

# GCSE

## Edexcel GCSE Science (2101)

### Unit tests (5005 - 5010)

March 2007

Examiner Reports

## Report on Units 5005 - 5010, March 2007

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### **Biology**

#### **B1a - Environment / Genes**

##### **Foundation tier**

Generally this paper was accessed well and candidates showed a good understanding of the subject matter throughout the environment part of the paper although the genetics section was less well answered.

Fossils were well understood although only 66% of candidates were aware that the lowest rock layer was likely to contain the oldest fossils. Simple food chains questions were completed well although interpretation of given data in a food web in terms of the numbers of predators was less well understood with only 56% of candidates able to identify the correct response. The classification of organisms in terms of the Linnaeus classification was poorly answered with only 21% of students able to successfully identify the correct genus and species.

In terms of questions related to genes candidates had difficulty in accessing these in most areas even those of recall. Only 47% of candidates could recognise that a gene is a unit of inheritance found on a chromosome and only 54% are aware that DNA is found in the nucleus of a cell and that the cell must have a nucleus to contain DNA. 42% of candidates recognised that an allele is an alternative form of a gene. These statements are vital if candidates are to improve in future module tests. Candidates also performed poorly in questions related to cloning with only 39% aware that cloning is a form of asexual reproduction, in this case 44% of the candidates believed wrongly that cloning is a form of selective breeding. Genetic engineering was better understood with the majority of students able to identify a genetic fingerprint and also the fact that DNA is cut using enzymes.

##### **Higher tier**

Higher tier candidates scored significantly higher on the crossover questions than the foundation candidates indicating that centres are correctly identifying the foundation and higher tier candidates.

Misconceptions in the crossover questions were on binomial classification with only 36% of candidates able to recognise the correct response of genus *Daphnia* and species *pulex*. This is an area which needs to be clarified to candidates in future. Candidates were not clear where the DNA was found in the blood or that the cell needed to have a nucleus to contain the DNA. 49% of candidates incorrectly identified the red blood cell as containing DNA with the white cell being the correct response.

In terms of the higher tier topic material, the principles of organic farming seem well understood although interpretation of the pie chart in terms of how much information it was providing was poorly answered with only 24% of candidates attaining the correct answer. In addition to this only 42% of candidates were able to successfully identify biological control as the use of natural predators being released to control pests. Candidates showed a good understanding of the process of natural selection and methods of classification of organisms although the knowledge that Darwin's book *The Origin of Species* contained information on both natural selection and evolution was not as well answered with only 49% of candidates giving the correct response. Although the use of enzymes in genetic modification was understood only 30% of candidates recognised that enzymes were used to both cut

DNA from the original organism and insert DNA into the new organism. Data interpretation was well understood by the higher tier candidates with them scoring very well on environmental effects and the result of environment on natural selection and the survival of the fittest.

### **B1b - Electrical and Chemical Signals / Use, Misuse and Abuse**

#### **Foundation tier**

Foundation candidates scored very poorly on this paper with very few candidates able to access even the simple recall questions related to the brain, IVF (*in vitro* fertilisation) the bodies reaction to disease and reaction times. Interpretation of data was handled better as were questions with a mathematical element.

The structure of the brain was not well understood with only 51% of the candidates able to identify the part of the brain associated with memory. Only 56% of candidates correctly identified the brain as part of the central nervous system and 42% of candidates knew that the brain is made of neurones with 53% of candidates incorrectly believing that the brain is made of muscle. 31% of candidates believed that hormones carried electrical signals with only 32% of candidates correctly identifying that hormones carried chemical messages. IVF was only correctly identified as *in vitro* fertilisation by 39% of candidates with only 20% having the knowledge that IVF involved a sperm fertilising an egg cell in a glass dish. Reaction times are historically poorly answered questions, candidates are aware that alcohol slows reactions but get confused by the time it takes for someone to respond, the correct response was alcohol increases the time it takes a person to react however 60% of candidates incorrectly believed that alcohol decreases the time it takes for a person to react. Only 41% of candidates correctly identified swelling as an example of an inflammatory response or that white cells are involved in this process. The specification statement that a pathogen is a disease causing organism was only correctly identified by 33% of candidates.

On the crossover questions the graph interpretation and bar chart interpretation question were answered well with 87% of candidates able to identify the trend that accommodation decreases with age, however, only 27% of candidates correctly identified accommodation as changes in lens thickness and 38% of candidates were aware that a reflex response is involuntary and fast. Questions related to smoking and drugs were answered with more insight.

#### **Higher tier**

The crossover questions were answered consistently better by the higher tier candidates than the foundation tier candidates indicating a correct choice of tiering by teachers in this paper. Candidates showed a good knowledge of scientific concepts and ideas in particular a good knowledge of TB and its problems although the areas of accommodation, disease transmission and the use of insulin in glucose regulation were less well understood.

Only 49% of candidates were aware that accommodation changes the lens thickness within the eye, with many candidates confusing accommodation with the iris reflex. Disease transmission by a mosquito was only correctly identified as vector borne by 52% of candidates and 63% of candidates were aware of the role of the non-specific immune system. The fact that diabetics are unable to make insulin was well understood with 92% of candidates identifying the correct response however the role of insulin to convert glucose to glycogen was less well answered with only 45% of candidates giving the correct response. 43% of candidates incorrectly believed that human cells could be genetically modified to create insulin rather than the correct

response of bacteria. 65% of candidates were able to correctly identify that insulin made from genetically modified bacteria are better because there are fewer side effects.

Data interpretation questions were in general well answered with candidates able to extrapolate the correct information. Questions related to drugs and smoking were also well answered showing candidates have gained a good insight into these areas of the specification.

## **Chemistry**

### **C1a - Patterns in Properties / Making Changes**

#### **Foundation tier**

The first 16 questions were generally well answered and all areas of the specification were accessible.

Candidates understand different types of chemical change but a surprisingly large number were unable to correctly identify the substance in baking powder. Only 58% of candidates realised that litmus paper was not necessary to carry out a flame test.

The extraction of metals from compounds showed variable knowledge. Only 26% of candidates correctly described the formation of zinc from zinc oxide as reduction.

Tests for gases, and colours of precipitates when sodium hydroxide is added to solutions of metal cations, appeared to have been guessed by many candidates.

Questions 17 to 24 showed that knowledge and understanding of the periodic table and atomic structure was not good.

#### **Higher tier**

The first 8 questions showed a good knowledge and understanding of the periodic table and atomic structure. A good understanding of balanced chemical equations was evident.

The properties of ammonia proved to be challenging for a significant number of candidates. Only 44% of candidates correctly identified that ammonia turns red litmus blue.

A significant number of candidates assumed that bubbles were formed when magnesium hydroxide reacts with acid. Flame test colours were not well known and only 30% of candidates identified and gave the correct formula for iron(III) hydroxide. Candidates struggled with the questions on the halogens especially the reactivity. Despite being a bold statement in the specification, 41% gave the formula of sodium chlorate as NaCl.

### **C1b - There's One Earth / Designer Products**

#### **Foundation tier**

Candidates showed a good knowledge of the uses of materials but 35% of candidates thought that the term breathable when applied to Gore-tex meant 'allows oxygen to pass in and carbon dioxide to pass out'. Knowledge of fuels was slightly weaker. 20% of candidates thought that a good fuel would produce a yellow flame, 34% believed that petrol is a bio-fuel and 30% said that hydrogen cannot be used as a fuel for cars. Knowledge of ethanol was weak with confusion being shown between fermentation and distillation. Only 13% could choose the correct word equation for fermentation and many candidates failed to understand that a disadvantage of producing ethanol fuel from plants is that large areas of land are required. Candidates found several of the later questions harder than expected with 49% believing that carbon dioxide makes crisps soft and only 23% knowing that dry air contains approximately 78% nitrogen. Only 32% knew that salt in crisps is sodium chloride and only 12% knew that sodium hydroxide is not used to flavour crisps. The action of emulsifiers was poorly understood with almost random choice of answers.

### **Higher tier**

Higher tier candidates performed better than foundation candidates on questions 17 to 24 but 39 % believed that carbon dioxide makes crisps soft and only 24% knew that sodium hydroxide is not used to flavour crisps. Generally candidates performed well on the sections on unusual materials and nanotechnology but only 33% showed good understanding of the use of nanoparticles in sunscreens. Balanced chemical equations proved difficult for many candidates.

## **Physics**

### **P1a - Producing and Measuring Electricity / You're in Charge**

#### **Foundation tier**

The early questions were quite well answered although the concept of power proved challenging for two thirds of students at this foundation level. Only a third of candidates recognised 1.5 kW as power. A clear majority of foundation candidates misunderstood ideas about the capacity of a battery and thought that a capacity of 5 A h gave 5 A for 5 hours. Such students would clearly benefit from pouring liquids from a bottle at different rates. Perhaps the most serious cause for concern was the fact that as many as 80% of students thought that the particles flowing in a wire were positive (65% thought positive electrons). This problem has been commented on in previous newsletters for the legacy specifications.

In the **overlap questions**, it was disappointing to note that as few as 40% of the foundation candidates were able to identify the experimental arrangements which would allow a given comparison. Nearly three-quarters of those who selected to answer the higher level correctly identified the experimental arrangement. This difference in performance between the two levels was typical of the overlap items and shows that students responded to the good advice of teachers as to the level they should attempt. A really serious problem occurred in working out the cost of charging the battery used in a toy car. Although the equation was given, only 6% of students at either level had practiced using it to the extent of realising that the 'power' to which it applies is kW (not W) even though the equation included the 'cost of 1kW h'.

#### **Higher tier**

The most mark yielding scenario featured solar cells. At the other extreme, as many as 70% of students chose distractors containing currents of 13 A rather than realising that the RCCB reacts to any difference of current in live and neutral wires for (nearly) all current values. Another difficulty experienced was in spotting the graph which corresponded to the onset of superconductivity, even though at least 80% had been introduced to the idea of Maglev trains and realised that superconductivity allowed large magnetic fields with small heat loss.

### **P1b - Now You See It, Now You Don't / Space and its Mysteries**

#### **Foundation tier**

Overall the questions were answered well across the whole of the specification.

Candidates displayed a good understanding of uses and associated dangers of different types of e.m. radiation, but over 40% of candidates thought a sinusoidal wave was a digital signal.

Candidates showed a good understanding of the Solar System, Milky Way galaxy and theories about the origin of the Universe. However, almost 60% believed that gravitational field strength in interplanetary spaces was the same as it is on Earth. Candidates showed good understanding of the risks of a comet striking the Earth and how a rocket might be powered in terms of action and reaction, but almost 50% of candidates thought that to become weightless an astronaut's mass had to be zero. Almost 55% of candidates could measure the amplitude of a wave, but only 15% could measure its wavelength.

### **Higher tier**

The early section of the paper was well answered.

Almost 70% of candidates could measure the amplitude of a wave, but only 35% could measure the wavelength. A common misconception was that of half a wavelength being equal to one wavelength.

Candidates displayed a good understanding of the components, order and uses of the electromagnetic spectrum.

A very common mistake was forgetting to halve the distance when calculating the distance to a reflecting surface.

Most candidates were able to use ideas about relative sizes in the solar system, SETI, red shift and gravitational field strength very well.

Another very common mistake was to forget about the weight of a spacecraft when calculating its acceleration as it takes off.

The most able candidates were able to answer questions using data about seismic waves to draw conclusions about the types of material found in the Earth's interior.