

# GCSE

Specification

# Human Health and Physiology

For exams June 2011 onwards

For certification June 2011 onwards



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# 1 Introduction

## 1.1 Why choose AQA?

AQA is the UK's favourite exam board and more students receive their academic qualifications from AQA than from any other board. But why is AQA so popular?

AQA understands the different requirements of each subject by working in partnership with teachers. Our GCSEs:

- enable students to realise their full potential
- contain engaging content
- are manageable for schools and colleges
- are accessible to students of all levels of ability
- lead to accurate results, delivered on time
- are affordable and value for money.

AQA provides a comprehensive range of support services for teachers:

- access to subject departments
- training for teachers including practical teaching strategies and approaches that really work presented by senior examiners
- personalised support for Controlled Assessment
- 24 hour support through our website and online *Ask AQA*
- past question papers and mark schemes
- comprehensive printed and electronic resources for teachers and students

AQA is an educational charity focused on the needs of the learner. All our income goes towards operating and improving the quality of our specifications, examinations and support services. We don't aim to profit from education – we want you to.

If you are an existing customer then we thank you for your support. If you are thinking of moving to AQA then we look forward to welcoming you.

## 1.2 Why choose Human Health and Physiology?

AQA's Human Health and Physiology specification enables students to gain an informed insight into how the human body works, the structures that make it work and how to keep the body healthy. Key aspects of the specification include nutrition, blood and circulation, defence against diseases, and 21st century health.

This is a revision of the AQA Human Physiology and Health Specification. It retains many features of the previous specification but has been updated, re-named and given a more "applied" approach to the subject. It has two units for more flexibility.

Integral to the subject is the development and use of practical skills relevant to the study of science in general and Human Health and Physiology in particular. Students are expected to carry out investigative activities and practical work appropriate to the study of Human Health and Physiology. This

work will be internally assessed, using a form of controlled assessment which is common with most other AQA GCSE and GCE Science specifications. The investigative skills assignment (ISA) part of this assessment has externally set questions that are marked by the teacher.

The Human Health and Physiology specification builds from the knowledge gained in Key Stage Three study and aspects of GCSE Science, although study of GCSE Science is not a prerequisite for the study of Human Health and Physiology. It could be offered as an option to follow GCSE Science, for example, an alternative to Additional Science for students with a particular interest in Human Health. As part of the AQA Science Suite, Human Health and Physiology provides an ideal base for progression to Human Biology AS and A2 and for employment in the Caring Professions (including teaching).

## 1.3 How do I start using this specification?

### Already using the existing AQA Human Health and Physiology Specification?

- Register to receive further information, such as mark schemes, past question papers, details of teacher support meetings, etc, at **<http://www.aqa.org.uk/rn/askaqa.php>** Information will be available electronically or in print, for your convenience.
- Tell us that you intend to enter candidates. Then we can make sure that you receive all the material you need for the examinations. This is particularly important where examination material is issued before the final entry deadline. You can let us know by completing the appropriate Intention to

Enter and Estimated Entry forms. We will send copies to your Exams Officer and they are also available on our website (**[http://www.aqa.org.uk/admin/p\\_entries.php](http://www.aqa.org.uk/admin/p_entries.php)**).

### Not currently using the AQA specification?

- Almost all centres in England and Wales use AQA or have used AQA in the past and are approved AQA centres. A small minority are not. If your centre is new to AQA, please contact our centre approval team at **[centreapproval@aqa.org.uk](mailto:centreapproval@aqa.org.uk)**

## 1.4 How can I find out more?

### Ask AQA

You have 24-hour access to useful information and answers to the most commonly-asked questions at **<http://www.aqa.org.uk/rn/askaqa.php>**

If the answer to your question is not available, you can submit a query for our team. Our target response time is one day.

### Teacher Support

Details of the full range of current Teacher Support meetings are available on our website at **<http://www.aqa.org.uk/support/teachers.php>**

There is also a link to our fast and convenient online booking system for Teacher Support meetings at **<http://events.aqa.org.uk/ebooking>**

If you need to contact the Teacher Support team, you can call us on 01483 477860 or email us at **[teachersupport@aqa.org.uk](mailto:teachersupport@aqa.org.uk)**

## 2 Specification at a Glance

**Human Health and  
Physiology  
4417**

**Unit 1:  
Topics in Human Health and Physiology**

**Foundation Tier (44151F)**

or

**Higher Tier (44151H)**

Written Paper – 2 hours  
120 marks – 75%

A question and answer booklet containing 10–16 compulsory short answer/structured questions/longer prose questions

**This unit must be taken at the end of the course**

**plus**

**Unit 2: (44152)**

**Investigations in Human Health and Physiology**

Investigative Skills Assignment (ISA)

An externally set, internally assessed test

45 minutes – 34 marks

+

Practical Skills Assessment (PSA)

A holistic skills assessment

6 marks

Total – 40 marks – 25%

# 3 Subject Content

## 3.1 Introduction to subject content

GCSE Human Health and Physiology is part of the GCSE Science suite of qualifications that allows a flexible progression route from KS3 through KS4 to further studies. GCSE Human Health and Physiology can be taken after GCSE Science as an alternative to GCSE Additional Science or GCSE Additional Applied Science by those candidates who wish to specialise in a human biology approach. It can also be taken post 16 as a stand alone GCSE qualification.

The specification leads to a single award GCSE Human Health and Physiology.

The assessment units are available in the June series only.

The controlled assessment is not tiered. The written papers are tiered with Foundation Tier being aimed at grades C–G, and Higher Tier being aimed at grades A\*–D. Questions for the Higher Tier will be more demanding requiring higher level skills allowing candidates to access the higher grades.

The level of demand of questions depends on factors such as the nature of the underlying scientific concepts being tested, amount of cueing provided including the plausibility of distractors, the context/application in which the question is contained, whether the response required is directed or open, and the extent to which reference material must be used in order to respond. Consideration of such factors allows GCSE Science questions to be allocated to one of three levels of demand (low, standard and high).

Foundation Tier papers contain low and standard demand questions, while Higher Tier papers contain standard and high demand questions. Quality of Written Communication (QWC) will be assessed in both the written papers and the Investigative Skills Assignment (ISA).

This specification may be studied as a 1 or 2 year course. Centres entering for Unit 2 (controlled assessment unit) should ensure that they use the correct ISA tests for their year of entry.

### 3.1.1 Examining 'How Science Works'

The GCSE Criteria for Science requires that new science specifications should cover the skills, knowledge and understanding of 'How Science Works' in the areas of:

- Data, theories and explanations
- Practical and enquiry skills
- Communication skills.

Each section of the specification considers some of the knowledge required by particular scientists and then goes on to explore how this knowledge and understanding may be applied in their working environment. Teachers are encouraged to use practical investigative techniques throughout the course as the applications and implications of science touch on all areas of the specification. In addition to the controlled assessment, ideas contained in 'How Science Works' will be examined in the written papers by providing candidates with appropriate data or text to comment on. Areas of the subject content suitable for teaching and learning 'How Science Works' are shown by statements such as:

- Candidates should be able to use their knowledge and understanding to explain....
- Candidates should use practical and enquiry skills to investigate....
- Candidates should, when provided with appropriate information, be able to evaluate....

### 3.1.2 Communication Skills

Throughout their GCSE Science course, candidates should be encouraged to develop and improve their scientific communication skills.

These include:

- recalling, analysing, interpreting, applying and questioning scientific information or ideas
- using both qualitative and quantitative approaches
- presenting information, developing an argument and drawing a conclusion, using scientific, technical and mathematical language, conventions and symbols and ICT tools.

These skills will be developed through the activities that candidates undertake during their course, including those required for this specification by the statements at the beginning of each section of the substantive content. Appropriate use of these skills will enable candidates to be successful in the written assessments for this specification.

### 3.1.3 ICT Skills

In undertaking activities to develop their knowledge and understanding of how science works, candidates should be given opportunities to:

- collect data from primary and secondary sources, using ICT sources and tools
- present information, develop arguments and draw conclusions using ICT tools.

### 3.1.4 Mathematical and other requirements

The knowledge and skills in mathematics which are relevant to science and which are given below will not be exceeded in making assessments in this specification. Candidates will not be prevented from demonstrating achievement in science by mathematics which is excessively demanding.

#### Foundation and Higher Tier

- The four rules applied to whole numbers and decimals
- Use of tables and charts
- Interpretation and use of graphs
- Drawing graphs from given data
- Reading, interpreting and drawing simple inferences from tables
- Vulgar and decimal fractions and percentages
- Scales
- Elementary ideas and application of common measures of rate
- Averages/means and the purpose for which they are used
- Substitution of numbers for words and letters in formulae (without transformation of simple formulae)

#### Higher Tier Only (in addition to the requirements listed above)

- Square and square root
- Conversion between vulgar and decimal fractions and percentages
- The four rules applied to improper (and mixed) fractions
- Expression of one quantity as a percentage of another; percentage change
- Drawing and interpreting of related graphs
- Idea of gradient
- Transformation of formulae
- Simple linear equations with one unknown
- Elementary ideas and applications of direct and inverse proportion

#### Units, symbols and nomenclature

Units, symbols and nomenclature used in examination papers will normally conform to the recommendations contained in the following.

- *Signs, Symbols and Systematics — the ASE companion to 16–19 Science.*  
Association for Science Education (ASE), 2000  
ISBN 0 86357 312 6
- *Signs, Symbols and Systematics — the ASE companion to 5–16 Science.*  
Association for Science Education (ASE), 1995.  
ISBN 0 86357 232 4

Any generally accepted alternatives used by candidates will be given appropriate credit.

### Tiering and Subject Content

In this specification there is additional content needed for Higher Tier candidates. Questions in the Higher Tier papers will also be more demanding, allowing candidates to access the higher grades.

- HT** ❖ Shown like this, HT indicates the additional material needed only by Higher Tier candidates.

## 3.2 Summary of Unit 1 Subject content

The content is divided into the following sections

- 3.3.1 Cells, Cell Organisation and Cell Processes
- 3.3.2 Nutrition
- 3.3.3 Physical and Chemical Breakdown of food
- 3.3.4 Blood and the Circulatory system
- 3.3.5 Gas exchange
- 3.3.6 Excretion
- 3.3.7 Nervous system, hormones and co-ordination

- 3.3.8 Muscles, bones and movement
- 3.3.9 Human reproduction, growth and development
- 3.3.10 Genetic information, inheritance of characteristics and Genetic Engineering
- 3.3.11 Pathogens, defence against disease and the immune response
- 3.3.12 The development of cancer research and treatments.
- 3.3.13 21st Century Health

## 3.3 Unit 1: Topics in Human Health and Physiology

### Introduction

The health of the human body depends upon the health of its individual parts. The human body is composed of systems of organs which, in turn, are composed of tissues with a wide variety of cells. Physiology describes the functions of cells, tissues and organs.

Candidates will learn about some of the science used by health professionals working in health and medical care, including:

- cytologists
- dieticians, nutritionists and food analysts
- dentists
- doctors and nurses
- scientists working in the blood transfusion service
- optometrists
- endocrinologists chiropractors, osteopaths, physiotherapists and orthopaedic surgeons
- gynaecologists, midwives and health visitors

In particular candidates will learn what these health professionals need to know to maintain and encourage good health.

Candidates will also learn about the contributions of scientists who have made significant breakthroughs in medicine, including:

- Alexander Fleming
- Edward Jenner
- Christiaan Barnard
- Banting and Best
- Richard Doll.

Candidates will also be expected to be aware of:

- the rapid changes in treatment techniques and modern breakthroughs in medicine in the 21st Century
- the problems that improved treatments impose on society such as the extra cost of medical care
- the problems for society of modern epidemics such as obesity and alcohol related liver disease.

### 3.3.1 Cells, Cell Organization and Cell Processes

Cytologists are scientists who study the structure and function of cells. All health scientist need to know and understand the processes which maintain healthy growth and development of cells in order to understand what happens when something goes wrong with parts of the body.

## Cells

### Candidates should know:

- that cells are the basic unit of the human body
- that cells are specialised to carry out particular functions eg blood cells, nerve cells, sperm cells, egg cells
- that most cells have the following parts:
  - a cell surface membrane which controls the passage of substances in and out of the cell
  - a nucleus which contains the genetic material and controls the activities of the cell
  - cytoplasm in which most of the chemical reactions take place
- HT** ❖ that the cytoplasm contains structures which are not visible with the light microscope. These include:
  - mitochondria to release energy in respiration
  - ribosomes to produce proteins eg enzymes, insulin, haemoglobin.

[Candidates are not expected to be familiar with photoelectronmicrographs.]

## Cell organisation

### Candidates should know:

- that a tissue is a group of cells with similar structure and function
- that organs are made of tissues. One organ may contain several tissues. The skin is the largest organ in the body
- that systems are groups of organs which perform a particular function eg the digestive system, the circulatory system
- that some organs can be part of more than one system eg the pancreas.

### Candidates should use practical and enquiry skills:

- to examine and compare a range of cells, using microscopes, bioviewers or internet images.

## Cell processes

Cells need energy, nutrients and oxygen to function efficiently. They also need enzymes which control all chemical reactions in the cell.

### Candidates should know and understand:

- that molecules and ions move from the outside into cells and also between cells. Nutrient molecules reach body cells via the digestive system. Oxygen reaches body cells via the lungs
- that waste molecules leave the cells and must be removed from the body
- that diffusion is the movement of molecules from high to low concentration
- that osmosis involves diffusion of water through a partially permeable cell membrane. Human cells are easily damaged by the entry or loss of too much water; hence it is important to regulate the solute-water balance of the blood
- that enzymes are catalysts and are important in both building-up and breaking-down processes
- that temperature and pH can each affect the functioning of enzymes
- that enzymes are proteins and can be denatured by extremes of temperature and pH
- that respiration is the release of energy within a cell from food molecules. All living cells of the body respire. Food is the main energy supply for the body. Glycogen and fats are stored forms of energy. Stored glycogen or fats are the body's main energy supplies
- that energy is needed for movement, for growth, building large molecules from small molecules and for keeping warm

### 3.3.2 Nutrition

- that aerobic respiration uses oxygen and produces carbon dioxide, releasing a large amount of energy

Word equation:

glucose + oxygen → carbon dioxide + water + energy

- anaerobic respiration may occur during vigorous physical exercise, when insufficient oxygen is available. It releases a limited amount of energy and leads to lactic acid production and muscle fatigue

Word equation:

glucose → lactic acid + energy.

Dieticians are health scientists who are able to advise about variations in diet to control normal growth and some health problems. They understand that humans need a balanced intake of nutrients, ie the whole range of nutrients and the correct amount of each.

Candidates should know and understand:

- why a person is malnourished if their diet is not balanced. This may lead to a person being too fat (obesity) or too thin (anorexia) and also to deficiency diseases eg scurvy, rickets and anaemia
- that dieticians can advise healthy and unhealthy people
- that dietary requirements with respect to the amounts of energy, protein, vitamins and mineral salts may change due to:
  - growth
  - pregnancy
  - amount of physical exercise
  - disorders such as diabetes, high blood pressure and heart disease.

Candidates should know:

- that human cells need a range of nutrients for healthy growth and development
- that the body needs a balanced diet of carbohydrates, lipids (fats), proteins, vitamins, mineral salts, water and fibre.

Candidates should be able to:

- identify rich sources of carbohydrates, proteins, fats, fat soluble vitamins D and A, water soluble vitamin C, mineral ions eg calcium, iron, sodium and chloride
- describe the functions of these essential nutrients
- compare the energy content of nutrients
- explain the consequences of calcium and iron deficiency
- explain the consequences of excess salt and sugar
- explain the benefits of fibre in the diet.

Candidates should, when given appropriate information, be able to evaluate:

- the effects of reducing or increasing the various food components in the diet
- the benefits of some fatty acids eg Omega 3 and 6
- the effects of taking vitamin and mineral supplements
- the effects of adding vitamins and minerals to processed foods
- the issues involved in adding chemicals to food and water.

### Food labelling and food testing

Food analysts use a range of techniques to identify the contents of natural and processed foods. They need to ensure that there is accurate nutritional information on food labels.

### 3.3.3 Physical and Chemical Breakdown of Food

#### Teeth

#### Digestion

Candidates should be able to use practical and enquiry skills to:

- interpret food labels with particular reference to quantities and energy values of the nutrients
- carry out qualitative food tests for starch, protein and reducing sugar
- test prepared liquid 'foods' containing starch, protein and glucose, using different concentrations of these three foods. Using the iodine test, biuret test and Benedict's test candidates should understand the principles of a fair test and quantitative testing (pre-prepared ranges of coloured solutions can be provided for comparison)
- carry out quantitative tests for vitamin C content
- carry out quantitative tests for energy content.

Candidates should be able to use data, theories and explanations:

- to evaluate qualitative and quantitative data on food analysis.

A wide range of health scientists need to understand how the food we eat is made available to the body cells. Doctors often have to deal with the consequences when the digestive system malfunctions.

Candidates should know:

- that large particles of food are broken down physically by the teeth
- that large, insoluble molecules are broken down chemically by enzymes, into soluble substances which can pass through cell surface membranes and can be absorbed into the bloodstream.

Dentists are health professionals who advise on tooth care but also repair the damage caused by poor diet and poor tooth cleaning. Dental hygienists support the work of dentists by removing plaque from teeth.

Candidates should know and understand:

- the structure and functions of human teeth
- the functions of saliva.

Candidates should be able to explain:

- the benefits of alkaline saliva
- how tooth decay is caused
- why pain is not felt until decay reaches the pulp
- the benefits of regular tooth brushing and dental check-ups.

Candidates should be able to use practical and enquiry skills:

- to evaluate the benefits of preventing acid production in the mouth by using a simple demonstration using teeth and a range of acid concentrations to compare rate of dissolving.

Candidates should know:

- the position of the mouth, salivary glands, oesophagus, stomach, liver, gall bladder, bile duct, pancreas, pancreatic duct, small intestine and large intestine, rectum and anus.

Candidates should understand:

- how the food is moved through the digestive system by swallowing and peristalsis
- how enzymes breakdown large molecules into smaller molecules that can be absorbed into the bloodstream

- the digestion of carbohydrates into sugars by carbohydrase enzymes produced by the salivary glands, the pancreas and the small intestine. Amylase is a carbohydrase which catalyses the digestion of starch into sugars
- the digestion of proteins into amino acids by protease enzymes in acidic conditions in the stomach, the pancreas and the small intestine
- the digestion of fats into fatty acids and glycerol by lipase enzymes produced in the pancreas and small intestine
- that enzymes active in the stomach work best in acid conditions
- that alkaline bile is produced in the liver, stored in the gall bladder and passes to the intestine via the bile duct
- that bile neutralises stomach acid and emulsifies fats to optimise enzyme activity.

Candidates should be able to use practical and enquiry skills to:

- *investigate enzyme activity and the factors which affect enzyme activity eg temperature and pH*
- *understand the need for controlling variables and the principles of a fair test*
- *distinguish between independent and dependent variables*
- *select a suitable range of values for the independent variable*
- *present data in a suitable form*
- *draw conclusions*
- *evaluate the method used and suggest possible improvements eg choice of measuring instrument, range of values chosen, number of repeats*

Candidates should know:

- that the soluble products of digestion are absorbed into the bloodstream in the small intestine
- that villi increase the surface area of the small intestine for efficient absorption
- HT** ❖ that villi have cells with microvilli
- that diffusion is important in absorption
- that absorbed glucose, fatty acids and glycerol are used for energy release, excess glucose is converted to glycogen and fat for storage and that amino acids are used for protein formation
- HT** ❖ that excess amino acids are deaminated by the liver and the ammonia produced is converted to urea for excretion
- that water is absorbed by the large intestine
- that the indigestible food which remains and bacteria make up the bulk of the faeces which are egested.

Candidates should be able to explain:

- HT** ❖ why patients with cystic fibrosis have difficulty in digesting and absorbing food due to the thick mucus which blocks the pancreatic duct and absorbing surfaces
- HT** ❖ why patients with diseases such as Coeliac disease have problems with absorbing food due to the reduced surface area of the villi.

### 3.3.4 Blood and the Circulatory System

Scientists in the National Blood Service of England and Wales must be able to determine blood type and to ensure that the blood is free from transmissible disease. They are also able to separate the parts of the blood in order to make blood products for use in specific treatments. Doctors require blood and blood products to treat a wide range of disorders.

#### Blood

Candidates should know:

- that blood contains three types of cells suspended in blood plasma
- the structure and functions of red blood cells, white blood cells, platelets and plasma.

Candidates should be able:

- HT** ❖ to explain the effects of anaemia
- HT** ❖ to give a simple description of the process of blood clotting as a series of enzyme controlled reactions, resulting in the change of fibrinogen to fibrin, which forms a network of fibres trapping blood cells and forming a clot.

Candidates should know that:

- there are four **main** types of human blood, O, A, B and AB
- blood group O is the universal donor.

Candidates should understand:

- the need for blood typing
- HT** ❖ the ABO compatibility table
- HT** ❖ how plasma can be used to treat patients who are dehydrated due to burns.

#### The circulatory system

All health professionals need to understand how useful materials reach all the body cells and how waste materials are removed. Much preventive medicine depends on maintaining a healthy circulatory system. Technicians use monitors to record heart activity.

Physiotherapists enable people to recover from heart attacks and strokes.

Candidates should know:

- that cells require oxygen and nutrients
- that waste materials from cells eg carbon dioxide and urea must be removed
- the structure of the circulatory system which has blood vessels and a pump
- the link between the pulse and the heart beat.

## Candidates should be able:

- to describe the structure of arteries, veins and capillaries in terms of the thickness of the walls and their internal diameter
- to relate the structure of blood vessels to their function and that arteries carry blood from the heart and veins to the heart
- to understand that capillaries are the exchange surface between the cells and the blood
- to explain why particular blood vessels contain oxygenated or deoxygenated blood
- to describe the structure of the heart
- to relate the structure of the heart to its function as a pump
  - the heart is a double pump, with muscular walls
  - the heart has four chambers, two atria and two ventricles which contract to pump blood
  - atria pump blood to the ventricles
  - ventricles force blood out of the heart
  - the right ventricle pumps deoxygenated blood to the lungs
  - the left ventricle pumps oxygenated blood to the rest of the body
  - valves in the heart prevent backflow.

## Candidates should be able to use data, evidence, theories and explanations to:

- HT** ❖ explain why blood changes in composition and pressure as it passes through the major organs of the body.

## Candidates should understand how:

- heart attacks and strokes can be caused by blood clots in the heart and brain vessels respectively.
- Cholesterol may be responsible for atheroma (narrowing of blood vessels) which increases the risk of heart attacks and strokes and may result in angina

## Candidates should, when given appropriate information, be able to evaluate:

- methods for reducing the incidence of heart attacks and strokes
- the benefits of physiotherapy following these.

## Candidates should know that:

- HT** ❖ the natural resting heart rate is controlled by the pacemaker, located in the right atrium
- HT** ❖ artificial pacemakers may be fitted which are electrical devices to stimulate the heart to beat faster or more regularly (details of pacemakers are not required).

Candidates should understand the scientific principles underlying the use of the following procedures. They should also appreciate the ethical, social and economic issues involved in the use of these procedures.

- the pioneering work by surgeons such as Christiaan Barnard and Sir Magdi Yacoub on organ (heart) transplantation
- the use of an artificial pump and oxygenating system ('heart-lung machine') to maintain normal blood circulation and oxygenation during surgery
- HT** ❖ the use of artificial devices such as pacemakers and valves in treating heart disease and mechanical hearts as a substitute for donor organs
- HT** ❖ the use of tissue typing and immunosuppression to overcome the problem of rejection.

### The effects of exercise on the circulatory system

Candidates should be able to use data, evidence, theories and explanations to:

- explain why increased exercise is linked to
  - the need for increased supplies of oxygen and glucose
  - the need for more carbon dioxide and heat to be removed
  - increased production of lactic acid

Candidates should be able to use practical and enquiry skills to:

- *investigate the effect of exercise on the pulse rate*
- *understand the need for controlling variables*
- *understand the difficulty of controlling variables when using human subjects*
- *understand the principles of a fair test*
- *distinguish between the independent and dependent variable*
- *select a suitable range of values for the independent variable*
- *present data in a suitable form*
- *draw conclusions*
- *evaluate the method used and suggest possible improvements eg choice of measuring instrument, range of values chosen, number of repeats.*

### 3.3.5 Gas exchange

All cells need a good supply of oxygen for respiration. All health professionals, including paramedics, nurses, doctors and physiotherapists need to understand how oxygen reaches the cells from the air and the consequences of lack of oxygen. The first priority when treating a casualty is to ensure that the airways are clear.

Candidates should understand:

- how oxygen is extracted from cleaned air and passed to all the body cells
- that the oxygen diffuses into the blood and at the same time carbon dioxide is removed.

Candidates should be able to:

- identify the parts of the breathing system:
  - lungs, trachea, bronchi, bronchioles, alveoli, diaphragm, ribs and intercostal muscles
- describe the functions of the parts of the breathing system
- describe the function of the ciliated cells and mucus secreting cells
- describe the mechanism of ventilation in terms of changes in volume and pressure
- describe how air is cleaned on entering the body
- describe the adaptations of the alveoli for gas exchange
- describe the consequences of reduced surface area in the lungs.

Candidates should understand:

- the relationship between heart beat, breathing rate and exercise
- HT** ❖ that breathing is co-ordinated by the respiratory centre in the brain
- HT** ❖ that high levels of carbon dioxide are detected by pH receptors
- HT** ❖ why expired air is used to stimulate breathing in mouth-to-mouth resuscitation.

Candidates should use practical and enquiry skills to:

- *compare breathing rate before and after exercise*
- *measure lung capacity.*

### 3.3.6 Excretion

Many health problems result when toxic materials, including alcohol, accumulate in the blood and interfere with the cell processes. Doctors use dialysis or kidney transplantation to treat patients with kidney disease.

Candidates should know that:

- carbon dioxide, water, mineral salts, urea are some of the main excretory products produced by cells
- toxic materials such as alcohol are also removed from the blood
- the lungs, skin and kidneys are the main excretory organs
- the lungs excrete carbon dioxide
- the skin releases sweat
- the kidneys excrete urine, a solution containing urea, mineral ions and other waste substances
- urea is made in the liver.

Candidates should be able to:

- understand the short term and long term effects of alcohol on the body, including the development of cirrhosis
- evaluate data relating to the use of breath, urine and blood tests in determining alcohol levels in the blood.

### 3.3.7 Nervous System, Hormones and Co-ordination, Homeostasis

#### Nervous system and co-ordination

#### Candidates should know:

- that there are two kidneys which pass urine to the bladder for storage
- that healthy kidneys filter the blood, reabsorb all the sugar and any dissolved ions needed by the body, and reabsorb as much water as the body needs.

#### Candidates should be able to:

- HT** ❖ explain the relationships between urine concentration, sweating and exercise
- HT** ❖ understand the principles of a dialysis machine where the blood is separated from the dialysis fluid by a selectively permeable membrane
- HT** ❖ evaluate the advantages and disadvantages of haemodialysis, peritoneal dialysis and kidney transplants.

#### Candidates should use practical and enquiry skills to:

- *identify artificial 'blood' (protein and glucose), 'filtrate' (glucose only) and 'urine' (neither) with clinistix (or Benedict's test) and Biuret*
- *use dialysis tubing to demonstrate that large molecules such as protein will not diffuse through but glucose will.*

Health professionals need to understand how the body detects and responds to changing conditions, both internal and external.

Optometrists are scientists who evaluate the ability of the eye to detect light. They can also detect other health problems by observing changes in the eye and testing pressures within the eye.

#### Candidates should know and understand:

- how the nervous system and hormones enable the body to respond to external changes and to control the internal environment
- how blood plays a central role in homeostasis due to its function in transporting materials and distributing heat.

#### Candidates should know:

- that reflex actions are rapid, automatic responses to stimuli
- that the body has receptors to detect changes in the external environment and the internal environment
- that voluntary actions start with impulses from the brain
- that the brain is a centre for co-ordination with the ability to learn and remember.

#### Candidates should be able to:

- understand the benefits of reflex actions to the individual eg the pupil in the eye constricting in bright light or moving the hand away from a heat source
- understand the difference between reflex and voluntary actions
- analyse a given reflex action in terms of

stimulus → receptor → co-ordination system →  
effector → response.

#### Candidates should know:

- the position of the sclera, cornea, iris, pupil, lens, ciliary muscles, suspensory ligaments, retina and optic nerve.

**Candidates should know and understand:**

- how the structure of the eye is related to its function as a receptor
  - the role of the cornea, lens, ciliary muscles, suspensory ligaments and iris in focusing light on the retina
- HT** ❖ how long sight is corrected with converging lenses
- HT** ❖ how short sight is corrected with diverging lenses.

**Candidates should, when provided with appropriate information, be able to:**

- evaluate the Health and Safety issues concerned with
  - the effect of a high number of decibels, too much light, type of light in the workplace
  - the use of modern technologies eg computers, mobile phones and personal music players
- understand the benefits of corneal transplants
- understand the significance of changes in the eye to identify a range of health problems eg diabetes.

**Candidates should be able to use practical and enquiry skills to:**

- *determine the number and position of touch and/or temperature receptors in the skin*
- *investigate the effect of light on the eye*
- *determine the range of frequency audible to the human ear*
- *investigate the taste receptors on the tongue.*

**Hormones and co-ordination**

Endocrinologists are scientists who investigate the effect of hormones on body functioning. Hormone imbalances can lead to a wide variety of health problems.

**Candidates should know:**

- that hormones are chemicals released by ductless glands (endocrine glands) into the blood which may affect a target organ or, in some cases, the whole body
- the position of the pituitary, thyroid, pancreas, adrenal glands, ovaries and testes.

**Candidates should understand:**

- the functions of:
    - growth hormone (stimulates growth and cell reproduction)
    - thyroxine (controls metabolic rate)
    - insulin (causes the liver to absorb glucose and convert it to glycogen when blood sugar levels are high)
    - glucagon (causes the liver to change glycogen to glucose when blood sugar levels are low)
    - adrenaline (increases blood sugar, heart rate, breathing rate and blood pressure at times of stress)
    - oestrogen (controls female sexual development)
    - testosterone (controls development of male sexual characteristics).
  - that endocrine glands are stimulated by chemical changes in the blood eg changes in blood sugar concentration.
- HT** ❖ that ADH increases reabsorption of water by the kidneys when the hypothalamus detects that the blood water content is too low

Candidates should be able to explain:

- HT** ❖ how blood glucose is detected and controlled
- HT** ❖ the advantages of the functions of adrenalin during times of stress
- HT** ❖ the principle of negative feedback as illustrated by blood sugar control and osmoregulation.

Candidates should, when provided with appropriate information, be able to evaluate:

- the methods used by Banting and Best to investigate a treatment for diabetes
- modern methods of treating diabetes including the use of genetically engineered insulin.

## Homeostasis

Hormone Control, Thermoregulation and Osmoregulation are examples of **Homeostasis**.

Candidates should know:

- that body temperature is monitored and controlled by the thermoregulatory centre in the brain which sends nerve impulses to the organs which need to act
- that the thermoregulatory centre has receptors sensitive to the temperature of the blood flowing through the brain. Temperature receptors in the skin also send impulses to the thermoregulatory centre giving information about skin temperature
- that sweating helps to cool the body. More water is lost when it is hot, and more water has to be taken as a drink or in food to balance this loss
- that if sweating increases, the loss of water in the urine decreases.

Candidates should know and understand:

- HT** ❖ that the thermoregulatory centre is in the hypothalamus
- HT** ❖ the changes which occur in the skin arterioles and sweat glands when the core body temperature rises and falls
- HT** ❖ how heat is lost from the skin by evaporation and radiation
- HT** ❖ the role of muscles in heat production.

## 3.3.8 Muscles, Bones and Movement

Back pain is the major cause of absence from work. A range of health professionals specialise in returning the muscles, bones and joints to their correct position following injury. Chiropractors, osteopaths, physiotherapists and orthopaedic surgeons all need to understand the structure and function of muscles, bones and joints.

Candidates should understand:

- that physical injury — eg sports injuries — may result in damaged ligaments, pulled or torn muscles, tendon rupture, torn cartilage, tendonitis, dislocation or fractured bones
- that degenerative diseases damage bone and joints eg osteoporosis and arthritis
- that back problems often arise due to poor posture when bending and lifting which may result in a ruptured disc in the vertebral column
- that modern surgery is used to keep the body mobile.

Candidates should know:

- the functions of the skeleton in support, protection, allowing movement and producing blood cells
- the structure and function of a synovial joint and its parts

- the arrangement of the extensor and flexor muscles across a joint and the antagonistic action of these in moving bones
- that muscles need energy to contract
- the gross structure of the vertebral column, the names of the vertebrae and the position of inter-vertebral discs
- the role of poor posture in back pain.

Candidates should, when provided with appropriate information, be able to evaluate:

- the benefits of keyhole surgery on joints
- the impact on society of working days lost due to back problems
- the health and safety issues surrounding the provision of suitable chairs etc in the workplace to avoid injuries
- methods of treating back pain
- the use of materials in joint replacement treatments.

Candidates should use practical and enquiry skills:

- to analyse bone structure
  - by placing bone in acid to remove the soluble inorganic compounds
  - by burning bone to remove the organic compounds.

### 3.3.9 Human Reproduction, Growth and Development

#### Human reproduction

Health service professionals involved with the care of women during pregnancy and birth include gynaecologists and midwives. Health visitors advise parents on the care of young children.

Candidates should know and understand:

- the structure and function of the following parts of the female and male reproductive systems: ovary, oviduct (fallopian tube), uterus, cervix, vagina, penis, urethra, testis, scrotal sac, sperm duct (vas deferens), and prostate gland
- the structure and function of the gametes, egg and sperm
- the number of chromosomes in human body cells
- that meiosis halves the number of chromosomes during the formation of gametes
- the mechanism of transferring the sperm in intercourse
- the significance of fertilization in restoring the 23 pairs of chromosomes in the zygote
- the site of fertilization in the upper part of the oviduct
- that the zygote divides by mitosis to form a ball of cells that is moved to the uterus where implantation occurs in the lining
- that the ball of cells divides to form the fetus, the amnion and the placenta
- that the amniotic fluid acts as a shock absorber to protect the fetus
- that the placenta is an exchange surface to allow materials to diffuse to and from the fetus eg oxygen, named nutrients, carbon dioxide
- the three stages of labour.

Candidates should be able to explain:

- why the mother requires a healthy diet, moderate exercise and sufficient rest during pregnancy
- the dangers of consuming alcohol or other drugs during pregnancy
- why carbon monoxide, from smoking, reduces the oxygen levels available to the fetus and reduces birth weight

## Human growth and development

- why viruses such as Rubella and HIV are able to cross the placenta and infect the fetus
- how identical twins and fraternal twins are produced
- the benefits of breast feeding
- the need for parental care.

### Candidates should know that:

- the growth rate of the whole body changes during development, there are growth spurts in young children and adolescents
  - the relative growth of the head, trunk and limbs also changes throughout development
  - many changes occur to boys and girls during adolescence, controlled by the sex hormones oestrogen and testosterone
  - in girls the menstrual cycle starts during early adolescence
  - the average menstrual cycle is repeated about every 28 days
  - ovulation occurs around the mid point of the 28 day cycle
  - the menstrual cycle is controlled by hormones
  - hormones are used as methods of contraception
- HT** ❖ ovulation occurs 14–16 days before the next menstruation in cycles which are **not** 28 days
- HT** ❖ oestrogen and progesterone are produced by the ovaries
- HT** ❖ oestrogen causes an egg to mature
- HT** ❖ oestrogen and progesterone cause the lining of the womb to thicken so it is ready for implantation
- HT** ❖ if implantation does not occur the ovaries stop producing oestrogen and progesterone and the lining of the uterus breaks down, leaving the body as the menstrual flow
- HT** ❖ if a woman is pregnant, the fertilized egg implants and the ovaries continue to produce oestrogen and progesterone to maintain the lining of the uterus
- HT** ❖ after 12 weeks the placenta produces hormones that maintain the lining of the uterus
- HT** ❖ the reproductive cycle is controlled by the pituitary hormones, follicle stimulating hormone (FSH) which stimulates the ovaries and luteinising hormone (LH) which stimulates ovulation (rupture of follicle to release egg)
- HT** ❖ LH also causes the remains of the follicle to develop into the corpus luteum and produce progesterone
- HT** ❖ if a fertilised egg is not implanted, the corpus luteum breaks down
- HT** ❖ during pregnancy the placenta secretes hormones, some of which inhibit FSH production, preventing more eggs maturing.

### Candidates should, when provided with appropriate information, be able:

- to evaluate the impact on society of a high birth rate
- HT** ❖ to evaluate modern methods of treating infertility.

### Candidates should appreciate:

- that there are different cultural and religious attitudes to fertility treatment.

### 3.3.10 Inheritance of Characteristics and Genetic Engineering

As the body develops the cells in the tissues divide. Healthy growth and development depends upon the accurate reproduction of these cells. Occasionally mistakes occur and the cells behave abnormally. Health professionals must understand what happens in cell division in order to try to treat unusual cell behaviour. Unfortunately scientists do not have all the answers as cell chemistry is very complex.

#### Genetic information

##### Candidates should know:

- that body cells have 23 pairs of chromosomes, each of which contains a DNA molecule
- that the DNA can be divided into a large number of genes each of which codes for a particular protein
- that females have 22 pairs plus two X chromosomes, males have 22 pairs plus one X and one Y chromosome
- that the Y chromosome is not genetically identical to the X chromosome
- that in the division of body cells, mitosis ensures that exact copies of the chromosomes are passed to 2 daughter cells which are therefore genetically identical
- that during gamete formation 4 cells are produced by meiosis, each of which contains half the number of chromosomes
- that gametes are all genetically different
- that the chromosomes carry the genetic information from parents to offspring
- that a change in a chromosome or a single gene is called a mutation.

##### Candidates should know and understand:

- HT** ❖ that mutations in genes may result in loss of an enzyme which disrupts the cell's chemical reactions or its structure, the effect may be minor but sometimes leads to genetic disorders.

#### Inheritance of characteristics

Genetic counsellors are health professionals who use their understanding of the mechanisms of inheritance to advise parents on the chances of a child being born with a genetic disorder.

##### Candidates should understand:

- how characteristics are inherited
  - how to complete a punnet square to show a genetic cross illustrated by suitable examples
  - the terms allele, genotype, phenotype, homozygous, heterozygous, dominant and recessive
  - that characteristics may be altered by lifestyle eg diet.
- HT** ❖ how to construct a punnet square using the conventional terms and symbols

##### Candidates should be able to explain:

- why parents who do not have a genetic disorder may have offspring who do have the condition
- HT** ❖ how sex linked genes are inherited
- HT** ❖ why disorders such as colour blindness, haemophilia and muscular dystrophy normally appear in males but can be inherited by females
- HT** ❖ how some disorders are due to the loss or duplication of part of or a whole chromosome eg Down's Syndrome.

## Genetic engineering

Candidates should use practical and enquiry skills

- to investigate genetic crosses using ICT and models eg beads.

Genetic engineers are scientists at the cutting edge of technology. They investigate the causes of inherited diseases with the aim of providing cures. They also genetically modify bacteria to produce complex chemicals such as human hormones.

Candidates should know:

- that a human gene can be transferred to bacterial DNA, using specific enzymes, and that the process can be used to manufacture hormones, such as insulin and vaccines
- HT** ❖ Experimental techniques are being developed where functional genes can be transferred to human cells in gene therapy to treat diseases such as cystic fibrosis
- HT** ❖ that there are experimental techniques being developed where stem cells can be used to replace damaged tissue.

Candidates should, when given appropriate information, be able:

- HT** ❖ to evaluate the benefits of genetic engineering, gene therapy, stem cell therapy and embryo screening.

### 3.3.11 Pathogens, Defence against Disease and the Immune Response

Microbiologists are scientists who study microorganisms. The immune system attacks microorganisms which cause disease. In hospitals, they identify pathogens, suggest appropriate treatments for infections, and oversee infection control measures.

## Pathogens

Candidates should know:

- that infectious diseases may be caused by:
  - viruses eg common cold and influenza viruses which damage the cells in which they reproduce
  - bacteria eg MRSA, Salmonella
  - fungi eg athlete's foot, thrush
  - protoctists eg malaria, amoebic dysentery
- infectious diseases may be transmitted:
  - through the air (droplet infection)
  - by direct contact, including sexual contact
  - through food and water
  - by vectors
- that microorganisms:
  - reproduce rapidly in the body
  - produce toxins (poisons)
  - are more likely to cause disease if large numbers of microorganisms enter the body as a result of unhygienic conditions or contact with infected people.

Candidates should, when provided with appropriate information, be able to:

- explain how living conditions and lifestyle affect the spread of disease.

## Defence against disease

Candidates should know and understand:

- how the body prevents the entry of pathogens by using:
  - the skin which acts as a natural barrier
  - mucus in the respiratory passages to trap some pathogens
  - cilia on cells in the respiratory passages to move the mucus and trapped pathogens up to the throat

- acid conditions in the stomach, vagina and urethra which kills some pathogens
- the ability to produce scabs which form following blood clotting at the site of wounds
- white blood cells to combat pathogens
- that antibiotics are used to cure bacterial infections
- why antibiotics cannot be used to treat viral infections.

Candidates should be able to use their knowledge and understanding:

- to explain how over use of antibiotics may lead to selection of resistant strains of bacteria
- to assess the problems of antibiotic resistance in a modern hospital context
- to suggest ways of reducing the spread of infection.

Candidates should understand how observations may lead to hypotheses, investigations and finally theories by using the discovery of Penicillin by Alexander Fleming as an example of:

- the importance of following up a chance observation that the mould, *Penicillium*, inhibited the growth of bacteria on an agar plate
- using that observation to reason that the mould must have released a chemical (an 'antibiotic') which inhibited the growth of the bacteria
- culturing the mould to produce a mixture, containing the antibiotic, which could be tested to show it was bactericidal and harmless to human cells.

Candidates should be able to use practical and enquiry skills to:

- *investigate the effect of antibiotics on bacteria.*

## The immune response

Health scientists produce vaccines which target specific pathogens. The vaccine triggers the body's immune system. Edward Jenner was one of the early researchers into the use of vaccines.

Candidates should know and understand:

- that lymphocytes produce antibodies in response to an infection (natural immunity) or a vaccine (artificial immunity)
- that antibodies will be produced more rapidly following the primary infection or vaccine – this is called active immunity
- that antibodies can be injected when a person has been exposed to a dangerous infective organism eg rabies – this is called passive immunity.

Candidates should know and understand:

- HT** ❖ that the immune response is stimulated by particular antigens
- HT** ❖ that antigens are foreign substances which are usually protein-based, found on cell surface membranes and virus coats
- HT** ❖ that the immune response involves the production of specific antibodies
- HT** ❖ that the immune response is slow if the body has not previously encountered the relevant antigen
- HT** ❖ that the immune response is rapid in the presence of an immunological memory in the form of specific lymphocytes.

Candidates should understand that:

- Jenner, when investigating smallpox vaccination, made an observation, formed an hypothesis and then investigated it.

### 3.3.12 The Development of Cancer Research and Treatments

Candidates should know that:

- modern methods of production and testing of vaccines involve the sequence:
  - identifying the part of the organism to be used in the vaccine
  - the use of tissue culture to test the first vaccine
  - animal testing
  - testing thousands of volunteers.

Candidates should, when provided with appropriate data and evidence, be able to evaluate the ethical, social, cultural and economic issues involved in:

- the use of vaccines, including possible side effects
- the use of a human subject in Jenner's experiment
- the use of human volunteers in testing new vaccines.

Many health professionals are involved in the diagnosis and treatment of cancer. Other scientists, including geneticists, dieticians and environmental scientists, carry out research into the causes of cancer.

Candidates should know:

- that cancer is an abnormal, uncontrolled growth of cells
- that cells from malignant tumours invade healthy tissue
- that some malignant cells may enter the blood stream and circulate to other parts of the body, forming secondary tumours
- that cancer can be caused by chemical carcinogens eg those found in tobacco smoke, and by ionising radiation eg UV and X-rays.

Candidates should, when provided with appropriate information, be able to:

- evaluate statistical data about the links between possible causes of a type of cancer and the disease
- evaluate the work of Richard Doll who demonstrated the link between cigarette smoking and lung cancer by:
  - the use of very large numbers of observations of cases of lung cancer
  - correlating the incidence of lung cancer and cigarette smoking
  - using the data about the incidence of lung cancer in non-smokers as a type of control to establish a baseline for comparison with the incidence in smokers
- evaluate the benefits to society of the ban on smoking in public places
- evaluate methods of diagnosing and treating cancer.

Candidates should understand:

- that cancer research is ongoing
- that statistical surveys are often used to determine the cause of a particular cancer
- that research is validated by repetition and confirmation by other scientists.

### 3.3.13 21st Century Health

21st Century Health Professionals have many drugs, techniques and technologies available to them but they are often constrained from using them. The Health Service also faces problems due to the increase in obesity, alcohol related disorders in the young and an aging population as well as issues such as antibiotic resistant bacteria.

Society has benefited from research into treatment of serious diseases such as cancer but, as life expectancy increases, other health problems arise.

Candidates should, when provided with appropriate information, be able to evaluate:

- the impact of obesity on individual health and on the NHS
- the availability of over the counter drugs including their overuse
- the use of organ transplants as opposed to other methods of treatment
- the problems of underage drinking
- the problem of antibiotic resistant bacteria in hospitals
- constraints on health professionals such as ethics, cost and availability of drugs and techniques
- the use of alternative therapies eg acupuncture, herbal medicine and homeopathy.

## 3.4 Unit 2 (44152) Investigations in Human Health and Physiology (Controlled Assessment)

### Introduction

Candidates should be encouraged to carry out practical and investigational work throughout the course. This work should cover the skills and knowledge of how science works: fundamental ideas, observation, investigation design, measurement, data presentation, identifying patterns in relationships and any social aspects or limitations of scientific evidence.

AQA identifies some areas of the specification suitable for investigational work and provides ISAs (Investigative

Skills Assignments) in the form of written tests relating to these areas of the specification. Candidates are required to carry out practical work beforehand and bring their own data with them. Teachers use their judgement and the marking guidance from AQA to mark each ISA. Teachers are also required to make an assessment of the general practical and safety skills of each candidate, the Practical Skills Assessment (PSA). The ISA mark and the PSA mark are both needed for the total mark for this Unit. It counts for 25% of the total marks for the award.

### 3.4.1 Investigative Knowledge and Skills for the Controlled Assessment

The following is a summary of the investigative knowledge and skills for this unit. It contains the following sections:

- a) Fundamental ideas**
- b) Observation**
- c) Designing an investigation**
- d) Making measurements**
- e) Presenting data**
- f) Identifying patterns and relationships in data**
- g) Societal aspects of scientific evidence**
- h) Limitations of scientific evidence**

A related Glossary of Terms is provided in *Appendix E*.

#### a) Fundamental Ideas

Candidates should be able to understand what is meant by scientific evidence and thus be able to distinguish between opinions based on scientific facts and opinions based on hearsay evidence or bias.

#### b) Observation

Candidates should be able to recognise key features and make observations in a rational and unbiased manner. They should realise that observations are often the starting point of investigations and

may be used as a basis for classification. They should realise that observations can lead to hypotheses and predictions, and that data from observations may support, refute or lead to new hypotheses.

### c) Designing an Investigation

#### *Design of investigations: Variable structure*

Candidates should be able to distinguish between the dependent and the independent variable. They should also know the difference between categoric, discrete and continuous variables.

#### *Design: Validity, 'fair tests' and controls*

Candidates should be able to describe the attributes of a 'fair test', They should also be able to identify other key variables that must either be controlled or, if that is not possible, at least monitored.

#### *Design: Choosing values*

Candidates should be able to specify the range of and interval between, readings to be taken and to appreciate that these can often be determined by means of a preliminary trial run. They should also be able to specify the number of readings to be taken.

#### *Design: Methodology*

Candidates should be able to explain how an investigation can be designed so that it will render data which enables the candidate to formulate a sensible conclusion.

#### *Reliability and validity of the design*

Candidates should be able to evaluate the design of an experiment or investigation by commenting on the ways in which the experimenter did or did not achieve reliability and validity.

### d) Making Measurements

#### *Measurement*

Candidates should be able to identify situations in which natural inherent variation in a measurement has been caused by uncontrolled variables, human error or the characteristics of the instrument used. Candidates should be able to make scientifically valid choices of instruments and ensure that their measuring instrument is calibrated and accurate. They should ensure the reliability and validity of their measurements and be able to make appropriate choices on the number and range of the measurements they are to take in an investigation.

### e) Presenting data

#### *Tables*

Candidates should be able to draw up a results table such that data can be presented in a meaningful and easy to understand way.

#### *Data presentation*

Candidates should be able to decide upon the most appropriate method of presenting and analysing data. Such methods include tables, bar charts, line graphs, scatter graphs, histograms and pie charts.

### f) Identifying Patterns and Relationships in Data

#### *Patterns and relationships in data*

Candidates should be able to recognise and describe patterns in data and drawn conclusions from them. Such patterns include linear and proportional relationships, curves and empirical relationships. They should be capable of drawing and interpreting lines of best fit. They should also be aware that anomalous data may need to be excluded before such a pattern is identified.

### 3.4.2 Guidance on Completing the Controlled Assessment.

#### *Reliability and validity of the data in the whole investigation*

Candidates should be able to explain why further evidence may be needed in order to draw a firm conclusion and how this extra evidence may be obtained.

#### g) Societal Aspects of Scientific Evidence

##### *Relevant societal aspects*

Candidates should be able to explain how the consequences of scientific experiments and developments may impinge upon society. They should understand that the credibility of scientific research may suffer as the result of any bias by the experimenters. They should also be aware of the consequences of scientific and technological developments and that acceptability is influenced by a range of other factors such as ethical, social, economic, and environmental issues.

#### h) Limitations of Scientific Evidence

Candidates should realise that it is sometimes difficult to collect sufficient evidence to answer a question. There are also questions that cannot be answered by looking at scientific evidence alone, for example, questions where moral judgements are involved.

(See also Section 6)

Controlled Assessment Advisors will be able to provide guidance to centres.

The Controlled Assessment comprises:

- An Investigative Skills Assignment (ISA) 34 marks
- A Practical Skills Assessment (PSA) 6 marks

#### Investigative Skills Assignment (ISA)

Each year AQA will provide centres with suitable practical activities related to topic areas in the specification. Guidance will be given on the vocational application to be used when introducing the practical activity to the candidate. Candidates carry out the practical activity and collect data on one of the topics listed by AQA as being available for assessment for a particular year.

Candidates should be actively involved in the design of the investigation and should make decisions for themselves as to the variables and range tested in their experiments. Teachers should not be explicit on these areas but may produce a worksheet for the candidates to use in the practical activity.

Each candidate must work independently to produce a blank table suitable for the results. Teachers may produce a blank table of results for the candidates to use when gathering their data if the candidate's own table is unsuitable.

The candidates may use their own results or group or class results as directed by the teacher but must work independently to produce their own graph/bar chart. The tables and graphs/bar charts should be collected in by the teacher and kept securely. Candidates should not be allowed to take any work home or out of the class.

The ISA is taken in a normal timetabled lesson, in the classroom or laboratory under controlled conditions. The candidate's investigative skills are assessed by completing an ISA supplied by AQA. In this session the candidate must be provided with the data that he or she has collected during the practical activity.

Any poster which contains answers to ISA questions eg definitions of How Science Works terminology should be removed.

The candidates should be seated as far apart as possible and should not communicate with each other in any way during the ISA test.

Mobile phones should be switched off and out of reach.

Access arrangements agreed for candidates are the same as for the written examinations and can be used for the ISAs.

The maximum time allowed for each ISA is 45 minutes.

The ISA is in two sections.

### Section 1

This will consist of a number of questions relating directly to the candidate's own Investigation and data. The table of results and a graph or chart of the processed results should be used in the ISA. This data must be stapled to the ISA paper.

The number of marks allocated to this section is between 14 and 20.

### Section 2

In this section, candidates are supplied with another set of data, relating to a vocational application of the same topic from the specification in which the candidate has conducted his or her practical work. A number of questions relating to the analysis and evaluation of this data then follow. In some questions candidates will also be required to relate their own method/results to this new context.

The number of marks allocated to this section is between 14 and 20.

Candidates may attempt one or both of the ISAs supplied by AQA, and submit the best mark to AQA. ISAs are re-issued each year and valid for only one year.

At the end of the 45 minute time allocation (or before, if all candidates have finished) the teacher should collect the ISA tests Each candidates' results table and graph/bar chart should be attached to their ISA test.

The completed ISAs must be marked by the teacher in accordance with the Marking guidelines supplied by AQA and then kept under secure conditions. The scripts should be retained until the last date for enquiry upon results.

Candidates may **not** attempt an ISA more than once.

Candidates are expected to carry out practical work within certain specified areas of the content of the specification. AQA will provide assignments and marking guidance on topics from the specification such as the following:

- 3.3.3 • *carry out qualitative food tests for starch, protein and reducing sugar*
  - *test prepared liquid 'foods' containing starch, protein and glucose, using different concentrations of these three foods. Using the iodine test, biuret test and Benedict's test*
  - *carry out quantitative tests for vitamin C content*
  - *carry out quantitative tests for energy content.*
- 3.3.4 • *investigate enzyme activity and the factors which affect enzyme activity eg temperature and pH*
- 3.3.5 • *investigate the effect of exercise on the pulse rate*
- 3.3.6 • *compare breathing rate before and after exercise*
  - *measure lung capacity*

- 3.3.7
- identify artificial 'blood' (protein and glucose), 'filtrate' (glucose only) and 'urine' (neither) with *clinistix* (or *Benedict's test*) and *Biuret*
  - use dialysis tubing to demonstrate that large molecules such as protein will not diffuse through but glucose will
- 3.3.8
- determine the number and position of touch and/or temperature receptors in the skin
  - investigate the effect of light on the eye
  - determine the range of frequency audible to the human ear
  - investigate the taste receptors on the tongue.
- 3.3.12
- investigate the effect of antibiotics on bacteria.

These topics, which are suitable for extended investigative work, are also identified within the subject content. They may form the basis for future ISAs. However, the list and the signposted topics are not intended to be exhaustive — and are provided for illustrative purposes only. Nonetheless, practical work in these areas will provide a good preparation for formal assessment in the Controlled Assessment including the ISAs.

A suitable strategy would be to teach the knowledge and the skills that provide for the gathering of data. Candidates should gain an understanding of the application of these concepts by applying them to supported practical studies and practice tests. Candidates should then be assessed when they apply these abilities in the formal ISA situation.

#### Practical Skills Assessment (PSA)

Candidates are assessed throughout the course on the implementation of practical work, using a scale from 0 to 6.

Since the skills in this section involve implementation, they must be assessed while the candidate is carrying out practical work. In order to provide appropriate opportunities to demonstrate the necessary skills, instructions provided must not be too prescriptive but should allow candidates to make decisions for themselves, particularly concerning the conduct of practical work, their organisation and the manner in which equipment is used.

Centres should bear in mind that a high performance should reflect the ability to work methodically and safely, demonstrating competence in the required manipulative skills and efficiency of managing time.

#### The assessment criteria for the PSA

Candidates should:

- Use apparatus and materials in an appropriate and careful way
- Carry out work in a methodical and organised way
- Work with due regard for safety and with appropriate consideration for the well-being of living organisms and the environment.

Descriptors are provided for 2, 4 and 6 marks. These descriptors should be used to judge the mark which best describes a candidate's performance.

Implementation of practical work	
Performance level	Skills
2	<p><i>Practical work is conducted:</i></p> <ul style="list-style-type: none"> <li>• safely, but with help to work in an organised manner.</li> </ul> <p><i>The candidate:</i></p> <ul style="list-style-type: none"> <li>• uses the apparatus with assistance.</li> </ul>
4	<p><i>Practical work is conducted:</i></p> <ul style="list-style-type: none"> <li>• safely and in a reasonably organised manner.</li> </ul> <p><i>The candidate:</i></p> <ul style="list-style-type: none"> <li>• uses the apparatus skilfully and without the need for assistance.</li> </ul>
6	<p><i>Practical work is conducted:</i></p> <ul style="list-style-type: none"> <li>• safely and in a well-organised manner.</li> </ul> <p><i>The candidate:</i></p> <ul style="list-style-type: none"> <li>• uses the apparatus skilfully in a demanding context</li> </ul>

3

NB In order to gain 5 or 6 marks, a candidate must:

- demonstrate competence with a range of equipment, some of which is quite complex
- take all measurements to an appropriate level of accuracy
- present, while the work is in progress, the data collected in a suitable table.

Descriptors are designed to be hierarchical so that a description at a particular mark subsumes descriptions at lower marks. Use should be made of intermediate marks (1, 3 and 5) when performance exceeds one description but only partly satisfies the next.

At each of the marks (2, 4 and 6) there are two bullet points. If **neither** of the bullet points for 2 marks is matched, the candidate should be awarded zero marks. If **either** of the bullet points for 2 marks is matched, the candidate will score 1 mark. If **both** bullet points for 2 marks are matched, the candidate will score 2 marks.

Once 2 marks have been awarded, consideration may be given to the two bullet points for 4 marks: matching either one will allow 3 marks to be awarded; both will result in 4 marks. Similarly, once 4 marks have been gained, consideration may be given to the two bullet points for 6 marks in order to determine whether the candidate should be awarded 5 or 6 marks.

# 4 Scheme of Assessment

## 4.1 Aims and learning outcomes

GCSE courses based on this specification should encourage candidates to:

- develop their interest in, and enthusiasm for, science;
- develop a critical approach to scientific evidence and methods;
- acquire and apply skills, knowledge and understanding of how science works and its essential role in society;
- acquire scientific skills, knowledge and understanding necessary for progression to further learning.

## 4.2 Assessment Objectives (AOs)

The assessment units will assess the following assessment objectives in the context of the content and skills set out in Section 3 (Subject Content).

### Assessment objective 1 (AO1): Knowledge and understanding of science and how science works

Candidates should be able to:

- a) demonstrate knowledge and understanding of the scientific facts, concepts, techniques and terminology in the specification
- b) show understanding of how scientific evidence is collected and its relationship with scientific explanations and theories
- c) show understanding of how scientific knowledge and ideas change over time and how these changes are validated.

### Assessment objective 2 (AO2): Application of skills, knowledge and understanding

Candidates should be able to:

- a) apply concepts, develop arguments or draw conclusions related to familiar and unfamiliar situations
- b) plan a scientific task, such as a practical procedure, testing an idea, answering a question, or solving a problem
- c) show understanding of how decisions about science and technology are made to different situations, including contemporary situations and those raising ethical issues
- d) evaluate the impact of scientific developments or processes on individuals, communities or the environment.

### Assessment objective 3 (AO3): Practical, enquiry and data-handling skills

Candidates should be able to:

- a) carry out practical tasks safely and skilfully
- b) evaluate the methods they use when collecting first-hand and secondary data
- c) analyse and interpret qualitative and quantitative data from different sources
- d) consider the validity and reliability of data in presenting and justifying conclusions.

### Quality of Written Communication (QWC)

GCSE specifications which require candidates to produce written material in English must:

- ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

In this specification QWC will be assessed in both Unit 1 (the written paper) and Unit 2 (the Investigative Skills Assignment [ISA])

## Weighting of Assessment Objectives for GCSE Human Health and Physiology

The table below shows the approximate weighting of each of the Assessment Objectives in the GCSE units.

Assessment Objectives	Unit Weightings (%)		Overall Weighting of AOs (%)
	Unit 1 Written paper	Unit 2 Controlled Assessment	
AO1	40		40
AO2	30	5	35
AO3	5	20	25
Overall weighting of units (%)	75	25	100

### 4.3 National criteria

This specification complies with the following.

- The Subject Criteria for Human Health and Physiology including the rules for Controlled Assessment
- Code of Practice
- The GCSE Qualification Criteria
- The Arrangements for the Statutory Regulation of External Qualifications in England, Wales and Northern Ireland: Common Criteria
- The requirements for qualifications to provide access to Levels 1 and 2 of the National Qualification Framework

4

### 4.4 Prior learning

This key stage 4 GCSE specification builds on the knowledge, understanding and skills set out in the National Curriculum programme of study for KS3 Science. While there is no specific prior level of attainment required for candidates to undertake a course of study based on this specification, a level of

scientific, literacy and numeracy skills commensurate with having followed a programme of study at key stage 3 is expected.

However, any requirements set for entry to a course following this specification are at the discretion of centres.

### 4.5 Access to assessment: diversity and inclusion

GCSEs often require assessment of a broader range of competences. This is because they are general qualifications and, as such, prepare candidates for a wide range of occupations and higher level courses.

The revised GCSE qualification and subject criteria were reviewed to identify whether any of the competences required by the subject presented a potential barrier to any candidates regardless of their ethnic origin, religion, gender, age, disability or sexual orientation. If this was the case, the situation was

reviewed again to ensure such competences were included only where essential to the subject. The findings of this process were discussed with groups who represented the interests of a diverse range of candidates.

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. Further details are given in Section 5.4.

# 5 Administration

## 5.1 Availability of assessment units and certification

Examinations and certification for this specification are available as follows:

	Availability of Units		Availability of Certification
	Unit 1	Unit 2	
June 2010	✗	✗	✗
June 2011 onwards	✓	✓	✓

## 5.2 Entries

Please refer to the current version of *Entry Procedures and Codes* for up to date entry procedures. You should use the following entry codes for the units and for certification.

Unit 1 – (44151F or 44151H)

Unit 2 – (44152)

GCSE – certification – 4417

QCA's 40% terminal rule means that 40% of the assessment must be taken in the examination series in which the qualification is awarded. This rule is not dependent on the size of the qualification. Therefore, all GCSE candidates, whether taking short course, single and double awards, must have 40% of their assessment taken at the end.

## 5.3 Private candidates

This specification is available to private candidates.

Private candidates should write to AQA for a copy of *Supplementary Guidance for Private Candidates*, or download from the website:

[http://www.aqa.org.uk/admin/p\\_private.php](http://www.aqa.org.uk/admin/p_private.php)

Arrangements must be agreed with AQA for the assessment and authentication of controlled assessments.

## 5.4 Access arrangements and special consideration

We have taken note of equality and discrimination legislation and the interests of minority groups in developing and administering this specification.

We follow the guidelines in the Joint Council for Qualifications (JCQ) document: *Access Arrangements, Reasonable Adjustments and Special Consideration: General and Vocational Qualifications*.

This is published on the JCQ website (<http://www.jcq.org.uk>) or you can follow the link from our website (<http://www.aqa.org.uk>).

### Access arrangements

We can make arrangements so that candidates with special needs can access the assessment. These arrangements must be made **before** the examination. For example, we can produce a Braille paper for a candidate with a visual impairment.

### Special consideration

We can give special consideration to candidates who have had a temporary illness, injury or indisposition at the time of the examination. Where we do this, it is given **after** the examination.

Applications for access arrangements and special consideration should be submitted to AQA by the Examinations Officer at the centre.

## 5.5 Language of examinations

We will provide units for this specification in English only.

## 5.6 Qualification titles

Qualifications based on this specification are:

- AQA GCSE in Human Health and Physiology

## 5.7 Awarding grades and reporting results

The GCSE and GCSE short course qualifications will be graded on an eight-grade scale: A\*, A, B, C, D, E, F and G. Candidates who fail to reach the minimum standard for grade G will be recorded as U (unclassified) and will not receive a qualification certificate.

We will publish the minimum raw mark for each grade, for each unit, when we issue candidates' results. We will report a candidate's unit results to centres in terms of uniform marks and qualification results in terms of uniform marks and grades.

For each unit, the uniform mark corresponds to a grade as follows.

### Written paper

(maximum uniform mark = 300)

Grade	Uniform Mark Range
A*	270–300
A	240–269
B	210–239
C	180–209
D	150–179
E	120–149
F	90–119
G	60–89
U	0–59

### Controlled assessment

(maximum uniform mark = 100)

Grade	Uniform Mark Range
A*	90–100
A	80–89
B	70–79
C	60–69
D	50–59
E	40–49
F	30–39
G	20–29
U	0–19

We calculate a candidate's total uniform mark by adding together the uniform marks for the units. We convert this total uniform mark to a grade as follows.

### GCSE Human Health & Physiology

(maximum uniform mark = 400)

Grade	Uniform Mark Range
A*	360–400
A	320–359
B	280–319
C	240–279
D	200–239
E	160–199
F	120–159
G	80–119
U	0–79

## 5.8 Re-sits and shelf-life of unit results

Unit results remain available to count towards certification within the shelf life of the specification whether or not they have already been used.

Candidates may re-sit a unit once only. The better result for each unit will count towards the final qualification provided that the 40% rule is satisfied. Candidates may re-sit the qualification an unlimited number of times.

Candidates will be graded on the basis of the work submitted for assessment.

Candidates must take units comprising at least 40% of the total assessment in the series in which they enter for certification.

# 6 Controlled Assessment Administration

The Head of Centre is responsible to AQA for ensuring that controlled assessment work is conducted in accordance with AQA's instructions and JCQ instructions.

The proposed tasks should allow for candidates to work individually to obtain data suitable for analysis or, if working in groups, allow the contribution of individual candidates to be identified and assessed.

Candidates may include supportive second-hand data and whole-class data. It is important, however, that the candidate identifies the data that has been collected under his or her direction. Whilst some practical situations can only be effectively conducted in groups, each candidate must have completed a set of data that has been derived under their own direction. Candidates should keep an independent record of the raw data collected in preparation for the ISA.

Teachers Notes will be despatched to centres each November, approximately 17 months before the date of submission.

The ISA CD will be despatched to Examinations Officers each April approximately 12 months before the date of submission

## Using the assignments

### *Prior practical work*

Whilst carrying out the practical work, candidates are expected to make and record detailed observations in a suitable way. Measurements should be made with an appropriate level of precision and accuracy and the data recorded logically in an appropriately constructed table. Candidates should use ICT where appropriate.

Candidates should be supplied with an outline method and asked to make their own results table. The outline method and instructions should not be too prescriptive. Centres are provided with setting guidance which will detail any particular requirements. As far as possible AQA does not put any restriction on the method to be used in the investigation.

Candidates must present, while the work is in progress, the data collected in a suitable table. They should not be assessed using evidence from formal reports written after the completion of the practical work. Candidates are also required to process the data into a graph or chart. Teachers should collect the table of data (and graphs or charts if appropriate) from each candidate when the task is complete and store it in readiness for the ISA. Candidates should not be allowed to take the work out of the classroom or complete it at home.

### *ISA Test*

The ISA should be taken as soon as possible after completion of the practical work, in a suitable timetabled lesson. Candidates should work on their

own and in silence. Each candidate is provided with an ISA to which the teacher has stapled the candidate's own data record.

Section 1 of the ISA contains questions concerning the candidate's own data. Section 2 provides the candidate with additional data relating to a vocational application of the same topic from the specification which the candidate is required to analyse, evaluate and comment on. Candidates are also required to make appropriate comparisons between their own and the presented data. Answers to both sections are written on the question paper. At the end of 45 minutes, the papers are collected from the candidates. Teachers are required to mark these papers, using a set of marking guidelines provided by AQA.

### *Candidates absent for the preliminary practical work*

If a candidate is absent for the practical work, the teacher may supply the candidate with some data to use in Section 1 and the teacher can mark it, but the mark for Section 1 cannot be submitted. However, a mark for Section 2 on its own may be submitted.

### *Security of assignments*

When teachers have marked the ISAs, they may tell candidates their marks but they **may not** return the papers. Completed ISAs should be treated like examination papers and kept under secure conditions until submission to AQA.

Practice ISAs from specimen or training material can be used to teach candidates the skills required, feeding back their marks as formative assessment. However, ISAs which are currently valid cannot be given back to the candidates. Candidates may sit one or both of the valid ISAs and the best mark can be submitted for certification. **Each ISA may be attempted once only.**

## Practical Skills Assessment (PSA)

Candidates are assessed throughout the course on the implementation of practical work, using a scale from 0 to 6.

The mark submitted for practical skills should be judged by the teacher over the duration of the course. Teachers may wish to use this section for formative assessment and keep an ongoing record of each candidate's performance, but the mark submitted should represent the candidate's practical abilities over the whole course.

This assessment may be made at any time during the course of a candidate's normal practice work.

### *Work to be submitted*

The work to be submitted for each candidate consists of their best Investigative Skills Assignment (ISA) and a Candidate Record Form showing the marks for this ISA and the Practical Skills Assessment (PSA).

## 6.1 Authentication of controlled assessment work

In order to meet the requirements of Code of Practice AQA requires:

- **candidates** to sign the Candidate Record Form to confirm that the work submitted is their own
- **teachers/assessors** to confirm on the Candidate Record Form that the work assessed is solely that of the candidate concerned and was conducted under the conditions laid down by the specification
- **centres** to record marks of zero if candidates cannot confirm the authenticity of work submitted for assessment.

The completed Candidate Record Form for each candidate must be should be attached to his/her work. All teachers who have assessed the work of any candidate entered for the controlled assessment must sign the declaration of authentication.

If teachers/assessors have reservations about signing the authentication statements, the following points of guidance should be followed.

- If it is believed that a candidate has received additional assistance and this is acceptable within the guidelines for the relevant specification, the teacher/assessor should award a mark which represents the candidate's unaided achievement. The authentication statement should be signed and information given on the relevant form.
- If the teacher/assessor is unable to sign the authentication statement for a particular candidate, then the candidate's work cannot be accepted for assessment.

If, during the external moderation process, there is no evidence that the work has been properly authenticated, AQA will set the associated mark(s) to zero.

## 6.2 Malpractice

Teachers should inform candidates of the AQA Regulations concerning malpractice.

Candidates must **not**:

- submit work which is not their own
- lend work to other candidates
- allow other candidates access to, or the use of, their own independently sourced source material (this does not mean that candidates may not lend their books to another candidate, but candidates should be prevented from plagiarising other candidates' research)
- include work copied directly from books, the internet or other sources without acknowledgement and attribution
- submit work typed or word-processed by a third person without acknowledgement.

These actions constitute malpractice, for which a penalty (for example disqualification from the examination) will be applied.

If malpractice is suspected, the Examinations Officer should be consulted about the procedure to be followed.

Where suspected malpractice in controlled assessments is identified by a centre after the candidate has signed the declaration of authentication, the Head of Centre must submit full details of the case to AQA at the earliest opportunity. The form JCQ/M1 should be used. Copies of the form can be found on the JCQ website (<http://www.jcq.org.uk/>).

Malpractice in controlled assessments discovered prior to the candidate signing the declaration of authentication need not be reported to AQA, but should be dealt with in accordance with the centre's internal procedures. AQA would expect centres to treat such cases very seriously. Details of any work which is not the candidate's own must be recorded on the Candidate Record Form or other appropriate place.

## 6.3 Teacher standardisation

AQA will hold annual standardising meetings for teachers, usually in the autumn term, for controlled assessment. At these meetings we will provide support in contextualising the tasks and using the marking criteria.

If your centre is new to this specification, you must send a representative to one of the meetings. If you have told us you are a new centre, either by submitting an estimate of entry or by contacting the subject team, we will contact you to invite you to a meeting.

AQA will also contact centres if

- the moderation of controlled assessment work from the previous year has identified a serious misinterpretation of the controlled assessment requirements, *or*
- a significant adjustment has been made to a centre's marks.

In these cases, centres will be expected to send a representative to one of the meetings. For all other centres, attendance is optional. If a centre is unable to attend and would like a copy of the written materials used at the meeting, they should contact the subject administration team at

**[aqa.science-gcse@aqa.org.uk](mailto:aqa.science-gcse@aqa.org.uk)**

## 6.4 Internal standardisation of marking

Centres must standardise marking to make sure that all candidates at the centre have been marked to the same standard. One person must be responsible for internal standardisation. This person should sign the Centre Declaration Sheet to confirm that internal standardisation has taken place.

Internal standardisation may involve:

- all teachers marking some trial pieces of work and identifying differences in marking standards
- discussing any differences in marking at a training meeting for all teachers involved in the assessment
- referring to reference and archive material such as previous work or examples from AQA's teacher standardising meetings.

## 6.5 Annotation of controlled assessment work

The Code of Practice states that the awarding body must require internal assessors to show clearly how the marks have been awarded in relation to the marking criteria defined in the specification and that the awarding body must provide guidance on how this is to be done.

The annotation will help the moderator to see as precisely as possible where the teacher considers that the candidates have met the criteria in the specification.

Work could be annotated by either of the following methods:

- key pieces of evidence flagged throughout the work by annotation either in the margin or in the text
- summative comments on the work, referencing precise sections in the work.

## 6.6 Submitting marks and sample work for moderation

The total mark for each candidate must be submitted to AQA and the moderator on the mark forms provided, by Electronic Data Interchange (EDI) or through the e-Portfolio system (only available for certain units/components) by the specified date (see **<http://www.aqa.org.uk/deadlines.php>**).

Centres will normally be notified which candidates' work is required in the sample to be submitted to the moderator (please refer to section 7.1 for further guidance on submitting samples).

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## 6.7 Factors affecting individual candidates

Teachers should be able to accommodate the occasional absence of candidates by ensuring that the opportunity is given for them to make up missed controlled assessments. An alternative supervised, time session may be organised for candidates who are absent at the time which the centre originally arranged.

If work is lost, AQA should be notified immediately of the date of the loss, how it occurred, and who was responsible for the loss. Centres should use the JCQ form JCQ/LCW to inform AQA Centre and Candidate Support Services of the circumstances.

Where special help which goes beyond normal learning support is given, AQA must be informed

through comments on the Candidate Record Form so that such help can be taken into account when moderation takes place.

Candidates who move from one centre to another during the course sometimes present a problem for a scheme of controlled assessment work. Possible courses of action depend on the stage at which the move takes place. If the move occurs early in the course the new centre should take responsibility for controlled assessment work. If it occurs late in the course it may be possible to arrange for the moderator to assess the work through the 'Educated Elsewhere' procedure. Centres should contact AQA at the earliest possible stage for advice about appropriate arrangements in individual cases.

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## 6.8 Retaining evidence

The centre must retain the work of all candidates, with Candidate Record Forms attached, under secure conditions, from the time it is assessed, to allow for the possibility of an enquiry upon results. The work

may be returned to candidates after the deadline for enquiries upon results. If an enquiry about a result has been made, the work must remain under secure conditions in case it is required by AQA.

# 7 Moderation

## 7.1 Moderation procedures

Moderation of the controlled assessment work is by inspection of a sample of candidates' work, sent by post to a moderator appointed by AQA. The centre marks must be submitted to AQA and to the moderator by the specified deadline (see <http://www.aqa.org.uk/deadlines.php>).

Centres entering fewer candidates than the minimum sample size should submit the work of all of their candidates. Centres entering larger numbers of candidates will be notified of the candidates whose work will be required in the sample to be submitted for moderation.

Following the re-marking of the sample work, the moderator's marks are compared with the centre

marks to determine whether any adjustment is needed in order to bring the centre's assessments into line with standards generally. In some cases it may be necessary for the moderator to call for the work of additional candidates in the centre. In order to meet this possible request, centres must retain under secure conditions and have available the controlled assessment work and Candidate Record Forms of every candidate entered for the examination and be prepared to submit it on demand. Mark adjustments will normally preserve the centre's order of merit, but where major discrepancies are found, AQA reserves the right to alter the order of merit.

## 7.2 Consortium arrangements

If there are a consortium of centres with joint teaching arrangements (ie where candidates from different centres have been taught together but where they are entered through the centre at which they are on roll), the centres must inform AQA by completing the JCQ/CCA form.

The centres concerned must nominate a consortium co-ordinator who undertakes to liaise with AQA on

behalf of all centres in the consortium. If there are different co-ordinators for different specifications, a copy of the JCQ/CCA form must be submitted for each specification.

AQA will allocate the same moderator to each centre in the consortium and the candidates will be treated as a single group for the purpose of moderation.

## 7.3 Post-moderation procedures

On publication of the results, AQA will provide centres with details of the final marks for the controlled assessment work.

The candidates' work will be returned to the centre after the examination. The centre will receive a report

giving feedback on the accuracy of the assessments made, and the reasons for any adjustments to the marks.

AQA may retain some candidates' work for archive or standardising purposes.

# Appendices

## A Grade Descriptions

Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions should be interpreted in relation to the content outlined in the specification; they are not designed to define that content.

The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives (see Section 4) overall. Shortcomings in some aspects of the candidates' performance may be balanced by better performances in others.

### Grade A

Candidates demonstrate a detailed knowledge and understanding of science content and how science works, encompassing the principal concepts, techniques, and facts across all areas of the specification. They use technical vocabulary and techniques with fluency, clearly demonstrating communication and numerical skills appropriate to a range of situations.

They demonstrate a good understanding of the relationships between data, evidence and scientific explanations and theories. They are aware of areas of uncertainty in scientific knowledge and explain how scientific theories can be changed by new evidence.

Candidates use and apply their knowledge and understanding in a range of tasks and situations. They use this knowledge, together with information from other sources, effectively in planning a scientific task, such as a practical procedure, testing an idea, answering a question, or solving a problem.

Candidates describe how, and why, decisions about uses of science are made in contexts familiar to them, and apply this knowledge to unfamiliar situations. They demonstrate good understanding of the benefits and risks of scientific advances, and identify ethical issues related to these.

They choose appropriate methods for collecting first-hand and secondary data, interpret and question data skilfully, and evaluate the methods they use. They carry out a range of practical tasks safely and skilfully, selecting and using equipment appropriately to make relevant and precise observations.

Candidates select a method of presenting data appropriate to the task. They draw and justify conclusions consistent with the evidence they have collected and suggest improvements to the methods used that would enable them to collect more valid and reliable evidence.

### Grade C

Candidates demonstrate a good overall knowledge and understanding of science content and how science works, and of the concepts, techniques and facts across most of the specification. They demonstrate knowledge of technical vocabulary and techniques, and use these appropriately. They demonstrate communication and numerical skills appropriate to most situations.

They demonstrate an awareness of how scientific evidence is collected and are aware that scientific knowledge and theories can be changed by new evidence.

Candidates use and apply scientific knowledge and understanding in some general situations. They use this knowledge, together with information from other sources, to help plan a scientific task, such as a practical procedure, testing an idea, answering a question, or solving a problem.

They describe how, and why, decisions about uses of science are made in some familiar contexts. They demonstrate good understanding of the benefits and risks of scientific advances, and identify ethical issues related to these.

They carry out practical tasks safely and competently, using equipment appropriately and making relevant observations, appropriate to the task. They use appropriate methods for collecting first-hand and secondary data, interpret the data appropriately, and undertake some evaluation of their methods.

Candidates present data in ways appropriate to the context. They draw conclusions consistent with the evidence they have collected and evaluate how strongly their evidence supports these conclusions.

## Grade F

Candidates demonstrate a limited knowledge and understanding of science content and how science works. They use a limited range of the concepts, techniques and facts from the specification, and demonstrate basic communication and numerical skills, with some limited use of technical terms and techniques.

They show some awareness of how scientific information is collected and that science can explain many phenomena.

They use and apply their knowledge and understanding of simple principles and concepts in some specific contexts. With help they plan a scientific task, such as a practical procedure, testing an idea, answering a question, or solving a problem,

using a limited range of information in an uncritical manner. They are aware that decisions have to be made about uses of science and technology and, in simple situations familiar to them, identify some of those responsible for the decisions. They describe some benefits and drawbacks of scientific developments with which they are familiar and issues related to these.

They follow simple instructions for carrying out a practical task and work safely as they do so. Candidates identify simple patterns in data they gather from first-hand and secondary sources. They present evidence as simple tables, charts and graphs, and draw simple conclusions consistent with the evidence they have collected.

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## B Spiritual, Moral, Ethical, Social, Legislative, Sustainable Development, Economic and Cultural Issues, and Health and Safety Considerations

AQA has taken great care to ensure that any wider issues, including those particularly relevant to the education of students at Key Stage 4 have been identified and taken into account of in the preparation of this specification. They will only form part of the assessment requirements where they relate directly to the specific content of the specification and have been identified in Section 3: Content.

### European Dimension

AQA has taken account of the 1988 Resolution of the Council of the European Community in preparing this specification and associated specimen units.

### Environmental Education

AQA has taken account of the 1988 Resolution of the Council of the European Community and the Report “Environmental Responsibility: An Agenda for Further and Higher Education” 1993 in preparing this specification and associated specimen units.

### Avoidance of Bias

AQA has taken great care in the preparation of this specification and specimen units to avoid bias of any kind.

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## C Overlaps with other Qualifications

GCSE Science A & B  
GCSE Additional Science  
GCSE Biology  
GCSE Environmental Science

Some topics within the Human Health and Physiology specification can be found in part in the GCSE Sciences.

However the approach, breadth and depth of coverage of these topics may vary considerably.

## D Key Skills – Teaching, Developing and Providing Opportunities for Generating Evidence

### Introduction

The Key Skills Qualification requires candidates to demonstrate levels of achievement in the Key Skills of Communication, Application of Number and Information and Communication Technology.

The Wider Key Skills of Improving own Learning and Performance, Working with Others and Problem Solving are also available. The acquisition and demonstration of ability in these 'wider' Key Skills is deemed highly desirable for all candidates.

Copies of the Key Skills Standards may be downloaded from QCA's website:

**[http://www.qca.org.uk/qca\\_6444.aspx](http://www.qca.org.uk/qca_6444.aspx)**

The units for each Key Skill comprise three sections:

- What you need to know
- What you must do
- Guidance.

Candidates following a course of study based on this specification for Human Health and Physiology can be offered opportunities to develop and generate evidence of attainment in aspects of the Key Skills of:

- Communication
- Application of Number
- Information and Communication Technology
- Working with Others
- Improving own Learning and Performance
- Problem Solving.

Areas of study and learning that can be used to encourage the acquisition and use of Key Skills, and to provide opportunities to generate evidence for Part B of units, are provided in the Teachers' Resource Bank for this specification.

The above information is given in the context of the knowledge that Key Skills at levels 1 and 2 will be available until 2010 with last certification in 2012.

## E Glossary of Terms

<b>Accuracy</b>	An accurate measurement is one which is close to the true value.
<b>Calibration</b>	This involves fixing known points and then marking a scale on a measuring instrument, between these fixed points.
<b>Data</b>	This refers to a collection of measurements. <i>For example: Data can be collected for the volume of a gas or the type of rubber.</i>
<b>Errors,</b>	
<b>- random</b>	These cause readings to be different from the true value. Random errors may be detected and compensated for by taking a large number of readings. <i>For example: Random errors may be caused by human error, a faulty technique in taking the measurements, or by faulty equipment.</i>
<b>- systematic</b>	These cause readings to be spread about some value other than the true value; in other words, all the readings are shifted one way or the other way from the true value. <i>For example: A systematic error occurs when using a wrongly calibrated instrument.</i>
<b>- zero</b>	These are a type of systematic error. They are caused by measuring instruments that have a false zero. <i>For example: A zero error occurs when the needle on an ammeter fails to return to zero when no current flows, or when a top-pan balance shows a reading when there is nothing placed on the pan.</i>
<b>Evidence</b>	This comprises data which have been subjected to some form of validation. It is possible to give a measure of importance to data which has been validated when coming to an overall judgement.
<b>Fair test</b>	A fair test is one in which only the independent variable has been allowed to affect the dependent variable. <i>For example: A fair test can usually be achieved by keeping all other variables constant.</i>
<b>Precision</b>	The precision of a measurement is determined by the limits of the scale on the instrument being used. Precision is related to the smallest scale division on the measuring instrument that you are using. It may be the case that a set of precise measurements has very little spread about the mean value. <i>For example, using a ruler with a millimetre scale on it to measure the thickness of a book will give greater precision than using a ruler that is only marked in centimetres.</i>
<b>Reliability</b>	The results of an investigation may be considered reliable if the results can be repeated. If someone else can carry out your investigation and get the same results, then your results are more likely to be reliable. One way of checking reliability is to compare your results with those of others. The reliability of data can be improved by carrying out repeat measurements and calculating a mean.
<b>True Value</b>	This is the value which would be found if the quantity could be measured without any errors at all.
<b>Validity</b>	Data is only valid for use in coming to a conclusion if the measurements taken are affected by a single independent variable only. Data is not valid if for example a fair test is not carried out or there is observer bias. <i>For example: In an investigation to find the effect on the rate of a reaction when the concentration of the acid is changed, it is important that concentration is the only independent variable. If, during the investigation, the temperature also increased as you increased the concentration, this would also have an effect on your results and the data would no longer be valid.</i>

**Variables,****- categoric**

A categoric variable has values which are described by labels.

When you present the result of an investigation like this, you should not plot the results on a line graph; you must use a bar chart or pie chart.

*For example: If you investigate the effect of acid on different metals, eg copper, zinc and iron, the type of metal you are using is a categoric variable.*

**- continuous**

A continuous variable is one which can have any numerical value.

When you present the result of an investigation like this you should use a line graph.

*For example: If you investigate the effect on the resistance of changing the length of a wire, the length of a wire you are using is a continuous variable since it could have any length you choose.*

**- control**

A control variable is one which may, in addition to the independent variable, affect the outcome of the investigation. This means that you should keep these variables constant; otherwise it may not be a fair test. If it is impossible to keep it constant, you should at least monitor it; in this way you will be able to see if it changes and you may be able to decide whether it has affected the outcome of the experiment.

**- dependent and independent variables**

Often in science we are looking at 'cause' and 'effect'. You can think of the independent variable as being the 'cause' and the dependent variable as being the 'effect'. In other words, the dependent variable is the thing that changes as a result of you changing something else.

**- dependent**

The dependent variable is the variable the value of which you measure for each and every change in the independent variable.

**- independent**

The independent variable is the variable for which values are changed or selected by the investigator. In other words, this is the thing that you *deliberately change* to see what effect it has.

**- discrete**

You may sometimes come across this term. It is a type of categoric variable whose values are restricted to whole numbers.

*For example, the number of carbon atoms in a chain.*

**- ordered**

You may sometimes come across this term. It is a type of categoric variable that can be ranked.

*For example, the size of marble chips could be described as large, medium or small.*



## GCSE Human Health and Physiology Teaching from 2009 onwards

**Qualification Accreditation Number: 500/4560/X**

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