments and with mainly reasoned judgements</td>
<td></td>
</tr>
</tbody>
</table>

Zero marks to be awarded where there is insufficient evidence to achieve a mark at band 1
<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Assessment criteria</th>
<th>Performance bands</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learner will:</td>
<td>LO4 be able to provide information about medicines</td>
<td>Band 1</td>
</tr>
<tr>
<td>AC4.1 communicate information to an audience</td>
<td>Communicates some information to an audience</td>
<td>Communicates some information to an audience</td>
</tr>
<tr>
<td></td>
<td>Present some information in appropriate ways</td>
<td>Effectively and clearly communicates information in an appropriate manner using language accessible to the audience</td>
</tr>
<tr>
<td></td>
<td>1-3</td>
<td>4-6</td>
</tr>
<tr>
<td>AC4.2 justify approach to communicate information</td>
<td>Justifies the approach used</td>
<td>Justifies the approach used</td>
</tr>
<tr>
<td></td>
<td>Low level explanations may not always clearly show reasoning</td>
<td>with some clear and detailed reasoning</td>
</tr>
<tr>
<td></td>
<td>1-2</td>
<td>3-4</td>
</tr>
<tr>
<td>AC4.3 work as part of a team</td>
<td>Demonstrates some ability to work as a team member</td>
<td>Demonstrates some ability to work as an effective team member</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2-3</td>
</tr>
</tbody>
</table>

Zero marks to be awarded where there is insufficient evidence to achieve a mark at band 1.
Assessment

This unit is internally assessed and externally moderated through a summative controlled assessment. All assessment must be conducted under controlled assessment conditions. Section 3.3 of the specification details the principles involved in internal assessment. WJEC has produced a model assignment for this unit which is available through the WJEC secure website.

Guidance for Delivery

Making teaching vocationally relevant

It is important that learners recognise the knowledge and understanding they develop are vocationally relevant. There are a number of ways in which this can be achieved:

- arranging visits to work places who prescribe, dispense and administer medicines and treatments, this could include; hospital departments, pharmacists, GP surgeries and Health centres;
- arranging talks by visiting speakers from a range of Health Care professions: doctors, consultants, health visitors and nurses;
- arranging talks by visiting speakers from pharmaceutical companies to talk about drug research and the action of specific drugs;
- developing learning activities in conjunction with relevant individuals/organisations, for example reviewing current advice/information provided to patients from a specific hospital department.

The following are examples of approaches to delivery which could be used to enhance the learners’ understanding of the vocational importance of medicines and the treatment of disease.

Example 1

Reviewing and improving advice on medicines

Learners will need to be provided with formative opportunities to develop the understanding and skills required by the summative assessment for this unit in the controlled assessment. Learners could review information that is currently provided as “medicines advice” by a pharmaceutical company or national organisation for a specific group of drugs. They could work in teams to review this information and then develop their own advice. For example, learners (working in teams) could review the information provided by the NHS on Beta-blockers (http://www.nhs.uk/Conditions/Beta-blockers/Pages/Introduction.aspx), they could then develop their own web pages.
Example 2

Providing information for specific groups

Learners need to consider how information and advice should be adapted to suit particular audiences. Information for colleagues in Health Care might be very different to information provided for patients. Alternatively information given on treatment might be very different in terms of format and style if the patient is a teenager compared to if the patient is elderly.

Depression is a condition which affects many teenagers, but also the elderly. Learners could be asked to produce information in suitable format and style for both of these groups on how medicines used to treat this condition work, any particular interactions and adverse reactions that these groups of patients need to be aware of.

Example 3

Presentation on cancer for a charity to use

The treatment of cancer is a rapidly evolving aspect of medicine. Learners could be asked to develop a presentation that “Cancer Research UK” could use to document the progress in cancer diagnosis, treatment and survival from the 1970’s to the present day. The presentation should include information on the potential impact of new treatments for cancer. Cancer research UK would like to use this presentation for fund raising purposes and will be selecting the “best” presentation from the class to use.

Making Contacts

Examples of organisations that may be approached to provide help include:

- Hospitals and Health Care Trusts;
- other health care settings and individuals (e.g. doctors, practice nurse, health centres);
- pharmacists;
- private health care facilities;
- university medical and human biology departments;
- pharmaceutical organisations.
Resources

Textbooks


Websites

Administration of medicines

http://www.nursingtimes.net/nursing-practice/specialisms/prescribing/the-administration-of-medicines/288560.article

http://www.slideshare.net/ankit_2408/routes-of-drug-administration-1

How do medicines work: general

http://hubpages.com/hub/How-Do-Medicines-Work-In-The-Body

How specific medicines work

http://www.nhs.uk/Conditions/Beta-blockers/Pages/Introduction.aspx
http://www.nhs.uk/conditions/Antidepressant-drugs/Pages/Introduction.aspx
http://www.nhs.uk/Conditions/Antibiotics-penicillins/Pages/Introduction.aspx

How new medicines are developed:

http://www.nationalstemcentre.org.uk/elibrary/resource/9180/clinical-research-workshop

Cancer and treatments

http://www.nhs.uk/Conditions/Cancer/Pages/Introduction.aspx
http://www.cancerresearchuk.org/about-cancer/cancers-in-general/treatment/

Non-adherence

http://www.nice.org.uk/guidance/cg76/resources/guidance-medicines-adherence-pdf

Communication

NHS brand guidelines http://www.nhsidentity.nhs.uk/tools-and-resources/patient- information/communicating-with-different-patient-groups
Unit 5  Clinical Laboratory techniques

WJEC unit entry code

Guided learning hours  45

Aim and purpose

This unit develops knowledge and understanding about the clinical laboratory techniques that can be used to assess body functions. It relates knowledge and understanding of human physiology and biochemistry to clinical measurement test results through an understanding of the principles of the measurement techniques.

The unit will enable learners to perform tests which will accurately measure a range of biochemical and microbiological parameters. They will be able to interpret the results of their tests, and other test results and link these results to possible physiological disorders.

Unit introduction

What measurements do biomedical scientists carry out on patient samples? How do they carry out these tests? How do they ensure that they work safely and avoid contamination? How do they interpret their data? How do they report their data in a suitable format for health professionals to draw conclusions?

Laboratory measurement plays a very important role in the diagnosis and treatment of patients in a range of clinical settings. These measurements may involve simple biochemical tests, microscopy or microbiology, or they may be more complicated, using the polymerase chain reaction (PCR) or Enzyme-linked immunosorbent assay (ELISA). Following these laboratory measurements, healthcare professionals will use the results to monitor for signs of abnormality (i.e. anything that falls outside of the 'normal' range). Health professionals will then be able to draw conclusions about the health status of the individual and any treatments they may require.

This unit is designed to help you understand how biomedical scientists investigate the function of body systems by undertaking laboratory-based measurements. You will learn how they use specialist equipment, advanced technologies and a range of different procedures. Most clinical scientists work in hospital laboratories or specialist departments, often working as a team to allow healthcare professionals to assess patient status.
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
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</thead>
</table>
| LO1 understand clinical testing | AC1.1 explain principles of clinical tests | **Clinical tests**  
  - biochemical tests e.g. simple identification tests (for glucose, protein, sodium ions, potassium ions, calcium ions), simple colorimetric assays, enzyme assays (kinetic and end point), chromatography (TLC, GLC, HPLC), radioactive immunoassays (RIA), ELISA, spectrophotometry, nephelometry, turbidimetry  
  - haematology tests e.g. red blood cell count, white blood cell count, haemoglobin, haematocrit, differential count, platelet number estimation  
  - histopathology techniques e.g. sample preparation, microscopy, immunohistochemistry  
  - microbiological techniques e.g. aseptic technique, serial dilution, staining, growth of bacterial populations  
  - genetic techniques e.g. use of restriction enzymes, gel electrophoresis, PCR, DNA sequencing |
| AC1.2 explain factors that affect clinical test results | **Factors**  
  - sensitivity  
  - specificity  
  - interfering agents  
  - human error |
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
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<tbody>
<tr>
<td>The learner will:</td>
<td>The learner can:</td>
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</tr>
<tr>
<td>LO2</td>
<td>AC2.1 plan tests</td>
<td>Plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• identify information required</td>
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<tr>
<td></td>
<td></td>
<td>• procedures and equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• sequencing of activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• timing</td>
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<td></td>
<td>AC2.2 assess biological samples using clinical tests</td>
<td>Biological samples</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• blood</td>
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<tr>
<td></td>
<td></td>
<td>• plasma</td>
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<td></td>
<td></td>
<td>• urine</td>
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<tr>
<td></td>
<td></td>
<td>Equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• correct use</td>
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<tr>
<td></td>
<td></td>
<td>Safe working practice</td>
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<tr>
<td></td>
<td></td>
<td>• works in accordance with risk assessment and laboratory requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• correctly uses PPE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• maintains tidy working area</td>
</tr>
<tr>
<td></td>
<td>AC2.3 record results from tests</td>
<td>Recording documentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• laboratory notebook</td>
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<td></td>
<td></td>
<td>• use of proformas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Records</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• key information recorded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• correct format</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• data recorded to correct precision</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• entries legible</td>
</tr>
<tr>
<td>Learning outcomes</td>
<td>Assessment criteria</td>
<td>Content</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------</td>
<td>---------</td>
</tr>
</tbody>
</table>
| LO3 be able to process data from clinical tests | AC3.1 use graphs to process data | **Graphs**  
  • calibration curve  
  • best-fit lines  
**Graphical methods**  
  • by hand  
  • using software (e.g. Excel/graphical packages) |
| AC3.2 use numerical methods to process data | **Numerical methods**  
  • manipulation of algebraic expressions  
**Significant figures**  
  • records data to appropriate number significant figure |
| AC3.3 interpret data from clinical tests | **Interpretation**  
  • identification of outliers  
  • compares data with expected range  
  • significance of data  
**Expected ranges**  
  • red blood cell count, white blood cell count, platelet count  
  • blood glucose  
  • plasma proteins  
  • sodium ions, potassium ions, calcium ions |
| AC 3.4 communicate information to an audience | **Communication style**  
  • audience  
    o scientifically literate audience  
    o audience with basic scientific understanding  
  • information  
    o structure, clarity, style  
  • language including technical and scientific  
  • appropriate use of English  
  • relevance information to audience |
<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Assessment criteria</th>
<th>Performance bands</th>
</tr>
</thead>
<tbody>
<tr>
<td>LO1 understand clinical testing</td>
<td>AC1.1 explain principles of clinical tests</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Band 1</td>
</tr>
<tr>
<td></td>
<td>Gives an explanation of the principles of clinical tests using some relevant scientific concepts.</td>
<td>Gives a mainly accurate and coherent explanation showing some detailed reasoning of the principles of clinical tests</td>
</tr>
<tr>
<td></td>
<td>Low level explanations may not always clearly show reasoning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Test 1 1-2</td>
<td>Test 1 3-4</td>
</tr>
<tr>
<td></td>
<td>Test 2 1-2</td>
<td>Test 2 3-4</td>
</tr>
<tr>
<td></td>
<td>Test 3 1-2</td>
<td>Test 3 3-4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Assessment criteria</th>
<th>Performance bands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC1.2 explain factors that affect clinical tests</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gives an explanation of the factors that affect clinical tests using some relevant scientific concepts.</td>
<td>Gives a mainly accurate and coherent explanation showing some detailed reasoning of the factors that affect clinical tests.</td>
</tr>
<tr>
<td></td>
<td>Low level explanations may not always clearly show reasoning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Zero marks to be awarded where there is insufficient evidence to achieve a mark at band 1
<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Assessment criteria</th>
<th>Performance bands</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The learner will:</strong></td>
<td><strong>The learner can:</strong></td>
<td><strong>Band 1</strong></td>
</tr>
<tr>
<td><strong>LO2 be able to carry out clinical laboratory techniques</strong></td>
<td><strong>AC2.1 plan tests</strong></td>
<td>Identifies some information to collect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Identifies some appropriate procedures and equipment to collect information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sets some achievable times to complete some aspects of the plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td><strong>AC2.2 assess biological samples using clinical tests</strong></td>
<td>Maintains tidy working area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Works in accordance with risk assessment and laboratory requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uses PPE when required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uses equipment to obtain some suitable data within expected tolerance of instruments / procedures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Test 1 1-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Test 2 1-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Test 3 1-2</td>
</tr>
</tbody>
</table>

Max mark available 18
Learning Outcome
The learner will:

<table>
<thead>
<tr>
<th>Assessment criteria</th>
<th>Performance bands</th>
</tr>
</thead>
<tbody>
<tr>
<td>LO2 cont. AC2.3 record results from tests</td>
<td>Band 1</td>
</tr>
<tr>
<td></td>
<td>Most key data is recorded</td>
</tr>
<tr>
<td></td>
<td>Entries are generally legible</td>
</tr>
<tr>
<td></td>
<td>Some data recorded to appropriate precision</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

Zero marks to be awarded where there is insufficient evidence to achieve a mark at band 1.
<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Assessment criteria</th>
<th>Performance bands</th>
</tr>
</thead>
<tbody>
<tr>
<td>LO3 be able to process data from clinical tests</td>
<td>AC3.1 use graphs to process data</td>
<td>Band 1</td>
</tr>
<tr>
<td>The learner will:</td>
<td></td>
<td>Suitable graph styles are used</td>
</tr>
<tr>
<td>The learner can:</td>
<td>Some suitable graph styles are used</td>
<td>Suitable graph styles are used</td>
</tr>
<tr>
<td></td>
<td>Mostly suitable sizes and scales are used to construct graphs</td>
<td>Graphs have some correct labelling</td>
</tr>
<tr>
<td></td>
<td>Graphs have some correct labelling</td>
<td>Band 1-2</td>
</tr>
<tr>
<td>AC3.2 use numerical methods to process data</td>
<td>Uses some suitable methods to process data</td>
<td>Uses suitable methods to mostly accurately process data</td>
</tr>
<tr>
<td></td>
<td>Some aspects of calculations are clearly presented</td>
<td>Calculations are mostly clearly and logically presented</td>
</tr>
<tr>
<td></td>
<td>Makes use of significant figures</td>
<td>Makes some appropriate and accurate use of significant figures</td>
</tr>
<tr>
<td></td>
<td>Band 1-2</td>
<td>3-4</td>
</tr>
<tr>
<td>AC3.3 interpret data from clinical tests</td>
<td>Makes some appropriate interpretation of information</td>
<td>Makes mostly accurate and appropriate interpretation of information</td>
</tr>
<tr>
<td></td>
<td>Band 1-2</td>
<td>Makes some appropriate interpretation of information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Makes mostly accurate and appropriate interpretation of information</td>
</tr>
<tr>
<td>AC3.4 communicate information to an audience</td>
<td>Communicate some information</td>
<td>Mostly clearly communicates information</td>
</tr>
<tr>
<td></td>
<td>Uses some appropriate scientific and technical language</td>
<td>Mostly uses appropriate scientific and technical language</td>
</tr>
<tr>
<td></td>
<td>Uses some appropriate styles and structure</td>
<td>Uses mostly appropriate styles and structure</td>
</tr>
<tr>
<td></td>
<td>Uses some accurate spelling, punctuation and grammar</td>
<td>Uses mostly accurate spelling, punctuation and grammar</td>
</tr>
<tr>
<td></td>
<td>Band 1-2</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Zero marks to be awarded where there is insufficient evidence to achieve a mark at band 1
Assessment

This unit is externally assessed by an assignment provided by WJEC annually in September of each academic year. This assignment will be downloadable from the WJEC secure website. Further information about the assessment of this unit can be found in section 3.2 of the specification.

Guidance for Delivery

Making teaching vocationally relevant

It is important that learners recognise the knowledge and understanding they develop are vocationally relevant. There are a number of ways in which this can be achieved:

- arranging visits to clinical laboratories;
- arranging talks by visiting speakers who are involved in clinical testing (doctors, nurses, laboratory-based scientists etc.)

The following are examples of approaches to delivery which could be used to enhance the learners’ understanding of the vocational importance of clinical laboratory techniques.

Example 1

A Medical Laboratory Scientific Officer could describe the processes that samples go through for biochemical testing. They could discuss the different assay methods used and throughput in the labs on a conventional day. Standard tests and less common testing methods could be discussed. Automation within clinical labs could be demonstrated. Learners could then write a short report on their findings.

Example 2

A medical practitioner such as a nurse could visit the centre to discuss how blood, urine, and other biological samples are taken. They could describe the processes which these samples go through to be ‘booked in’ for clinical testing. The learners could create a ‘timeline’ for analysis and results to be relayed to patients.

Example 3

Learners could visit a histopathology laboratory to observe the processes whereby tissue samples are preserved and embedded, sectioned and viewed under the microscope. They could be showed different staining techniques and the use of immunohistochemistry could be demonstrated.

Making Contacts

Examples of organisations that may be approached to provide help include:

- Local Health Authorities;
- Local clinical testing laboratories and services;
- Local universities offering biomedical science degrees;
- The Association for Clinical Biochemistry and Laboratory Medicine – www.acb.org.uk.
Resources

Textbooks

A Level Biology textbooks

Websites

Lab tests online – shows how individual patient samples are processed
http://labtestsonline.org.uk/

Information on PCR/Restriction enzymes/ELISA/RIA with animation links
http://www-naweb.iaea.org/nafa/aph/resources/

microbiology resources http://www.sgmjournals.org/

Practical biology techniques
http://www.nuffieldfoundation.org/practical-biology

Biochemical methods and protocols
http://www.bioexplorer.net/Methods_and_Protocols/Biochemistry/

ELISA tutorial
http://www.sumanasinc.com/webcontent/animations/content/ELISA.html

PCR tutorial (and also other methods)
http://www.maxanim.com/genetics/index.htm

Histopathology techniques
http://www.nottingham.ac.uk/pathology/default.html

Guide to immunohistochemistry

histopathology animation – this link shows liver but there are many more on this website
http://biology-animations.blogspot.co.uk/2010/11/histopathology-liver-cirrhosis-video.html

Guide to different chromatographic techniques
http://www.chemguide.co.uk/analysis/chromatogmenu.html#top
Unit 6  Medical case study

WJEC unit entry code

Guided learning hours 35

Aim and purpose

This unit is the overall synoptic unit for the Diploma qualification. It provides the opportunity for candidates to demonstrate their understanding of the connections between the other five units of this Medical Science qualification. The content of this unit requires candidates to apply skills, techniques, knowledge, understanding and concepts from across the qualification content in order to complete the required assessment.

The assessment provides integrated and purposeful contexts in which candidates will demonstrate the knowledge, understanding and skills they have developed through all the other units within the qualification. The contexts provided are medical case studies, which require candidates to analyse the information provided and develop a thorough assessment of the situation based on their knowledge and understanding gained from the other units of this qualification.

Unit introduction

How is a case study approach used within medical and healthcare education and training? How do they provide information about a particular patient or particular scenario, which can be reviewed and assessed, so that recommendations can be made? What methods are used to collect patient data? How does patient data and case studies allow health professionals to draw conclusions?

Medical case studies are useful when there is a need to obtain an in-depth appreciation of a condition or patient of interest, in a real-life context. Typically data is gathered from a variety of sources and by using several different methods. Research may also continue for an extended period of time so processes and developments can be studied as they happen.

The case study method often involves simply observing what happens to, or reconstructing ‘the case history’ of a single participant or group of individuals (such as a school class or a specific social group). The case study is not itself a research method, but researchers select methods of data collection and analysis that will generate material suitable for case studies.

In this unit you will develop your problem-solving skills through the analysis of case studies. You will make use of your knowledge and understanding of human physiology, physiological measurement, clinical testing, statistical research, and medical treatment including the use of medicines.
<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Assessment criteria</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LO1</strong> understand physiological information presented within case studies</td>
<td>Assessment criteria from unit 1</td>
<td>Content from unit 1</td>
</tr>
<tr>
<td><strong>LO2</strong> understand how physiological measurement techniques can be used to</td>
<td>Assessment criteria from unit 2</td>
<td>Content from unit 2</td>
</tr>
<tr>
<td>support diagnosis and treatment</td>
<td>In addition, candidates should also be able to use the knowledge and understanding</td>
<td>Physiological measurements play a very important role in the diagnosis and treatment of patients in a range of clinical settings.</td>
</tr>
<tr>
<td></td>
<td>gained from <strong>unit 2</strong> to recommend ways in which physiological measurement</td>
<td>This will require candidates to draw on their knowledge of the principles and purpose of different physiological measurement tests, as well as their understanding of how tests are performed and the relevance of results that are generated.</td>
</tr>
<tr>
<td></td>
<td>techniques can be used in the particular case study situation.</td>
<td></td>
</tr>
<tr>
<td><strong>LO3</strong> understand how medical research can help support diagnosis and treatment</td>
<td>Assessment criteria from unit 3</td>
<td>Content from unit 3</td>
</tr>
<tr>
<td><strong>LO4</strong> understand ways in which medical treatments can be used to treat diseases</td>
<td>Assessment criteria from unit 4</td>
<td>Content from unit 4</td>
</tr>
<tr>
<td>and disorders</td>
<td>In addition, candidates should be able to use the knowledge and understanding gained</td>
<td>Knowing how specific interventions, in particular medicines, can be used is an essential requirement in the successful management and treatment of disorders and disease.</td>
</tr>
<tr>
<td></td>
<td>from <strong>unit 4</strong> to recommend ways in which medical treatments, including medicines</td>
<td>This will require candidates to draw on their knowledge and understanding of how medicines are managed and how they work. Candidates will also need to use their knowledge and understanding of other treatments for specific disorders such as cancer.</td>
</tr>
<tr>
<td></td>
<td>can be used to treat diseases and disorders.</td>
<td></td>
</tr>
<tr>
<td><strong>LO5</strong> understand ways in which clinical measurement techniques can be used to</td>
<td>Assessment criteria from unit 5</td>
<td>Content from unit 5</td>
</tr>
<tr>
<td>support diagnosis and treatment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Content: further guidance

As this unit is the synoptic for the whole qualification, there is relatively little new content within the unit. All the content within the unit comes from the other five units of the qualification. The unit and the associated assessment are however of a sufficient size to meaningfully cover the full range of the qualification’s content. It is important that learners are given the opportunity and time to develop skills that will enable them to integrate and apply their learning in the context demanded by case studies.

Assessment

This unit is assessed through a written examination set each summer. It is a synoptic assessment of the entire qualification. Information relating to synoptic assessment can be found in section 3.4. Details relating to the external assessment and the management of the case studies background information accompanying the examination can be found in section 3.2.3 and 3.2.4 of the specification respectively.

Guidance for Delivery

Making teaching vocationally relevant

It is important that learners recognise the knowledge and understanding they develop are vocationally relevant. There are a number of ways in which this can be achieved:

- Arranging talks by visiting speakers from the medical profession such as GPs, Nurses, Occupational Therapists.
- Developing learning activities in conjunction with healthcare professionals.
- Using real data from the three conditions selected in a particular exam series. For example local hospitals or clinics may provide anonymised data that could be used.
- Arranging visits to workplaces that deal with patient care. These could be hospitals, GP surgeries, occupational health clinics, physiotherapists, opticians etc.

This unit requires that learners integrate their learning from units 1 to 5. This can be done through:

- linking the underlying physiology of systems and how physiological data is measured to medical case studies;
- linking biochemical markers to measurement techniques;
- understanding how statistical data can show trends in disease and conditions;
- understanding how conditions can be treated by clinical and non-clinical methods;
Resources

Textbooks

A level Biology Textbooks

Websites

The websites outlined in other units provide a useful starting point for this unit. In addition the following sites provide case studies for study of disease:

Net Doctor - useful treatment advice and case studies
http://www.netdoctor.co.uk/

Boots WedMD – symptom checker and useful treatment advice
http://www.webmd.boots.com/symptoms/

Bupa – useful health tools and treatment advice
https://www.bupa.co.uk/health-information

Office of National Statistics – useful for obtaining data to study nationwide prevalence of disease
http://www.ons.gov.uk/ons/index.html

NHS Choices – useful to study how lifestyle and disease affects health
http://www.nhs.uk/Pages/HomePage.aspx

Public Health Wales- a useful website for information on health problems in Wales
http://www.publichealthwales.wales.nhs.uk/

Public Health England – As above, but for England
https://www.gov.uk/government/organisations/public-health-england

Resources for genetic disease
http://www.geneticseducation.nhs.uk/genetic-conditions-54

Cancer research UK- Lots of data and information regarding cancer
http://www.cancerresearchuk.org

CDC-Useful for looking up information on specific disease
http://www.cdc.gov/diseasesconditions/
6 ENTRY PROCEDURES

WJEC Level 3 Applied Diploma in Medical Science will be available for certification from June 2018. Thereafter, the qualification will be available for certification each June.

Centres planning to offer this qualification must be registered as an accredited WJEC centre. For details on the application and accreditation, centres should contact WJEC.

Entries for the June series must be submitted no later than 21 February.

Unit entry

Entry for individual units must be made by submitting the relevant unit codes as indicated on each unit of the specification. Entries can be made for units in the following sessions:

<table>
<thead>
<tr>
<th>Unit</th>
<th>January 2017</th>
<th>June 2017</th>
<th>January 2018 and thereafter</th>
<th>June 2018 and thereafter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Certification (qualification award)</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

Qualification entry

Learners will be entered for the qualification when entering for aggregation (cash-in). Aggregation does not take place automatically: it is necessary to enter the relevant code for aggregation to take place.
7 EXTERNAL MODERATION

The consistency of assessment practices and decisions across centres will be assured through the external moderation of a sample of work.

For each series where learners are entered, centres will submit a sample, according to the formula below.

<table>
<thead>
<tr>
<th>Total number of candidates</th>
<th>Work to be submitted (Numbers relate to alphabetical order)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 10</td>
<td>All</td>
</tr>
<tr>
<td>11 - 19</td>
<td>1st and every second (1, 3, 5, 7 etc.) plus the lowest scoring* folder and additional folders as necessary (reflecting the spread of marks) to make a total sample of 10</td>
</tr>
<tr>
<td>20 - 45</td>
<td>1st and every fifth (1, 6, 11, 16 etc.) plus the lowest scoring* folder and additional folders as necessary (reflecting a spread of marks) to make a total sample of 10</td>
</tr>
<tr>
<td>46 - 99</td>
<td>1st and every eleventh (1, 12, 23, 34 etc.) plus the lowest scoring* folder and additional folders as necessary (reflecting a spread of marks) to make a total sample of 10</td>
</tr>
</tbody>
</table>

* The score is based upon the marks the learners obtain for each of the units being submitted for moderation.

Centres should ensure they keep all learner portfolios not sent to the moderator in their possession for two months after the closing date for sending samples for moderation. WJEC may require all portfolios for moderation and centres must be able to comply immediately with such a request.

Centres should submit a sample for each unit that includes:

- the controlled assignment brief used to set the assessment activity;
- a controlled assessment activities sheet completed and signed by the assessor to confirm that the controls for the unit, including authenticity of evidence, have been applied;
- completed mark record sheets outlining which performance bands are met by the evidence;
- all evidence produced by learners in completion of the controlled assessment, annotated appropriately by the assessor.

Moderators will review all evidence presented to ensure standards are aligned. Evidence will be judged against the following criteria:

- Task setting – were tasks set within the controls set by WJEC in the model assignment?
• Task taking – is there evidence that tasks were completed under the controlled conditions set out in the model assignment?
• Performance bands – does the evidence support assessor’s judgement of a learner against national standards?
• Annotation – is the evidence produced by learners appropriately annotated?
• Authentication – is it clear that the evidence submitted was authentically produced by the learner?
• Standardisation – is there evidence of effective standardisation/internal quality assurance within the centre?

Timetable

Samples of work must be submitted for external moderation, and related mark sheets should be returned to WJEC by 15 May for the June series. Centres will need to ensure that internal submission dates are set sufficiently in advance of this to allow for authentication, assessment and standardisation.

Feedback

The outcome of moderation will be to either accept or amend a centre’s assessment decisions. Guidance on actions needed before re-sitting of specified units at a subsequent moderation series will be also be provided.

Feedback will be provided through a centre moderator’s report for each certification title, covering the units entered by the centre and will be accessible through WJEC secure website. The report will address the criteria referred to above.

A Principal Moderator’s report will be provided for each series.
8 AWARDING AND REPORTING

Awarding and reporting of results in WJEC Level 3 Applied Diploma in Medical Science will take place in August of each year.

A Qualification Certificate, issued at a later date, will confirm the:

- Title
- Level
- Grade of qualification (E, D, C, B, A, A*)

Individual unit results are reported on a uniform mark scale (UMS) with the following grade equivalences:

<table>
<thead>
<tr>
<th>Unit</th>
<th>UMS mark</th>
<th>UMS grade boundaries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>1</td>
<td>240</td>
<td>192</td>
</tr>
<tr>
<td>2</td>
<td>120</td>
<td>96</td>
</tr>
<tr>
<td>3</td>
<td>120</td>
<td>96</td>
</tr>
<tr>
<td>4</td>
<td>240</td>
<td>192</td>
</tr>
<tr>
<td>5</td>
<td>120</td>
<td>96</td>
</tr>
<tr>
<td>6</td>
<td>120</td>
<td>96</td>
</tr>
</tbody>
</table>
9 ACCESS ARRANGEMENTS

Qualifications at this level often require assessment of a broad range of competencies. This is because they are vocational qualifications and prepare candidates for a wide range of occupations and higher level courses.

This specification has been designed to offer fair access for all and to minimise the need to make reasonable adjustments for learners who have particular requirements. It is expected that normally, individual learners’ abilities, interests and needs will be appropriately catered for by centres through:

(a) the choice of units and qualifications available;

(b) the potential for personalisation of controlled assessment.

If there are any queries about the use of this flexibility inherent in the specification to meet learners’ needs, or about the use of reasonable adjustments, centres should contact WJEC.

Reasonable adjustments are made for disabled candidates in order to enable them to access the assessments. For this reason, very few candidates will have a complete barrier to any part of the assessment. Information on reasonable adjustments is found in the Joint Council for Qualifications document *Regulations and Guidance Relating to Candidates who are eligible for Adjustments in Examinations*. This document is available on the JCQ website (www.jcq.org.uk).
10 POST-RESULTS SERVICES

If a centre wishes to query the outcome of the moderation and/or examination process this must be done formally by the head of the centre, notifying WJEC within 21 days of the publication of results.

The sample of work submitted for moderation will be reviewed by a moderator/examiner not involved in the original process, and the centre informed of the outcome.

Should the centre not be satisfied with the outcome of the review, there is provision for an appeal to WJEC.
11 CLASSIFICATION CODES

Every specification is assigned a national classification code (discounting code) indicating the subject area to which it belongs. The classification code for this specification is QA3.

Centres should be advised that where learners take two qualifications with the same classification code, performance indicators for the centre will show that they have only achieved one of the two qualifications. The same view may be taken if learners take two specifications that have different classification codes but have significant overlap of content. The discounting system affects the calculation of performance measures for a school in the performance tables. It does not alter the awards an individual learner has achieved or limit the qualifications they can take.

Learners who have any doubts about their subject combinations should check with the institution to which they wish to progress before embarking on their programmes.

Information on performance points can be obtained from (www.education.gov.uk) and/or DAQW (www.daqw.org.uk).
12 THE WIDER CURRICULUM

Opportunities for use of technology

Candidates need to be both effective and confident users of technology in order to move on to a more advanced study of medical science. This specification allows candidates to develop ICT skills in a wide range of different contexts.

There are numerous opportunities to use ICT throughout all units. Examples include:

- gathering data from sensors linked to data-loggers or directly to computers
- analysing data – e.g. use of spreadsheets to present graphs and calculate lines of best fit;
- using presentation software e.g. to assist in giving a presentation to an audience;
- using word processing packages to present written reports;
- using blogging software to share information to a world-wide audience;
- making videos or podcasts;
- designing leaflets to communicate information.

Spiritual, Moral, Ethical, Social and Cultural Issues

The specification provides a framework and includes specific content through which individual courses may address spiritual, moral, ethical, social and cultural issues. It aims to show how science can be used to assist in understanding the underlying causes of disease. Learners should consider how conditions are treated, and balance the need for new treatments with cost to society.

Examples of issues which can be addressed through the specification are listed below.

- How lifestyle may affect health (unit 1)
- How ethical issues affect research (unit 3)
- How factors are considered when prescribing medicines (unit 4)

Citizenship

The applications and implications of science are dealt with in meaningful medical contexts, and encourage the development of a responsible attitude to citizenship. An understanding that individuals have a collective responsibility is fostered in relation to various ethical issues included in the specifications such as treatment regimens, side effects of medicines, cost of medicines to society. The consequences of lifestyle on health are also examined throughout the qualification in a number of different contexts.
Medical Issues

The qualification deals with medical science in meaningful contexts. The whole qualification therefore highlights how science is used to improve the quality of life, protecting individuals and society. Each unit will outline the medical context of the science that is to be delivered. Learners are also made aware of legislation that is in place governing activities that have a potential medical impact.

Health and Safety Consideration

Under UK law, health and safety is the responsibility of the employer. There are a number of regulations (notably Management of Health and Safety at Work Regulations 1999 and COSHH Regulations 2002 (as amended)) that require the completion of a risk assessment before commencing a procedure or activity that uses microorganisms or chemicals.

There are opportunities for learners to develop their own risk assessments when carrying out laboratory work in almost all units. Throughout the qualification there are also many opportunities to underscore the requirement to work in compliance with risk assessments in order to safeguard the health and safety of workers and members of the public.

The European Dimension

Medical issues can be rarely confined to a particular place since human actions in one country can also impact another. Challenges faced by medicine also need to be dealt with at national, European and global levels. This specification should make learners aware that medical scientists need to cooperate with scientists from other countries.

The context led nature of the units will give centres the opportunity of examining medical issues at a European level. Examples where a European dimension can be underscored include international protocols and European legislation relating to adverse drug reactions and licencing of medicinal products for human use.
Appendix 1 - Unit structure

Unit title
The title summarises in a concise manner the content of the unit.

Guided learning hours
Guided learning time represents only those hours in which a tutor is present and contributing to the learning process. In some organisations this is known as ‘contact time’. This time includes lectures, supervised practical periods and supervised study time.

Aim and purpose
The aim and purpose provides a brief and clear summary of the unit. It also indicates the applied purpose for the unit.

Unit Introduction
This is written to the learner and gives a summary of the unit content. It sets the vocational context of the unit and highlights the purpose of the learning in the unit.

Learning outcomes
Learning outcomes state what the learner should know, understand or be able to do as a result of completing the learning in the unit.

Assessment Criteria
The assessment criteria specify the standard a learner is expected to meet to demonstrate that the learning outcomes of that unit have been achieved.

Unit content
The indicative content defines the breadth and depth of learning for each assessment criteria. It is expected that all the indicative content will be delivered during the programme of learning. It is not required to assess every aspect of the content when assessing the unit. Learners will be expected to apply the knowledge, understanding and skills acquired through the learning to the specifics of the assessment context.

Performance Bands
These are used to determine the overall unit mark. Performance bands do not add additional requirements to the assessment criteria.

Assessment
WJEC Level 3 Applied Diploma in Medical Science is assessed through both controlled assessment and external assessment. This section of the unit summarises the form of assessment used.
**Guidance for delivery**

This gives the tutor some ideas on how to deliver the unit in a vocational setting consistent with the philosophy of the qualifications and intent of the unit. The guidance also gives ideas of vocational settings for the unit and suggests possible contacts that could be made in the delivery of the learning.

**Resources**

This identifies useful resources to help in the delivery of the learning. Many of the resources listed are suitable for using with learners.
Appendix 2 - Grade Descriptors

Grade descriptors are used by WJEC to set grade boundaries for each unit. Grade descriptors give a general indication of the levels of attainment likely to be shown by a representative learner performing at each boundary. An Award meeting involving experienced examiners and teachers will be required to set the following grade boundaries for each unit. The following grade boundaries will be set at the Award meeting:

- A/B
- E/U

Grade descriptors are interpreted in relation to the content outlined in the specification; they are not designed to define that content. Once grade boundaries have been set by WJEC, learner marks are then converted to UMS marks.
<table>
<thead>
<tr>
<th>Area</th>
<th>A/B</th>
<th>E/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge and understanding of medical science</td>
<td>Demonstrate detailed knowledge and understanding of most principles, concepts and facts from the specification.</td>
<td>Demonstrate knowledge and understanding of some principles and facts from the specification.</td>
</tr>
<tr>
<td></td>
<td>Consistently selects and uses relevant information from the specification.</td>
<td>Select and use some relevant information from the specification.</td>
</tr>
<tr>
<td></td>
<td>Consistently organises and presents information clearly, logically and in suitable structure.</td>
<td>Present some information in a clear format.</td>
</tr>
<tr>
<td></td>
<td>Use appropriate scientific terminology and conventions from the specification.</td>
<td>Use some appropriate terminology and conventions from the specification.</td>
</tr>
<tr>
<td>Application of skills, knowledge and understanding in appropriate medical contexts</td>
<td>Apply principles and concepts from the specification in familiar and new contexts involving several steps in the argument.</td>
<td>Apply given principles or concepts from the specification in familiar and new contexts involving a few steps in the argument.</td>
</tr>
<tr>
<td></td>
<td>Describe significant trends and patterns, with clear explanations, shown by complex data presented in tabular or graphical form.</td>
<td>Describe, and provide a limited explanation of, trends or patterns shown by complex data presented in tabular or graphical form.</td>
</tr>
<tr>
<td></td>
<td>Interpret qualitative and quantitative data accurately; and present arguments and evaluations clearly.</td>
<td>Interpret some qualitative and quantitative data.</td>
</tr>
<tr>
<td></td>
<td>Evaluate critically the statements, conclusions or data.</td>
<td>Identify, when directed, inconsistencies in conclusions or data.</td>
</tr>
<tr>
<td></td>
<td>Carry out accurately complex calculations specified for medical science.</td>
<td>Carry out some steps within calculations specified for medical science.</td>
</tr>
<tr>
<td></td>
<td>Translate successfully data presented as prose, diagrams, drawings, tables or graphs, from one form to another.</td>
<td>Translate data successfully from one form to another, in some contexts.</td>
</tr>
<tr>
<td></td>
<td>Select a wide range of facts, principles and concepts from the specification.</td>
<td>Select some facts, principles and concepts from the specification.</td>
</tr>
<tr>
<td></td>
<td>Link together appropriate facts principles and concepts from different areas of the specification.</td>
<td>Put together some facts, principles and concepts from different areas of the specification.</td>
</tr>
<tr>
<td>Area</td>
<td>A/B</td>
<td>E/U</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>Use of practical skills within medical contexts</td>
<td>Devise and plan suitable experimental and investigative activities, selecting appropriate techniques.</td>
<td>Devise and plan some aspects of experimental and investigative activities.</td>
</tr>
<tr>
<td></td>
<td>Consistently demonstrates safe and skilful use of practical techniques to produce data within the expected range of tolerance for the technique.</td>
<td>Demonstrate safe use of practical techniques to produce some data within expected range of tolerance for the technique.</td>
</tr>
<tr>
<td></td>
<td>Make observations and measurements with appropriate precision and record these methodically.</td>
<td>Make observations and measurements and record them.</td>
</tr>
<tr>
<td></td>
<td>Interpret, explain, evaluate and communicate the results of their own and others’ experimental and investigative activities, in appropriate contexts.</td>
<td>Interpret, explain and communicate some aspects of the results of their own and others’ experimental and investigative activities, in appropriate contexts.</td>
</tr>
<tr>
<td>Reporting medical information</td>
<td>Make a clear and accurate use of English (styles, spelling, punctuation and grammar) to communicate ideas and structure arguments.</td>
<td>Make some appropriate use of English (styles, spelling, punctuation and grammar to communicate ideas and structure arguments.</td>
</tr>
<tr>
<td></td>
<td>Produce logical and well-structured reports, showing a detailed scientific understanding of their work.</td>
<td>Produce a mostly clear report, showing some understanding of their work.</td>
</tr>
<tr>
<td></td>
<td>Logically organise work in a coherent structure linking conclusions to supporting evidence with clarity.</td>
<td>Some organisation and structure with some valid evidence.</td>
</tr>
<tr>
<td></td>
<td>Clearly communicate with few minor errors in the use of technical terms, spelling, punctuation and grammar.</td>
<td>Communicate some suitable information without significant errors.</td>
</tr>
</tbody>
</table>